# Lead, Elevated Blood Lead Levels (Screening)

## Clinical Preventive Service Recommendations

**U.S. Preventive Services Task Force (USPSTF) Recommendation**

In 1996, the U.S Preventive Services Task Force recommended that clinicians screen children at risk for lead exposure for elevated blood lead levels. Given the availability of new evidence, the USPSTF has decided to update its 1996 recommendation. This work is currently in progress.

**CDC Recommendation**

The Centers for Disease Control and Prevention (CDC) recommends blood lead testing for children at high risk for exposure from lead paint, from house dust and soils contaminated by lead paint, from industrial sources of lead (e.g., smelters), and from imported cosmetics, traditional remedies, and cultural items that contain lead.[1]

**Other Recommended Guidance Centers for Medicare and Medicaid Services (CMS)**

The Centers for Medicare and Medicaid Services (CMS) requires blood lead testing of all Medicaid enrolled children at 1 and 2 years of age or at 3 years of age if not previously tested.[2]

***Evidence Rating:***

CMS Mandate

**Information Sources**

The recommendations and supporting information contained in this document came from several sources, including the:

- Advisory Committee on Childhood Lead Poisoning Prevention (ACCLP)
- Agency for Toxic Substances and Disease Registry (ATSDR)
- Center for Medicare and Medicaid Services (CMS)
- Centers for Disease Control and Prevention (CDC)
- National Health and Nutrition Examination Survey (NHANES)
- Peer-reviewed research
- U.S. Department of Health and Human Services (USDHHS)
- U.S. Environmental Protection Agency (EPA)

The background and supporting information contained in this document is a compilation of research findings. All information presented in this document should be attributed to its referenced source and should not be considered a reflection of other organizations cited in the text.

## Condition/Disease Specific Information

**Epidemiology of Condition/Disease**

The dangers of lead are well-documented for all age groups. High levels of lead exposure produce serious neurologic complications that can result in permanent disability or death. Lead affects multiple organ systems such as the cardiovascular,

renal, and hepatic systems.[3-4] Lead can also reduce growth, resulting in restricted height.[5-6] Among children, elevated blood lead levels (BLLs) are associated with behavioral and reaction (attention) deficits[7-11] and intellectual impairments (lowered IQ).[12-17] Neurologic complications associated with lead exposure and lead poisoning are irreversible, even with treatment. The association between elevated BLLs and reduced intellectual capacity is strong and has a dose-response relation, meaning that the more lead present in the blood, the more severe the impairments become.[18-19] For example, a rise in blood lead from 10 to 20 µg/dL reduces a child's score on an IQ test by an average of 2 points.[18] No "safe" BLL in children has been specified.[15-16,19]

It is estimated that 310,000 children between the ages of 1 and 5 years have elevated BLLs.[20] An estimated 24 million housing units have significant lead-based paint hazards, including 1.2 million homes occupied by low-income families with children under the age of 6 years. These units pose a serious threat to children's health.[20]

The prevalence of elevated BLLs among young children in the United States has declined 98% since 1976-1980.[20] A critical factor in reducing children's BLLs has been the reduction in the number of homes with lead-based paint, which fell from 64 million in 1990 to approximately 38 million in 2000.[20] Despite the dramatic reduction in elevated BLLs, lead exposure and lead poisoning remain serious public health problems in the United States, especially for young children, who are most susceptible to the harmful effects of lead.

Reducing BLLs and eliminating BLLs higher than 10 µg/dL in children are two of the nation's *Healthy People 2010* objectives.[21]

### Condition/Disease Risk Factors

Racial and ethnic minorities (particularly African-Americans), individuals with low incomes, children living in housing built before 1950, and those living in urban centers and in the Northeast bear the highest rates of lead exposure.[22-23]

Major sources of lead exposure include dilapidated housing with lead-based paint (commonly used until 1950) and paint dust, lead-soldered pipes, and lead found in dust or soil from peeling paint, leaded gasoline, or industrial emissions. Other sources of lead exposure include lead waste brought into the home from industry,[24] ethnic remedies,[25–27] or from lead in consumer products.[28–31]

## Value of Prevention

### Economic Burden of Condition/Disease

The costs of providing medical care and public health services to treat adverse health outcomes constitute the immediate direct costs of lead exposure and lead poisoning. Between 1988 and 1992, childhood lead poisoning was estimated to result in 53,400 hospitalization days and $41 million in inpatient treatment costs.[32] The longer term burden to taxpayers includes the costs of special education and lost tax revenues from the lower wages of workers with intellectual deficits due to childhood lead exposure or lead poisoning. The total economic burden would be much higher if lifetime productivity losses due to cognitive impairment and premature mortality were included in cost analyses.

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| **Workplace Burden of Condition/Disease** | Lead poisoning results in dose-related reductions in IQ which, in turn, contributes to lower wages and diminished lifetime earning power. The present value of economic losses attributable to lead exposure in the birth cohort of current 5-year-olds was estimated to be $43.4 billion in 1997.[33] |
| **Economic Benefit of Preventive Intervention** | Reducing lead exposure yields economic benefits by avoiding healthcare and special education costs and by preventing reductions in children's intelligence, academic achievement, and future productivity. A recent study quantified economic benefits from projected improvements in worker productivity that resulted from the reduction in children's exposure to lead in the United States since 1976. It was estimated that, because of falling BLLs in the United States, preschool-aged children in the late 1990s had IQs that were, on average, 2.2 to 4.7 points higher than they would have been if they had the blood lead distribution observed among United States preschool-aged children in the late 1970s. It was also estimated that each IQ point raises worker productivity 1.76% to 2.38%. With discounted lifetime earnings of $723,300 for each 2-year-old in 2000 dollars, the estimated economic benefit for each year's cohort of 3.8 million 2-year-old children ranges from $110 billion to $319 billion.[34] |
| **Estimated Cost of Preventive Intervention** | In 2004, the private-sector cost of blood lead screening (venous sample test) averaged $22 per specimen for shipping, handling, and laboratory analysis; approximately 95% of all paid claims fell within the range of $8 to $55.35 Including the blood draw, which costs an average of $9, the total cost for blood lead level screening averaged $31. Approximately 95% of all paid medical claims fell within the range of $10 to $69.[35] |
| **Estimated Cost of Treatment** | Chelation therapy, the standard treatment, which leeches lead from the body, costs an estimated $2,046 (in year 2001 dollars) for each child treated.[36] |
| **Cost-Effectiveness and/or Cost-Benefit Analysis of Preventive Intervention** | A study based on mathematical simulations of a blood lead screening program, estimated that, compared with no screening, universal screening of all 1-year old children for elevated BLLs would produce economic benefits exceeding program costs in communities where at least 11% to 17% of children had elevated BLLs.[37] |

## Preventive Intervention Information

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| **Preventive Intervention: Purpose of Screening** | Identifying children with elevated BLLs allows parents to make necessary environmental changes to limit the child's exposure to lead and allows clinicians to begin medical treatment with chelating agents (if necessary), before lead poisoning and its serious complications occur. Environmental changes, such as lead-paint abatement and removal of lead-soldered pipes, can have beneficial effects on both exposed children and other children who live in the home. |
| **Benefits and Risks of Intervention** | Risks associated with BLL screening include increased anxiety among parents, discomfort to the child of repeated blood draws, and the inconvenience associated with office visits. As with all screening tests, a false-positive test result can lead to unnecessary treatment. However, the benefits of screening, including early identification of lead exposure and the prevention of lead poisoning, outweigh the costs and risks associated with screening. |

Chelating agents can cause adverse effects, which may be severe. Thus, the benefits and risks associated with lead poisoning treatment should be carefully weighed.

**Initiation, Cessation, and Interval of Screening**

Children at risk for lead exposure should be screened at or before age 12 months. Clinicians should note that, on average, blood levels peak in exposed children between 18 and 24 months of age. Screening for elevated BLLs should cease when the clinician determines the child is no longer at risk for exposure based on age or environmental risk profile.

At a minimum, blood lead testing for at-risk populations should be conducted at the following ages:

- 12 months
- 24 months
- 36–72 months

Children of any age should be screening when deemed medically necessary by a clinician's risk assessment, when clinical signs or symptoms consistent with elevated BLL are present, or when other evidence indicates possible exposure.

Children with symptoms consistent with increased intracranial pressure should also be considered for screening.

Recently resettled refugee, immigrant, and internationally adopted children 6 months to 16 years of age should be tested upon arrival and again 3 to 6 months after resettlement if local conditions warrant.[38]

State screening plans can be found on the CDC Childhood Lead Poisoning Prevention Branch website (www.cdc.gov/nceh/lead).

**Intervention Process**

Screening for lead exposure is conducted by measuring the amount of lead circulating in the blood through either a capillary or venous blood sample. Venous samples are more accurate and are thus the preferred method of testing. However, because of the added discomfort and cost of venous samples, clinicians often screen low-risk populations by taking a capillary blood sample and by performing a confirmatory venous blood lead concentration test on samples that show elevated BLLs.

**Treatment Information**

The main treatment for lead exposure is to stop the exposure by removing environmental or dietary sources of lead. Lead exposure reduction may include full lead abatement in the home, special cleaning techniques, the removal of contaminated objects, or the removal of the child from the home.[40] Treatment for lead poisoning (a BLL of 45 µg/dL or higher) requires pharmacologic intervention. Chelation therapy is the most common form of lead poisoning treatment and may prevent further damage by reducing the amount of lead circulating in the blood. Clinicians may choose to begin chelation therapy for children with BLLs lower than 45 µg/dL if the children have persistently elevated BLLs that do not respond to environmental risk reduction.[39]

Health benefits should include provisions for diagnostic, surveillance, and treatment services.

**Strength of Evidence for the Clinical Preventive Service**

The evidence supporting the recommendations contained in this section is described below.

***Recommended Guidance:***

Centers for Disease Control and Prevention's (CDC) Advisory Committee on Childhood Lead Poisoning Prevention
Strength of Evidence: Not Specified

- The CDC supports routine blood lead testing for children at high risk for exposure from lead paint, from house dust and soils contaminated by lead paint, from industrial sources of lead (e.g., smelters), and from imported cosmetics, traditional remedies, and cultural items that contain lead.[1]

Center for Medicare and Medicaid Services (CMS)
Strength of Evidence: CMS Mandate

- The Centers for Medicare/Medicaid Services (CMS) requires blood lead testing of all Medicaid enrolled children at 1 and 2 years of age or at 3 years of age if not previously tested.[2]

**Authored by:**

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