National Institute of Environmental Health Sciences
Your Environment. Your Health.

Lead and Your Health

Tremendous progress has been made in the United States to reduce lead exposure and to lower blood lead levels.[1] Much of this success is due to research supported by the National Institute of Environmental Health Sciences (NIEHS) and others who have helped to identify and reduce the health effects of lead exposure in children and adults.

What is lead?

Lead is a naturally occurring metal found deep in the ground. It occurs in small amounts in ore, along with other elements such as silver, zinc, or copper. Even though it is found in small amounts, there is an abundant supply of lead throughout the earth. Because it is widespread, and easy to extract and work with, lead was used for hundreds of years in a wide variety of products found in and around homes, including paint and gasoline.

Where is lead found now?

Lead can still be found in lead-based paint used in older homes, contaminated soil, household dust, drinking water pumped through leaded pipes, lead crystal, lead-glazed pottery, airplane fuel, some toys, and some inexpensive metal jewelry. Until 1978, lead paint was commonly used on the interior and exterior of homes. Deteriorated lead paint in older housing remains the most common source of lead exposure for children in the United States.

NIEHS supports research that looks at the health effects of lead and how it may influence the incidence or progression of a range of diseases, including those with cardiovascular, respiratory, and neurological outcomes. NIEHS is also developing ways to more effectively detect and prevent health effects associated with lead exposure. Preventing lead exposure before it occurs is the best protection.

How does lead get into the body?

Lead can get into your body in two ways — through breathing it in or by eating it. For example, lead can enter the body through eating or inhaling paint dust or chips. The soil around your home can pick up lead from sources such as exterior paint. Lead can also enter your drinking water through your plumbing.

Who is most vulnerable to the effects of lead?

Both children and adults are vulnerable to the effects of lead. Young children under the age of 5 are particularly vulnerable, because their body, brain, and metabolism are still developing. Two-year-olds tend to have the highest blood level concentration, because they put many things into their mouth, including toys or other products that may contain lead.

How do you measure lead exposure?

Blood tests are typically used to measure the concentration or amount of lead in your blood, and are used to detect lead in both children and adults. Although long-standing national surveys, such as the National Health and Nutrition Examination Survey, show that blood lead levels have decreased over the last 30 years for all age groups, black, non-Hispanic children have higher levels of lead detectable in their blood.[2] A person's blood lead level reflects both the current environmental exposure and previous lead exposures stored in body tissues, primarily in bone.

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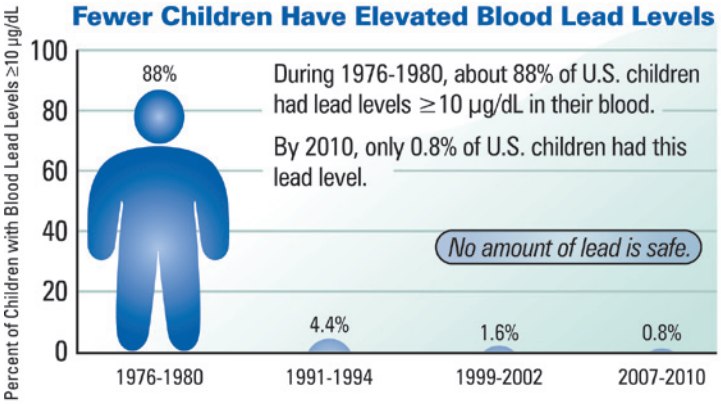
Measuring bone lead requires specialized testing equipment, whereas blood lead testing is the most readily available indicator for lead exposure.

What are the effects of lead in children?

Exposure to lead can have a wide range of effects on a child's development and behavior. Blood lead levels less than 10 micrograms per deciliter (µg/dL) are associated with increased behavioral effects, delayed puberty, and decreases in hearing, cognitive performance, and postnatal growth or height. Some of these health effects are found even at low blood lead levels less than 5 µg/dL, including lower IQ scores, decreased academic achievement, and increases in both behavioral problems and attention-related behaviors. There is a wide range of lead-associated behavioral effects in the area of attention. Attention deficit hyperactivity disorder (ADHD) is one example on the more severe end of the spectrum.

Blood Lead Level	Health Effects
Blood lead levels below 5µg/dL	**Children:** Decreased academic achievement, IQ, and specific cognitive measures; increased incidence of problem and attention-related behaviors **Adults:** Decreased kidney function, maternal blood lead associated with reduced fetal growth
Blood lead levels below 10µg/dL	**Children:** Delayed puberty, reduced postnatal growth, decreased IQ and hearing **Adults:** Increased blood pressure, risk of hypertension, and incidence of essential tremor



Source: National Health and Nutrition Examination Surveys (NHANES) for children 1-5 years old. CDC Morbidity and Mortality Weekly Report. 2013. 62(13):245-248.

What are the health effects of lead in adults?

Lead exposure has been linked to a number of health effects in adults. As a general rule, the more lead you have in your body, the more likely it is you'll have health problems. High blood lead levels greater than 15 µg/dL are associated with cardiovascular effects, nerve disorders, decreased kidney function, and fertility problems, including delayed conception and adverse effects on sperm and semen, such as lower sperm counts and motility.

Blood lead levels below10 µg/dL are associated with decreased kidney function and increases in blood pressure, hypertension, and incidence of essential tremor, a degenerative disorder of the central nervous system whose most recognizable feature is a tremor of the arms or hands during voluntary movements, such as eating and writing. There is also evidence showing that adults who have low levels of exposure to lead less than 5 µg/dL may have decreased kidney function.

Pregnant women need to be particularly careful around lead. Maternal blood lead levels less than 5 µg/dL are associated with reduced fetal growth. Because the effects of lead are different for everyone, more research needs to be done to fully understand the health effects.

A 2004 study, supported by NIEHS, also showed that lifetime lead exposure may increase the risk of developing cataracts,[3] a clouding of the eye lens resulting in partial loss of vision, which can be common in older people.

Most adults with elevated blood lead levels are exposed to lead at work. Those in occupations related to mining, ironwork or welding, construction, renovation and remodeling activities, smelters,

firing ranges, the manufacture and disposal of car batteries, automobile radiator repair, metal shop work, and the manufacture of pottery or stained glass are particularly at risk for lead exposure.

How much lead is harmful?

No amount of lead is safe. Eliminating all lead exposure in our environment is our best course of action.

New findings from NIEHS-supported grantees, as well as the National Toxicology Program (NTP), provide support for many adverse health effects in both children and adults at blood lead levels below 10 µg/dL, and, for some, below 5 µg/dL.

These findings add to the body of evidence that led the Centers for Disease Control and Prevention (CDC), in 2012, to update its reference value to identify children who have been exposed to lead and who require case management. The new level is based on the population of children aged 1-5 years, in the U.S., who are in the top 2.5 percent of children when tested for lead in their blood.[4] Currently, this means that public health actions be initiated for children with blood lead levels above 5 µg/dL. Prior to this, children were identified as having a blood lead level of concern if the test result was 10 µg/dL or more.[5] As part of a shift in focus to primary prevention of lead exposure, the CDC has dropped the level of concern terminology, since no safe blood lead level in children has been identified. The new, lower value gives parents, doctors, and public health officials an opportunity to prevent and reduce lead exposure very early on.

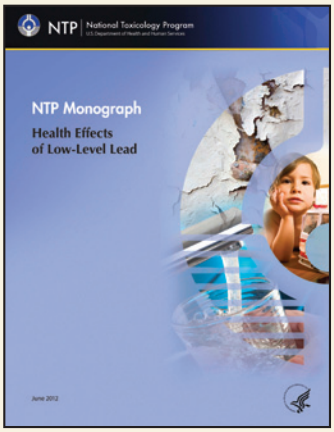
Although lead is no longer in the gasoline used to fuel most vehicles, there is still lead in our environment from widespread use in the past.

Preventing exposure to lead is the best course of action against its health effects.

Are there treatments to remove lead from the body?

Yes, medications exist that can remove some lead from the body. However, no medical treatment is recommended for children with blood lead levels lower than 45 µg/dL. Medications, such as succimer, have been shown to significantly reduce lead in children with very high blood lead levels.[6] Although succimer lowered blood lead about 25% in the short term, it did not improve IQ or other test scores. This reinforces the need for prevention. Treatment after the fact does not undo the damage caused by lead. Children must be protected from being exposed at all.

The NTP Monograph on Health Effects of Low-Level Lead was released in June 2012. It provides an overview of the science on the potential health effects from low-level exposures to lead. NTP found evidence of many adverse health effects, in both children and adults, at blood lead levels below 10 µg/dL, and, for some, below 5 µg/dL.



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How can I protect my family from being exposed to lead?

Prevention is the best way to protect your family. You and your health care provider are in an excellent position to prevent and detect lead exposure and the associated health effects. The source of most lead in children is dust and chips from deteriorating lead paint on interior surfaces.

- If you live in an older home, check with your local health department about any lead that may be in the paint, dust, or drinking water. Professional cleaning, painting over old paint to stabilize it, and removal of hazardous building components, such as old pipes, can prevent lead exposure. All of these should be done by trained professionals and contractors certified by the EPA.
- Avoid storing food in imported pottery and dishware, as it may contain lead.
- Monitor recalled toys and jewelry by visiting the Consumer Product Safety Commission website, and remove recalled items from your home.
- If a household member works in a lead-related occupation, they should change work clothes and shoes before entering the home, and their work clothes should be washed separately.

What role has the government played in reducing health effects of lead?

Since 1980, there has been a significant decrease in exposure to airborne lead in the United States. Research by NIEHS and others has shown the harmful effects that lead can have on human health. Federal and state regulatory standards and programs have helped to minimize or eliminate the amount of lead in consumer products, tap water, occupational settings, and the environment. Federal legislation in the 1970s and 1980s removed lead from gasoline, decreased smokestack emissions, and removed lead from water pipes and solder.

Where can I find out more about lead?

National Institute of Environmental Health Sciences
http://www.niehs.nih.gov/health/topics/agents/lead

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

U.S. Environmental Protection Agency
http://www2.epa.gov/lead

NIH National Institute of Environmental Health Sciences

For more information on the National Institute of Environmental Health Sciences, go to our website at: **http://www.niehs.nih.gov.**

[1] HHS (U.S. Department of Health and Human Services) Healthy People.gov. 2013. Environmental Health. Available: http://www.healthypeople.gov/2020/topicsobjectives2020/overview.aspx?topicid=12 [accessed September 10, 2013].

[2] Jones RL, Homa DM, Meyer PA, Brody DJ, Caldwell KL, Pirkle JL, Brown MJ. 2009. Trends in blood lead levels and blood lead testing among US children aged 1 to 5 years, 1988-2004. Pediatrics 123(3):e376-385.

[3] Schaumberg DA, Mendes F, Balaram M, Dana MR, Sparrow D, Hu H. 2004. Accumulated lead exposure and risk of age-related cataract in men. JAMA 292(22):2750-2754.

[4] CDC (Centers for Disease Control and Prevention). 2012. What Do Parents Need to Know to Protect Their Children? Available: http://www.cdc.gov/nceh/lead/ACCLPP/blood_lead_levels.htm [accessed 10 September 2013].

[5] CDC (Centers for Disease Control and Prevention). 2013. Lead. Available: http://www.cdc.gov/nceh/lead/ [accessed 10 September 2013].

[6] Dietrich KN, Ware JH, Salganik M, Radcliffe J, Rogan WJ, Rhoads GG, Fay ME, Davoli CT, Denckla MB, Bornschein RL, Schwarz D, Dockery DW, Adubato S, Jones RL. 2004. Effect of chelation therapy on the neuropsychological and behavioral development of lead-exposed children after school entry. Pediatrics 114(1):19-26.