

A PARENT'S GUIDE
TO
CHILDHOOD
LEAD POISONING
PREVENTION



Environmental Epidemiology Program
Bureau of Epidemiology

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Lead Poisoning and Children

Lead poisoning is one of the most common and preventable pediatric health problems in the United States today. No level of lead in the blood has been shown to be safe. There have been many studies that have documented the effects of lead in children. Those studies have shown an association between *blood lead poisoning and diminished intelligence*, delayed or impaired neurobehavioral development, lower IQ, decreased hearing acuity, speech and language handicaps, growth inhibition, poor attention span, and antisocial and delinquent behaviors. At very low levels, the effects may occur without overt clinical symptoms. The effects of low-level lead poisoning in childhood may be irreversible. Children who are under the age of six are the most susceptible.

Those findings prompted the Agency for Toxic Substances and Disease Registry (ATSDR), the U.S. Environmental Protection Agency (EPA) and the Centers for Disease Control and Prevention (CDC) to view blood lead levels of 10 µg/dL (10 micrograms per deciliter) and above as harmful. **In October 1991, the CDC formally recommended that children's blood lead be reduced to levels below 10 µg/dL.**

Estimates from the 1991-1994 National Health and Nutrition Examination Survey (NHANES), conducted by CDC, suggest that in the United States, as many as one million children under the age of six years of age, have blood levels over 10 µg/dL. Lead poisoning in children is found in all socioeconomic boundaries.

Because children can be exposed to lead from many sources, and because there may be no safe threshold for lead poisoning, CDC is recommending that:

- ☒ All children be screened for lead as part of their routine pediatric care
- ☒ Physicians use a blood lead test for that screening
- ☒ Children with lead poisoning need follow-up that can range from educational and nutritional counseling to environmental intervention to pharmacologic therapy.

Sources of Exposure

Lead-Based Paint: Dust from deteriorating lead-based paint is usually the *primary cause* of childhood lead poisoning. Until the 1950's, many homes and other structures that children can go to, were typically covered inside and out with lead-based paint. Lead paints began to fall into disfavor in the early 1950's, and their use as house paints were banned after 1977. Still, approximately 75% of the houses where children live today, were built before 1980 and may contain lead-based paint. In older, poorly maintained houses, deteriorating dust may form, which can fall into window wells, rooms, and into the soil at the base of the house. In older houses undergoing repair or renovation, lead contaminated dust can expose anyone in the vicinity. Even in well-maintained homes, contaminated dust from paint and soil can be an important source of lead.

Leaded Gasoline: During the 1960s and '70s, the use of leaded gasoline contributed to widespread lead exposure by contaminating the air and soil around roads. The heaviest concentrations of airborne lead were near busy roads. The airborne lead from car exhaust settles out into the soil to form lead contaminated dust. While leaded gasoline use has dropped significantly since 1980, soils within 25 meters of major roadways still contain 30 to 2,000 parts per million (ppm) lead above the natural levels. Some roadside soils have lead levels as high as 10,000 ppm. Nationwide, an estimated 4-5 million metric tons of lead from gasoline remain in dust and soil.

Living Close to Smelters, Scrap Metal Recycling Facilities and Battery Recycling Plants: Many metal smelting, scrap metal recycling, and battery recycling operations can release lead in the form of vapors from melting ores or cutting metals containing lead. Lead vapors can enter the body by respiration or the lead can be precipitated out to form lead dust and contaminated soil. Dust can be tracked into homes from outdoors where the soil contains lead from paint, automobile exhaust, or smelter and scrap metal emissions.

Working Members of the Family: Lead can be carried home as dust on clothing or in the hair of adults who are working in industries that use lead. Such industries include smelting and metal forgers, electronics, recycling (especially metals and car batteries) manufacturing of paint and plastic, painting and renovation and construction. Lead is used both as a pigment and as bonding agent in paints and plastics.

Lead Water Pipes and Solders: Lead leached from lead pipes and solder can also appear in drinking water. Because plumbing installed before 1940 is likely to contain lead, lead-contaminated drinking water is often a problem in old houses. In newer houses, lead from solder can leach into water for about five years after installation from such sources as brass faucets. Brass contains 3-8 percent lead. Thus, although federal regulations passed in 1986, prohibited using lead solder in drinking water pipes, lead sources in newer plumbing can still present a problem. Lead solder in older commercial coffee urns and lead solder or liners in cisterns or public water coolers can also be a source of lead exposure.

Crystal, Leaded Glass and Lead Containing Glazes: Acidic foods and beverages that are stored in crystal, leaded glassware or containers glazed with lead pigments can leach the lead, contaminating food or beverages stored in the containers.

Produce from Lead Contaminated Soils: Lead may enter or adhere to foodstuffs as they grow in contaminated soils.

Hobbies in the Home: Hobbies such painting, rebuilding old cars, pottery, stained glass, ceramics, reloading ammunition, target practicing in poorly ventilated indoor firing ranges, refinishing furniture and hobby supplies such as fishing tackle, paints, and cosmetics can be sources of childhood lead poisoning in the home.

Home Remedies: A variety of folk remedies may contain lead. Mexican-Americans, for example, may treat gastrointestinal ailments with *azarcon* (lead tetroxide) or *greta* (lead

monoxide). Laotians may use the lead-based compound called *pay-loo-ah*. Those remedies work by deadening the nerves in the gastrointestinal tract, rather than solving the problem.

Lead's Effects on Health

In children, lead toxicity manifests itself principally in the red blood cells, the nervous system, and the kidneys. Lead affects human reproduction, can cause high blood pressure and has been shown to be carcinogenic and mutagenic in animal studies. Severe lead poisoning can be fatal.

Clinical and Acute Toxicity: Blood lead levels above 40-45 µg/dL in children (60 µg/dL in adults) have been associated with clinical lead poisoning. Symptoms range from pronounced anemia, stomach and muscle cramps, weakness, headaches, hearing loss, kidney problems, confusion, and loss of coordination. Blood lead levels above 80 µg/dL in children (120 µg/dL in adults) are associated with acute toxicity. Symptoms include convulsions, irreversible intellectual and behavioral impairments, coma and even death. Blood lead levels below 40 µg/dL are not normally associated with distinctive symptoms, but can cause irreparable health damage.

Effects on Blood: Anemia is the most serious hematological outcome of lead toxicity. Lead impairs the production of oxygen carrying heme molecules. Lead also increases red blood cell destruction. In young children, the anemic effects first become evident at blood lead levels above 20 µg/dL.

Effects on the Learning Ability: In children, blood lead levels greater than 10 µg/dL, are associated with lower IQ scores and delayed mental development. Those clinically invisible, central nervous system dysfunctions are characterized by subtle deficits in intelligence, behavior, and school performance. Studies have found that children with elevated lead but no clinical symptoms of lead poisoning may lose 2-8 points in the children's IQ scores or mental development index scores. That damage is seen in the child's deficit in vocabulary, reading disabilities, fine motor skills, reaction time and hand-eye coordination. Children suffering from lead induced learning disorders tend to have more disruptive classroom behavior. They are also seven times more likely not to graduate from high school.

Prenatal Lead Exposure: Some of those studies have also indicated that the most critical exposure period for the child is actually before the child is born. That exposure to lead comes from lead in the mother's blood. That lead can affect the unborn child's nervous system at the time it is developing the fastest and is the most vulnerable to poisoning. Another study suggests that children whose blood lead levels were reduced after birth and stayed under 10 µg/dL, recovered or compensated for the initial delayed development by the age of five.

Who is at Risk?

Virtually all children are at risk for lead poisoning. Children who are six months to six years of age are at the highest risk. CDC conducted a study between 1991 and 1994 known as the National Health and Nutrition Examination Survey III Phase 2. The study data indicate that about 4.4 percent of U.S. children under the age of six, or about one million children, may have blood lead levels above 10 µg/dL. In the U.S., children in poor inner-city neighborhoods have the highest risk, because of the complexity of the sources and behaviors.

Screening for Lead: Because virtually all children are at risk for lead poisoning, CDC recommends screening all children for lead using a blood lead test. There are three blood lead test methods. Two use blood obtained by a finger-stick, the other uses a tube of venous blood. The finger-stick specimen is easy to contaminate, and so all positive test results should be retested with a venous blood test.

Children who are at high risk for lead poisoning should be screened beginning at six months of age. If the blood lead levels are <10 µg/dL, the child should be re-screened every six months after that, until the age of seventy-two months. If the blood lead levels are 10-14 µg/dL, the child should be re-screened every 3-4 months, and actions should be taken to reduce the lead until the blood lead level is <10 µg/dL. If any blood lead level is ≥15 µg/dL then intervention action should occur.

Children who are at low risk for lead poisoning should be screened at 12 and 24 months of age.

Intervention

Confirmed cases of lead poisoning should be reported to local health authorities. The goal of the local health authorities is reducing the elevated blood lead levels of children. Those local health authorities can assist you in reducing your child's blood lead level through intervention. There are several levels of intervention that can occur:

Risk Management Education: Children with blood lead levels of 10-14 µg/dL are considered borderline cases. There is a possibility that the screening test gave a false positive result. Also, most children with those levels of lead are probably exposed to several low-level sources of lead, rather than one predominant source. Removing those sources of exposure is the main treatment for children with elevated blood lead levels. At this level of intervention, the parents/guardians need to be aware of ways to reduce exposure with simple housekeeping measures, such as washing floors with a high phosphate solution, keeping the child away from peeling paint or chewable surfaces covered with lead paint, washing the child's hands, face, toys and pacifiers often, and flushing water pipes before using water for drinking or cooking.

Nutritional Intervention: Children with blood lead levels of 15 µg/dL or higher need more careful follow up. People who lack adequate essential trace minerals, such as calcium, iron, zinc, copper or phosphorous tend to absorb lead more easily. Protein-deficient diets and high-fat foods also increase lead absorption. Irregular eating habits may increase lead susceptibility, since lead absorption appears to be greater on an empty stomach. At this level of intervention, children should be tested for iron deficiency and parents need to be aware of their child's nutrition. Good diet, including iron and calcium supplements, can be important in the treatment and prevention of chronic, low-level lead exposure.

Medical Intervention: Children with blood lead levels of 20 µg/dL and higher should have a full medical evaluation that includes a detailed behavioral history that explores learning disabilities, the child's mouthing activity, and nutritional status.

Environmental Intervention: Children with blood lead levels of 15-20 µg/dL and higher may be poisoned from a single persistent source of lead such as deteriorating lead-based paint. At this level of intervention, specialists trained in lead-based paint inspections and/or environmental lead risk assessments should be brought to the home to test the child's home and play environments for lead sources. Those sources should then be removed or treated to minimize the potential for poisoning children in the future.

Pharmaceutical Intervention and Chelation: In children some lead will be stored in bones and other tissues. The rest of the lead is eventually excreted in the urine and feces. At high levels (greater than 25 µg/dL), the child's physician may use a procedure called chelation, using a chelator (a drug) to help bind up the lead so that it can be excreted by the body. However, all drugs have potential side effects, and they must be used wisely and with caution.

The 1991 CDC guidelines "Preventing Lead Poisoning in Young Children" recommend the following intervention scheme:

| Venous Blood Lead Level | Action |
|-----------------------------------|--|
| less than or equal to 9 µg/dL | Those levels are not considered lead poisoning; you should continue to screen on schedule. |
| 10-14 µg/dL | You should re-screen your child at 3 to 4 month intervals and arrange to receive risk management educational material. |
| 15-19 µg/dL | You should re-screen child at 3 to 4 month intervals and arrange for nutritional and educational intervention and educational material. If levels persist, you may want to arrange for environmental assessment. |
| 20-44 µg/dL | You should arrange for medical, nutritional and environmental intervention. Your child's physician may want your child to receive pharmaceutical treatment. |
| 45-69 µg/dL | You should arrange for medical, nutritional and environmental intervention. Your child's physician may want your child to receive chelation therapy. |
| greater than or equal to 70 µg/dL | Those levels are considered medical emergency. Your child's physician should arrange for immediate hospitalization for your child. You should also arrange for immediate medical and environmental intervention. |

In general, CDC recommends sending children who need urgent follow-up, children with blood lead levels of 45 µg/dL and above, to a clinic or medical center with experience in managing childhood lead poisoning.

Treatment for lead toxicity, at any level, must always involve removing the child from further exposure. It is futile, even dangerous, to treat a child for lead toxicity without reducing the child's exposure first.

Simple Things You Can Do To Prevent Exposure To Lead

- ☞ Have your children tested for lead; if the child's blood lead level is 10-14 $\mu\text{g}/\text{dL}$ or above, you should use housekeeping measures to reduce lead exposure. If blood lead levels of 15-19 $\mu\text{g}/\text{dL}$ persist, you should arrange for an environmental inspection.
- ☞ Wash your children's hands frequently, especially before meals and bedtime.
- ☞ If your home was built before 1978, you may want to have the house tested for lead-based paint. You should take care of peeling and chipping paint. Water damaged, peeling or chipping paint, or paint that is scrapped on a friction surface creates lead contaminated paint dust. If you decided to renovate or abate the lead-based paint, you should consult an expert first.
- ☞ Test for lead before remodeling or repairing older homes. If the home contains lead-based paint, you should hire a trained contractor to do the work. If you plan to do the work, you should consult with an expert first.
- ☞ Consider replacing windows if they are covered with lead paint. Friction bearing surfaces on windows can be an important source of lead dust.
- ☞ Avoid using lead-glazed pottery or pewter dishes to store or serve foods.
- ☞ Plant grass and shrubs over bare soil in the yard.
- ☞ Keep children's play areas away from heavy traffic and buildings painted with deteriorating lead-based paint.
- ☞ In high-exposure areas, take off shoes before entering the house, wet mop floors, and wash window wells often to get rid of lead dust. Do not vacuum unless you have a HEPA vacuum; vacuuming can spread lead dust. A HEPA vacuum has a special filter in it that prevents microscopic particles of lead and dust from escaping.
- ☞ Wash fruits and vegetables (especially those grown close to or in soils contaminated with lead) before eating.
- ☞ Always wash hands before meals.
- ☞ Adults should shower or change clothes as soon as possible if exposed to lead at work or through such hobbies as ceramics or stained glass making.
- ☞ Eat a well-balanced diet containing large amounts of Vitamin C, calcium and iron.

- ☞ Use only water from the cold water tap for drinking and cooking. Flush faucets for 2-3 minutes when water hasn't been used for more than 6 hours.
- ☞ Have tap water tested for lead by a state-approved laboratory if the house is over 40 years old, or has plumbing over 10 years old.
- ☞ Don't use leaded gasoline. Replace engines (lawn-mower, chain saw, etc) that require leaded gasoline.
- ☞ Don't store food in opened cans.

For additional information, contact the local health department office nearest you (see next page), or call the Environmental Epidemiology Program at (801) 538-6191.

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Local Health Departments

Bear River Health Department

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|--------------|---|----------------|
| Tremonton | 125 South 100 West, Tremonton 84337 | (801) 257-3318 |
| Brigham City | 817 West 950 South, Brigham City 84302 | (801) 734-0845 |
| Logan | 655 East 1300 North, Logan 84341 | (801) 752-3730 |
| Randolph | Courthouse, 20 South Main, Randolph 84064 | (801) 793-2445 |

Central Utah Public Health Department

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|-------------|---|----------------|
| Nephi | 146 North Main, Nephi 84648 | (801) 623-0696 |
| Delta | 428 East Topaz Blvd, Suite D, PO Box 176, Delta 84624 | (801) 864-3612 |
| Fillmore | 55 South 400 West, PO Box 745, Fillmore 84631 | (801) 743-5723 |
| Junction | Courthouse, PO Box 40, Junction 84740 | (801) 577-2521 |
| Richfield | 70 Westview Drive, Richfield 84701 | (801) 896-5451 |
| Loa | Courthouse, 18 South Main, Loa 84747 | (801) 836-2671 |
| Manti | 40 West 200 North, Manti 84642 | (801) 835-2231 |
| Mt Pleasant | 20 South 100 West, Suite 30, Mt Pleasant 84647 | (801) 462-2449 |

Davis County Health Department

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| Farmington | 50 East State Street, PO Box 618, Farmington 84025 | (801) 451-3340 |
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Salt Lake City/County Health Department

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| Salt Lake City | 2001 South State Street S-2500, Salt Lake City 84190 | (801) 468-2700 |
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Southeastern Utah District Health Department

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| Price | 28 South 1st East, PO Box 800, Price 84501 | (801) 637-3671 |
| Castle Dale | 45 East 100 South, PO Box 644, Castle Dale 84513 | (801) 381-2252 |
| Moab | 471 South Main, Suite 4, PO Drawer E, Moab 84532 | (801) 259-5602 |
| Blanding | 558 South 200 East, PO Box E, Blanding 84511 | (801) 678-2723 |
| Monticello | Courthouse, PO Box 127, Monticello 84535 | (801) 587-2021 |

Southwest Utah Public Health Department

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|------------|---|----------------|
| Panguitch | 609 North Main, PO Box 374, Panguitch 84759 | (801) 676-8800 |
| Escalante | 155 West 100 North, PO Box 14, Escalante 84626 | (801) 826-4397 |
| Cedar City | 88 East Fiddlers Canyon Road, Suite H, Cedar City 84720 | (801) 583-2437 |
| Kanab | 245 South 200 East, Kanab 84741 | (801) 544-2537 |
| St George | 285 West Tabernacle, St George 84770 | (801) 673-3528 |
| Hildale | 320 East Newell Avenue, PO Box 51, Hildale 84784 | (801) 874-2469 |
| Hurricane | 25 South Main, Hurricane 84737 | (801) 635-4458 |
| Beaver | 380 East 100 North, PO Box G, Beaver 84713 | (801) 438-2482 |
| Milford | 21 West 500 South, Milford 84751 | (801) 387-2671 |

Summit County Public Health Department

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|-----------|---|----------------|
| Coalville | 85 North 500 East, PO Box 128, Coalville 84017 | (801) 336-4451 |
| Park City | 1753 Sidewinder, PO Box 680166, Park City 84068 | (801) 649-9072 |
| Kamas | 110 North Main, PO Box 698, Kamas 84036 | (801) 783-4321 |

Tooele County Health Department

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| Tooele | 151 North Main Street, Tooele 84074 | (801) 843-2300 |
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Uintah Basin Public Health Department

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| Manila | Box 156, Manila 84046 | (801) 784-3494 |
| Roosevelt | 34 South 200 East, Roosevelt 84066 | (801) 722-5085 |
| Duchesne | 734 North Center, Box 210, Duchesne 84021 | (801) 738-2202 |
| Vernal | 147 East Main Street, Vernal 84078 | (801) 781-5475 |

Utah County Health Department

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| Provo | 589 South State Street, Provo 84606 | (801) 370-8700 |
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Wasatch City/County Health Department

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| Heber City | 805 West 100 South, PO Box 246, Heber City 84032 | (801) 654-2700 |
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Weber/Morgan District Health Department

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| Morgan | Courthouse, 48 West Young Street, Morgan 84050 | (801) 829-6811 |
| Ogden | 2570 Grant Avenue, Ogden 84401 | (801) 399-8433 |

