

Lead poisoning in children

Background

- Lead is a heavy, soft, low melting, bluish-gray metal that occurs naturally in the Earth's crust. However, it is rarely found naturally as a metal. It is usually found combined with two or more other elements to form lead compounds. (ASTDR)
- Lead poisoning (also known as plumbism or painter's colic) is a toxic condition that occurs when an individual is consistently exposed to levels of lead above the federally defined Maximum Contaminant Level (MCL). Lead poisoning primarily affects red blood cell chemistry and the nervous system. (Aquasana: Lead poisoning: prevention and statistics 2004)
- Lead has no biological role in the body. However, when it is ingested, lead has the ability to mimic other, more necessary metals, such as iron and zinc. This mimicry allows lead to bind with vital proteins and molecules in the body and to disrupt their functioning. Lead most commonly disrupts the production of hemoglobin, a fundamental ingredient for proper red blood cell chemistry. (Aquasana 2004)
- Childhood lead poisoning is one of the greatest environmental health threats facing American families today. At one time it was freely used in many products, including paint, batteries, solder, pottery, toys and gasoline. This metal is virtually indestructible, and it is not biodegradable. (Ashcraft & Gerel)
- Lead poisoning can affect virtually every system in the human body and often occur with no distinctive or outward signs or symptoms. Doctors and scientists have determined that lead can be especially harmful to young children and fetuses. Lead is very dangerous at all stages of a child's development, because during the developmental period the human brain is much more susceptible to injury from chemicals and poisons. (Ashcraft and Gerel)
- Lead poisoning most commonly affects children under the age of 12. Young toddlers under the age of two are particularly at risk for lead poisoning, as they come into more contact with lead through household dust and increased water intake. (Aquasana 2004)
- Childhood lead poisoning is known as a silent danger. This is because unless the child's lead level is extremely high there are little to no outward signs or symptoms.

Some children with chronic lead exposure display trouble sleeping, loss of appetite or hyperactivity. Unfortunately, these signs can be hard to distinguish from a typical or healthy child's regular pattern of behavior. Experts suggest that the quickest and best way to learn whether a child has lead poisoning is by taking your child to his or her doctor or pediatrician, and asking for a simple blood test. An initial test can even be done merely by a finger prick without a needle into the child's vein. However, if that test comes back positive, a venous or vein blood drawing is known to be a more accurate.

- When a pregnant woman has an elevated blood lead level, that lead can easily be transferred to the fetus, as lead crosses the placenta. In fact, pregnancy itself can cause lead to be released from the bone, where lead is stored—often for decades—after it first enters the blood stream. (The same process can occur with the onset of menopause.) Once the lead is released from the mother's bones, it re-enters the blood stream and can end up in the fetus. In other words, if a woman had been exposed to enough lead as a child for some of the lead to have been stored in her bones, the mere fact of pregnancy can trigger the release of that lead and can cause the fetus to be exposed. In such cases, the baby is born with an elevated blood lead level.

Statement of the Problem

- High lead levels in the body can cause problems with the brain, kidneys, and bone marrow (soft tissue inside bones). Symptoms of high lead levels can include abdominal pain, headaches, vomiting, confusion, muscle weakness, seizures, hair loss or anemia (low red blood cell count).
- Lower levels of lead in the body can still cause problems, like trouble paying attention, behavior problems, learning difficulties and a fall in the IQ of young children. (IQ stands for "intelligence quotient" and is one measure of how smart a person is.)
- Government and health officials have had a difficult time defining a legally safe level of lead in the body. Because young children are at most risk of lead poisoning, the bulk of the research has pointed toward them to determine contaminant thresholds. The original threshold below which lead was not a significant adverse factor in the blood was 25ug/dL. Scientists are now suggesting this number should be moved to 10ug/dL, but many health officials believe even this number may not represent a safe threshold for lead in the blood of small children. What is the national incidence of lead poisoning? According to a recent report from the Centers for Disease Control (CDC), 310,000 children in the U.S. have elevated levels of lead in their blood. While this number may not seem terribly significant, the U.S. EPA recently named childhood lead poisoning “A major environmental health problem in the U.S.” (Aguasana 2004)

- CDC's Childhood Lead Poisoning Prevention Program is committed to the Healthy People 2010 (<http://www.healthypeople.gov/>) goal of eliminating elevated blood lead levels in children by 2010. CDC continues to assist state and local childhood lead poisoning prevention programs, to provide a scientific basis for policy decisions, and to ensure that health issues are addressed in decisions about housing and the environment.

- One of the goals of Healthy People 2010 is the elimination of childhood lead poisoning as a public health problem. CDC, HUD, EPA, and other agencies have developed a federal interagency strategy to achieve this goal by 2010. The key elements of this interagency strategy include:
 - Identification and control of lead paint hazards;
 - Identification and care for children with elevated blood lead levels;
 - Surveillance of elevated blood lead levels in children to monitor progress; and
 - Research to further improve childhood lead poisoning prevention methods.

- Eliminating Childhood Lead Poisoning: A Federal Strategy Targeting Lead Paint Hazards:
 - Consistent with the interagency strategy, CDC developed the following objectives.
 - Increase the proportion of Medicaid-enrolled children screened for lead.
 - Ensure appropriate management of children with elevated blood lead levels.
 - Expand initiatives to educate public health professionals, parents of at-risk children, and the public about lead poisoning.
 - Support innovative approaches to identify children at risk for lead exposure and ensure their housing is lead-safe before children are exposed.
 - Improve the state-based blood lead surveillance system to determine populations at risk and direct intervention efforts.
 - Provide international leadership in lead poisoning prevention.
 - Conduct research on innovative methods to identify and reach children at risk for lead poisoning.

- Toddlers explore their world by putting things in their mouths. Therefore, young children who live in older buildings are at especially high risk of getting lead poisoning. Children can get lead poisoning by chewing on pieces of peeling paint or by swallowing house dust or soil that contains tiny chips of the leaded paint from these buildings.
- Beginning in May of 2007, there have been several large and very public manufacturer recalls of toys made in China, because these toys were painted with lead based paint. Mattel Inc. announced in August that it is recalling 9.75 million toys in the United States because of lead paint on some toys and other toys with detachable magnets that could cause intestinal perforation or blockage in children who swallow these magnets. These include the Fisher-Price and Sarge toy line popular with preschoolers. This has come on the heels of another large recall of Thomas & Friends or Thomas the Tank Engine Toys that were found to contain excessive lead based paint. RC2 Corp. has recalled 1.5 million of these popular toys due to lead paint. (Ashcraft and Gerel)
- CDC recommends that states develop a plan to find children who may be exposed to lead and have their blood tested for lead. CDC recommends that the states test children:
 - at ages 1 and 2 years;
 - at ages 3–6 years if they have never been tested for lead;
 - if they receive services from public assistance programs for the poor such as Medicaid or the Supplemental Food Program for Women, Infants, and Children;
 - if they live in a building or frequently visit a house built before 1950;
 - if they visit a home (house or apartment) built before 1978 that has been recently remodeled; and/or
 - if they have a brother, sister, or playmate who has had lead poisoning.
- The Lead Contamination Control Act of 1988 authorized the Centers for Disease Control and Prevention (CDC) to initiate program efforts to eliminate childhood lead poisoning in the United States. As a result of this Act, the CDC Childhood lead Poisoning Prevention Branch was created, with primary responsibility to:
 - Develop programs and policies to prevent childhood lead poisoning.
 - Educate the public and health-care providers about childhood lead poisoning.
 - Provide funding to state and local health departments to determine the extent of childhood lead poisoning by screening children for elevated blood lead levels, helping to ensure that lead-poisoned infants and children receive medical and environmental follow-up, and developing neighborhood-based efforts to prevent childhood lead poisoning.

- Support research to determine the effectiveness of prevention efforts at federal, state, and local levels.
- Since its inception in 1990, the CDC childhood lead poisoning prevention effort has:
 - Funded nearly 60 childhood lead poisoning prevention programs to develop, implement, and evaluate lead poisoning prevention activities;
 - Provided technical assistance to support the development of state and local lead screening plans;
 - Fostered agreements between state and local health departments and state Medicaid agencies to link surveillance and Medicaid data;
 - Provided training to public health professionals through CDC's Lead Poisoning Prevention Training Center;
 - Supported the formation of collaborative relationships between CDC's funded partners and other lead poisoning prevention organizations and agencies (e.g., community-based, nonprofit, and housing groups);
 - Developed the Childhood Blood Lead Surveillance System through which 46 states currently report data to CDC;
 - Expanded public health laboratory capacity in states to analyze blood and environmental samples and to ensure quality, timely, and accurate analysis of results; and
 - Published targeted screening and case management guidelines which provide health departments and health care providers with standards to identify and manage children with elevated blood lead levels.

Solutions to the problem

- Maintain the paint in your home and clean up any lead dust. If you live in a home built before 1978, the most important step to take to reduce the risk of exposure to lead is to make sure that the paint is well maintained. Whenever repainting, renovation, or other work is undertaken that may end up disturbing a painted surface, it is critical to moisten the surface first, in order to prevent the work from generating dust. Similarly, all painted debris from the work should be contained, in other words prevented from spreading beyond the area where the debris can be carefully gathered and then safely disposed of. (NSC December 23, 2004)
- If you think you may have a lead dust problem, you can clean up lead-contaminated dust yourself by carefully and thoroughly washing the area, using soapy water and a mop. A three-bucket system is ideal, with one bucket holding the soapy water (a general all-purpose cleaner is adequate, but dishwasher soap containing phosphates or a lead-specific

detergent may be more effective), a second bucket serving as the rinse bucket, and the third containing only clean water. After you wash a section of floor with the soapy water, rinse the mop in the rinse bucket, then dunk it in the clean water bucket, and finally dip it back in the soapy water bucket before cleaning the next area. For smaller areas such as window sills, a rag should be used instead of a mop. Once done, throw the mop or rag away. (NSC)

- Whenever cleaning lead-contaminated dust, vigorous wiping is most effective in removing the lead.
- However, wiping should never be done in a back-and-forth manner, but rather from left to right (or vice-versa), or from the top of a wall downwards. Once cleaning has been completed for a given room, it is time to rinse, using only clean water and preferably a new mop head. (NSC)
- Remember that if you do have a lead dust problem, you will also need to address the source of the lead dust. In many instances, lead dust particles are generated by friction caused by the opening and shutting of old windows. With old, deteriorating windows, outright window replacement may be the best option. In addition to solving your lead dust problem, this also typically results in significantly increased energy efficiency, higher property values, and lower heating and cooling bills. (NSC)
- If you have a young child in your home and you suspect there may be a lead problem, take the recommended steps to eliminate any lead-contaminated dust, and make sure the child washes his/her hands frequently. Also make sure to clean any toys that have been lying about in areas that you suspect may contain lead-contaminated dust. (NSC)
- Check the water. To ensure your drinking water does not contain a hazardous level of lead, test the water at your faucets. Call the EPA Safe Drinking Water Hotline at 800-426-4791 for more information. Kits for testing water, along with the instructions for doing so, are available from a number of providers. (NSC)
- Lead poisoning is one of the most easily preventable pediatric diseases. Below are simple measures you can take to reduce or even eliminate lead in your home's water:
 - Have your drinking water tested. If the test yields results of greater than 15 ppb lead contamination, take immediate action. However, even lower levels can add to your overall lead intake and produce harmful effects.
 - Flush your system before using water for drinking or cooking. If a tap has gone unused for more than six hours, lead can begin to build up in the water. Run cold water through the tap for 1-2 minutes before using the water for cooking or drinking.

- As often as possible, use only cold water for cooking and drinking. Hot water can corrode lead from the plumbing more easily than cold water. If you need hot water, heat cold water on the stove rather than using hot water from the tap.
 - Replace any lead-soldered pipes in your home. If you have brass fixtures, be sure to flush water through them before using them for cooking or drinking.
 - Have an electrician check the wiring in your home. More lead may leach into water if the wiring has been grounded to a lead-soldered pipe. If that is the case, consider relocating the wires.
 - Filter your water before using it for drinking or cooking. A water filter reduces lead in your water at the point of use, where the possibility of re-contamination is least likely. However, some water filters may exacerbate the problem by using brass fixtures to dispense filtered water. Be sure to check independent testing and performance data sheets to verify that your water filter reduces lead. Also, look for water filters that use ion exchange processes to filter lead. Simple, mechanical filtration will not reduce dissolved lead in water.
- Eat right. The amount of lead the human body retains can be reduced if you make sure your child's diet includes plenty of foods that contain iron, calcium and zinc. Foods rich in iron include eggs, raisins, greens, beans, peas, and other legumes. Dairy products such as milk, cheese, and yogurt are recommended for their high calcium content. Lean red meat and oysters are examples of foods that contain zinc. Avoid giving children fried or fatty foods—although remember that a certain amount of dietary fat is vital for children under two years of age. And make sure your children always wash their hands before eating. (NSC)
 - Check your ceramic ware. Some pottery may contain lead that can leach into food and drinks. Avoid eating off any colorfully painted ceramic plates, and avoid drinking from any ceramic mugs unless you know they do not leach lead. This is particularly important if the pottery was made in Mexico or another Latin America country, or in Asia. Generally, pottery made in the US, in Canada, or in Western Europe tends to be safe. (NSC)
 - Cover bare soil play areas. You should ensure your child avoids playing in bare soil areas unless you know they are lead free. Often, bare soil will contain some lead, either deposited there by vehicle emissions from leaded gasoline days, or from deteriorated exterior paint. This is frequently the case in vacant lots, where old buildings once stood, or in a neighborhood where extensive renovation work may have occurred. If you have a bare soil problem, the easiest way to reduce the risk is to cover the soil with mulch (for instance, pebbles, shrubbery, or grass). A child who plays in lead-contaminated bare soil is likely to get some under his/her fingernails, which will eventually find their way into his/her mouth, or on toys, or on their shoes, which could track the lead into the home. Similarly, a dog that rolls around in lead-contaminated bare soil may end up transporting some of that lead into the home.(NSC)

- If your child's blood lead level is above the acceptable range, your doctor will give you information on how you can lower your child's lead level. Your doctor will then test your child's blood lead level every few months until the level drops into the normal range.
- Fortunately, only a small number of babies and children have high enough levels of lead in their blood that they need treatment. If your child's blood lead level is very high, your doctor will treat your child with medicine to lower the amount of lead in the blood.
- If one or more of your children has high blood lead levels, your doctor will call your local health department. Persons from the health department can help by inspecting your home for old peeling paint and getting workers to remove the paint or cover it with new paint.
- To locate a lead inspector, a risk assessor, or another certified professional in lead hazard evaluation and control activities, proceed to the Lead Listing at <http://www.leadlisting.org>.

Epidemiological Picture

- More than 4 percent of children in the United States have lead poisoning. Rates of lead poisoning are even higher in large cities and among people with low incomes.
- The most common cause of lead poisoning today is old paint with lead in it. Lead has not been used in house paint since 1978. However, many older houses and apartment buildings (especially those built before 1960) have lead-based paint on their walls.
- Although lead toxicity has been recognized for 2,000 years, knowledge of its neurobehavioral effects, sources of exposure, and risk population has grown dramatically during the last 40 years. In 1950, the level of blood lead believed to be toxic to children was in the range of 60 to 80 micrograms per deciliter. The principal source of poisoning was considered to be lead paint and the risk population was perceived to be poor children living in dilapidated housing. By 1990, epidemiological research had established that lead was ubiquitous. The risk population had expanded to include 17 percent of American children under the age of six. Contributors to the advance of lead research have been the civil rights and environmental movements, improved laboratory techniques, and the availability of large data bases. This article reviews the scientific and political processes that have led to a redefinition of the lead problem. (Jstor)
- The US Centers for Disease Control and Prevention (CDC) in 1991 chose 10µg/dL as an initial screening level for lead in children's blood. Current data on health risks and intervention options do not support generally lowering that level, but federal lead poisoning prevention efforts can be improved by revising the follow-up testing schedule for infants aged 1 year or less with blood lead levels of 5 µg/dL or higher; universal

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education about lead exposure risks; universal administration of improved, locally validated risk-screening questionnaires; enhanced compliance with targeted screening recommendations and federal health program requirements; and development by regulatory agencies of primary prevention criteria that do not use the CDC's intervention level as a target "safe" lead exposure.

- In 1992, the U.S. Congress passed the Residential Lead-Based Paint Hazard Reduction Act, which requires the promulgation of health-based dust lead and soil lead standards for residential dwellings to prevent undue lead exposure in children. Unfortunately, the levels of lead in house dust and soil that are associated with elevated blood lead levels among U.S. children remain poorly defined. This pooled analysis was done to estimate the contributions of lead-contaminated house dust and soil to children's blood lead levels. The results of this pooled analysis, the most comprehensive existing epidemiologic analysis of childhood lead exposure, confirm that lead-contaminated house dust is the major source of lead exposure for children. These analyses further demonstrate that a strong relationship between interior dust lead loading and children's blood lead levels persists at dust lead levels considerably below the U.S. Department of Housing and Urban Development's current post abatement standards and the Environmental Protection Agency's guidance levels.

Finally, these analyses demonstrate that a child's age, race, mouthing behaviors, and study-site specific factors influence the predicted blood lead level at a given level of exposure. These data can be used to estimate the potential health impact of alternative health-based lead standards for residential sources of lead exposure. (Environmental Research Volume 79, Issue 1, October 1998, Pages 51-68)

- Lead occurs naturally in the environment. However, most of the high levels found throughout the environment come from human activities. Environmental levels of lead have increased more than 1,000-fold over the past three centuries as a result of human activity. The greatest increase occurred between the years 1950 and 2000, and reflected increasing worldwide use of leaded gasoline. Lead can enter the environment through releases from mining lead and other metals, and from factories that make or use lead, lead alloys, or lead compounds. Lead is released into the air during burning coal, oil, or waste. Before the use of leaded gasoline was banned, most of the lead released into the U.S. environment came from vehicle exhaust. In 1979, cars released 94.6 million kilograms (208.1 million pounds) of lead into the air in the United States. In 1989, when the use of lead was limited but not banned, cars released only 2.2 million kg (4.8 million pounds) to the air. (Environmental Research Volume 79, Issue 1, October 1998, Pages 51-68)

- Since EPA banned the use of leaded gasoline for highway transportation in 1996, the amount of lead released into the air has decreased further. Before the 1950s, lead was used in pesticides applied to fruit orchards. Once lead gets into the atmosphere, it may travel long distances if the lead particles are very small. Lead is removed from the air by rain and by particles falling to land or into surface water.(ASTDR)
- The US has made much progress in eliminating some significant sources of lead in recent years. The use of leaded gasoline was phased out during the early 1990s. Leaded plumbing solder and lead solder on food cans were both banned during the 1980s. Lead-based paint was banned in 1978. However, today there are still about 38 million homes that contain some lead paint—about 40% of all US housing. Leaded gasoline emissions that were deposited over the years in the soil near highways and busy roads continue to contaminate many yards. And thousands of old lead pipes that continue to serve as water service lines in many older US cities also continue to leach lead into drinking water.(NSC)
- In 2003, CDC awarded \$31.7 million to 42 state and local health departments to develop and implement comprehensive lead poisoning prevention efforts. To contact a childhood lead poisoning prevention program (CLPPP) in your area please visit [CLPP Programs](#). (CDC)

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Lead poisoning in children (Class Handout)

- Lead is a heavy, soft, low melting, bluish-gray metal that occurs naturally in the Earth's crust. However, it is rarely found naturally as a metal. It is usually found combined with two or more other elements to form lead compound
- Lead poisoning (also known as plumbism or painter's colic) is a toxic condition that occurs when an individual is consistently exposed to levels of lead above the federally defined Maximum Contaminant Level (MCL). Lead poisoning primarily affects red blood cell chemistry and the nervous system. (Aquasana: Lead poisoning: prevention and statistics 2004)
- Childhood lead poisoning is one of the greatest environmental health threats facing American families today. At one time it was freely used in many products, including paint, batteries, solder, pottery, toys and gasoline. This metal is virtually indestructible, and it is not biodegradable. (Ashcraft & Gerel)
- More than 4 percent of children in the United States have lead poisoning. Rates of lead poisoning are even higher in large cities and among people with low incomes.
- Lead poisoning most commonly affects children under the age of 12. Young toddlers under the age of two are particularly at risk for lead poisoning, as they come into more contact with lead through household dust and increased water intake.
- Toddlers explore their world by putting things in their mouths. Therefore, young children who live in older buildings are at especially high risk of getting lead poisoning. Children can get lead poisoning by chewing on pieces of peeling paint, toys (painted with lead base paint) or by swallowing house dust or soil that contains tiny chips of the leaded paint from these buildings.
- High lead levels in the body can cause problems with the brain, kidneys, and bone marrow (soft tissue inside bones). Symptoms of high lead levels can include abdominal pain, headaches, vomiting, confusion, muscle weakness, seizures, hair loss or anemia (low red blood cell count).
- Lower levels of lead in the body can still cause problems, like trouble paying attention, behavior problems, learning difficulties and a fall in the IQ of young children. (IQ stands for "intelligence quotient" and is one measure of how smart a person is.)
- Childhood lead poisoning is one of the most common and preventable environmental health problems today. The leading cause of childhood lead poisoning is dust from lead-based paint in homes. Although lead was banned in residential paint in 1978, a high percentage of homes in Connecticut were built before 1978 and may still contain lead-based paint. However, housing built before 1950 generally contains the highest amount of lead-based paint, since paint used at that time had a high lead content.

- It is currently estimated that some 890,000 U.S. children have a BLLs >9 ug/dL (CDC, 1997). Since the elimination of lead from gasoline, lead-based paint hazards in homes are the most important remaining source of lead exposure in U.S. children.

Take our quiz to see if your child is at risk of lead poisoning. Unanswered questions will considered to be a 'yes' or 'Don't Know' response.

Do your children?	Yes	No	Don't Know
1) Live in or often visit a house that was built before 1950.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2) Live in or often visit a house that was built before 1978 and is being remodeled.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
3) Have playmates or friends that have high lead levels.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
4) Live in a zip code where more than 27% of the housing was built before 1950 (check with your local health department to see if you live in a high risk area).	<input type="checkbox"/>	<input type="checkbox"/>	
5) Belong to a high risk group, including living in poverty, receiving aid from Medicaid and/or WIC.	<input type="checkbox"/>	<input type="checkbox"/>	

Your child may also need to be screened for lead poisoning if he has any of the following risk factors that place him at risk for being exposed to lead:

6) Eats or chews on nonfood things (called pica), such as paint chips or dirt.	<input type="checkbox"/>	<input type="checkbox"/>	
7) Has family members that work at a place or has a hobby that involves any of the following:			
<ul style="list-style-type: none"> • radiator repair • lead industry • welding • battery manufacture or repair • house construction or repair • smelting • chemical preparation • making pottery • going to a firing range • stained glass with lead solder • brass or copper foundry 	<input type="checkbox"/>	<input type="checkbox"/>	

- valve and pipe fittings
- bridge, tunnel and elevated highway construction
- industrial machinery or equipment
- casting ammunition, fishing weights or toy soldiers
- refinishing furniture
- burning lead painted wood
- automotive repair shop

8) Lives or plays near an area with any of the following:

- smelter
- hazardous waste site
- lead industry
- place where batteries are manufactured or repaired
- house construction site
- heavily traveled major highway
- place where cars are abandoned or repaired

9) Consumes any of the following products:

- medicines (especially home remedies) imported from another country, including:
 - **pay-loo-ah** (fever and rash treatment).
 - **azarcon** (a Mexican treatment for intestinal blockage or 'empacho' that is 90% lead. Also called Maria Luisa, Liga, Alarzon, Greta, Coral and Rueda. It is a bright orange powder).
 - Asian folk remedies, including **Ghasard** (a brown powder used to aid digestion), **Bali Goli** (a round, flat black bean that is dissolved in water) and **Kandu** (a red powder used to treat stomachaches).
 - Middle Eastern folk remedies, including **farouk** (teething) and **bint al zahab** (colic).
- nutritional pills other than vitamins
- cosmetics like **surma** or **kohl**

10) Lives in a home in which the plumbing has lead pipes, lead solder or lead containing holding tanks.

11) Eats foods that are cooked or stored in imported or glazed pottery.

12) Eats foods that are canned outside the United States.

13) Frequently chews on keys (which often contain small amounts of lead).

14) Has access to other lesser known sources of lead, including:

- curtain weights
- some candles made outside of the United States
- pewter figurines
- lead sinkers used for fishing
- lead soldiers and other collectible figurines

Department of Public Health

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www.keepkidshealthy.com/welcome/lead/leadscreening.html