



**SANDHILLS
CENTER**



Blood lead screening and exposure

Clinical Policy ID: CCP.1333

Recent review date: 8/2021

Next review date: 12/2022

Policy contains: Blood lead exposure, preventive screening.

This policy is a Sandhills Center Clinical Coverage Policy adopted from AmeriHealth Caritas of North Carolina. These clinical policies are used to assist with making coverage determinations. Sandhills Center's clinical policies are based on guidelines from established industry sources, such as the Centers for Medicare & Medicaid Services (CMS), state regulatory agencies, the American Medical Association (AMA), medical specialty professional societies, and peer-reviewed professional literature. These clinical policies along with other sources, such as plan benefits and state and federal laws and regulatory requirements, including any state- or plan-specific definition of "medically necessary," and the specific facts of the particular situation are considered by Sandhills Center when making coverage determinations. In the event of conflict between this clinical policy and plan benefits and/or state or federal laws and/or regulatory requirements, the plan benefits and/or state and federal laws and/or regulatory requirements shall control. Sandhills Center clinical policies are for informational purposes only and not intended as medical advice or to direct treatment. Physicians and other health care providers are solely responsible for the treatment decisions for their patients. Sandhills Center's clinical policies are reflective of evidence-based medicine at the time of review. As medical science evolves, Sandhills Center will update its clinical policies as necessary. Sandhills Center clinical policies are not guarantees of payment.

Coverage policy

Blood lead testing and screening (measurement of blood lead level) is clinically proven and, therefore, medically necessary when any of the following criteria are met:

All members ages 12 and 24 months, and any member age 24 to 72 months with no record of a previous blood lead screening test, in accordance of Medicaid requirements whether coverage is funded through title XIX or XXI. The Medicaid requirement is met only when the two blood lead screening tests identified above, or a catch-up blood lead screening test, are conducted (U.S. Centers for Disease Control and Prevention, 2020a; Wachino, 2016).

In addition, a risk assessment is to be performed with appropriate action to follow if possible at the following ages: six months, nine months, three years, four years, five years, and six years (American Academy of Pediatrics, 2020).

Lead screening is also considered medically necessary for members older than six years who have symptoms of lead poisoning. In particular, screening for blood lead levels for members in occupations that involve lead is considered medically necessary (National Institute for Occupational Safety and Health, 2018).

Limitations

All other uses of blood level testing are not medically necessary. Blood lead screening tests are considered not clinically proven and not medically necessary for asymptomatic members, or members with no risk factors under age five, and asymptomatic pregnant members (U.S. Preventive Services Task Force, 2019).

Alternative covered services

Consult with the participating Primary Care Practitioner about a lead screening blood test.

National Lead Information Center 1-800-424-LEAD (5323) or visit www.epa.gov/lead.

Background

Lead is a metal that occurs naturally in the earth's crust. Much of environmental lead is introduced from human activities such as mining and manufacturing. For many years, lead was an element in paint; older houses may still have paint containing lead. Exposure can occur by (Centers for Disease Control and Prevention, 2020b):

- Eating food or drinking water that contains lead. Water pipes in older homes may contain lead.
- Working in a job where lead is used.
- Using lead in a hobby, such as making stained glass or lead-glazed pottery.
- Using folk remedies such as herbs or foods that contain lead.

Breathing air, drinking water, eating food, or swallowing or touching dirt that contains lead can cause many health problems. Lead can affect almost every organ and system in the body. In adults, lead can increase blood pressure and cause infertility, nerve disorders, and muscle and joint pain. It can also make a person irritable and affect their ability to concentrate and remember. Short-term lead poisoning symptoms in exposed adults can include abdominal pain, constipation, fatigue, headache, Irritability, loss of appetite, memory loss, pain/tingling in the hands and feet, and weakness. Exposure over time can lead to abdominal pain, constipation, depression, distraction, forgetfulness, irritability, and nausea (National Institute for Occupational Safety and Health, 2018).

Lead is particularly dangerous to children because their growing bodies absorb more lead than adults do and their brains and nervous systems are more sensitive to the damaging effects of lead. Lead exposures to babies and young children are 4-5 times than those in adults (World Health Organization, 2018), because they often put their hands and other objects that can have lead from dust or soil on them into their mouths (Mayo Foundation for Medical Education and Research, 2019). Children may also be exposed to lead by eating and drinking food or water containing lead or from dishes or glasses that contain lead, inhaling lead dust from lead-based paint or lead-contaminated soil or from playing with toys with lead paint.

A child who swallows large amounts of lead may develop anemia, severe stomach ache, muscle weakness, and brain damage. Reduced attention span, increased antisocial behavior, reduced educational attainment, and lower intelligence quotients are found at higher rates in children exposed to lead (World Health Organization, 2018). Even at low levels, lead can affect a child's mental and physical growth. Today at least four million households have children being exposed to high levels of lead. There are approximately 535,000 U.S. children ages 1-5 with blood lead levels above five micrograms per deciliter ($\mu\text{g/dL}$), the reference level that the U.S. Centers for Disease Control and Prevention recommends public health actions be initiated (Council on Environmental Health, 2016).

Adults may be exposed to lead by eating and drinking food or water, or from dishes or glasses that contain lead. They may also breathe lead dust by spending time in areas where lead-based paint is deteriorating, and during renovation or repair work that disturbs painted surfaces in older homes and buildings. The most common source of lead exposure in adults is occupational; working in a job or engaging in hobbies where lead is used, such as making stained glass, can increase exposure as can certain folk remedies containing lead (Centers for Disease

Control and Prevention, 2012). A pregnant woman's exposure to lead from these sources is of particular concern

because it can result in exposure to her developing baby.

No safe blood lead level in children has been identified (Centers for Disease Control and Prevention, 2021b). Lead exposure can affect nearly every system in the body. Because lead exposure often occurs with no obvious symptoms, it frequently goes unrecognized. The Center for Disease Control and Prevention's Childhood Lead Poisoning Prevention Program is committed to the Healthy People 2030 goal of reducing blood lead levels in children age 1 – 5 (U.S. Department of Health and Human Services, 2020). The program is part of the National Center for Environmental Health's Division of Emergency and Environmental Health Services.

In the past, blood lead level tests above 10 µg/dL may or may not have been reported to parents. The new lower value means that more children will likely be identified as having lead exposure allowing parents, doctors, public health officials, and communities to take action earlier to reduce the child's future exposure to lead.

In January 2012, a committee of experts recommended that the Centers for Disease Control and Prevention change its "blood lead level of concern." The recommendation was based on a growing number of scientific studies that show that even low blood lead levels can cause lifelong health effects. The committee recommended that the Centers link lead levels to data from the National Health and Nutritional Examination Survey to identify children living or staying for long periods in environments that expose them to lead hazards (Centers for Disease Control and Prevention, 2012).

This new level of concern is based on the population of children aged 1-5 years in the U.S. who have levels in the highest 2.5th percentile, or at least 5 µg/dL of lead in blood. The Centers for Disease Control and Prevention's "blood lead level of concern" had been 10 µg/dL. The new value means that more children will be identified as having lead exposure earlier and parents, doctors, public health officials, and communities can take more prompt action. The committee also asserted, as the Centers for Disease Control and Prevention has long maintained, that the best way to protect children is to prevent lead exposure.

Lead is a pollutant regulated by many laws administered by the U.S. Environmental Protection Agency, including the Toxic Substances Control Act, Residential Lead-Based Paint Hazard Reduction Act of 1992 (Title X), Clean Air Act, Clean Water Act, Safe Drinking Water Act, Resource Conservation and Recovery Act, and Comprehensive Environmental Response, Compensation, and Liability Act, among others.

Under the Early and Periodic Screening, Diagnostic and Treatment benefit, Medicaid provides comprehensive coverage, for any service described in section 1905(a) of the Social Security Act needed that is medically necessary to correct or ameliorate defects in physical or mental illnesses or conditions identified by screening services, whether or not such service is otherwise covered under the state plan. In 2012, the Centers for Medicare & Medicaid Services expanded its lead screening policy to allow states to request approval from the Centers to implement a targeted lead screening program. This change was made to align the Medicaid lead screening policy with that of the Centers, recognizing that lead exposure risk in some states may not be evenly spread throughout the state, allowing resources to be used more efficiently for children most at risk (Wachino, 2016).

The Healthcare Effectiveness Data and Information Set maintained by the National Committee for Quality Assurance includes a measure that plans ensure all members on Medicaid receive at least one capillary lead screening test by the second birthday (National Committee for Quality Assurance, 2020).

Findings

The Centers for Disease Control and Prevention Lead Poisoning Prevention Program includes standards for screening. It recommends that virtually all American children be screened for lead poisoning, using a test of venous blood by an accredited laboratory. Those at greatest risk for high levels should be screened more frequently, including those living in old buildings, with parents whose occupation involves lead exposure, and with unexplained seizures, neurological symptoms, abdominal pain, or other symptoms consistent with lead poisoning. Children at high risk should be screened starting at six months of age, and others starting at 12 months. The standard for retesting is at 24 months for children with low lead levels, and more frequently if high levels are found (Wachino, 2016; U.S. Centers for Disease Control and Prevention, 2020a).

The U.S. Preventive Services Task Force concluded that insufficient evidence exists to assess benefits and risks of screening asymptomatic children and asymptomatic pregnant women for blood lead levels (U.S. Preventive Services Task Force, 2019).

One study of 27,284 U.S. foreign-born refugee children age six months to 16 years found a high rate of 19.3% with elevated blood lead levels (Pezzi, 2019). Thus, the Centers for Disease Control and Prevention maintains guidelines for blood lead screening in the refugee population, recommending:

- Initial screening of all infants and children 16 years or younger; of adolescents over 16 if elevated levels are suspected or if signs and symptoms are present; and of all pregnant and lactating women and girls;
- Follow up screening 3 – 6 months later of all children under 6 years, regardless of the initial result; of children age 7 – 16 with elevated levels; and (consideration of) persons over 16 with risk factors (Centers for Disease Control and Prevention, 2021c).

The toxic threshold for blood lead levels in children has been reduced dramatically in the past decades. Prior to 1975, this level was 60 µg/dL or greater, and was reduced to 30 (1975), 25 (1985), 10 (1991), and most recently five (2012) (Akkus, 2014). These changes have corresponded with dramatic reductions of blood lead levels. From 1997 to 2015, the percentage of U.S. (tested) children age under six with levels greater than 10 µg/dL declined from 7.61% to 0.50% (n = 11,681 in 2015). The number of young children with blood lead levels greater than five µg/dL declined from 282,434 to 79,957 (3.31% in 2015) between 2010 and 2015 (U.S. Centers for Disease Control and Prevention, 2021a). About 10% of American children of this age were tested, making the steady decline significant.

Mean 2015-2016 U.S. blood lead levels, in µg/dL, were 0.704 for Mexican-Americans, 0.856 for white non-Hispanics, 0.856 for black non-Hispanics, and 1.070 for Asian-Americans. Averages for all races combined by age were 0.820 (age 1 – 5), 0.571 (age 6 – 11), 0.467 (age 12 – 19), and 0.920 (age 20 and over) (Centers for Disease Control and Prevention, 2018). In 2013-2016, the percent of U.S. children 1 – 5 with high blood lead levels were 0.9% and 0.7% for those living below and above poverty (U.S. Environmental Protection Agency, 2020). All figures represent dramatic declines and narrowing of disparities in the past several decades.

A systematic review of 24 studies (n = 11,433) that was presented to the U.S. Preventive Services Task Force could not identify any studies that evaluated the benefits or harms of identifying elevated blood lead levels in screening versus no screening in children under age five (Cantor, 2019).

A systematic review of 19 studies of postnatal lead exposure, which had an inverse association with executive

function processes across childhood, most strongly for working memory and cognitive flexibility in middle childhood. Also in middle childhood, postnatal lead exposure had a marginal inverse association for unitary

executive functioning and attention, along with no relationship with inhibition (Arnold, 2020).

Numerous studies have established the basis for a causal link between lead exposure and reduced intelligence quotient scores. A recent meta-analysis of 22 case-control studies concluded that higher blood lead levels are correlated with lower (full scale and performance) intelligence quotient scores ($P < .0001$), but not verbal intelligence quotient scores (Wu, 2017). Another study did identify a link between lead and reduced verbal intelligence quotient levels (Jeong, 2017).

After 12,139 Hispanic third-grade children in Chicago were tested for blood lead levels, the adjusted risk ratios for reading and math failures using the Illinois Standard Achievement Test were both significantly high at 1.34 and 1.53. All analysis was conducted for lead levels below 10 $\mu\text{g}/\text{dL}$ (Blackowicz, 2016). This analysis was part of a larger study of 58,650 Chicago third graders; statistically significant elevated adjusted risk ratios of 1.32 each were calculated for both reading and math failure (Evens, 2015). A strong dose-response relationship was found between elevated lead levels and reduced proficiency in standardized mathematics, science, and reading tests among 21,281 Detroit schoolchildren in 3rd, 5th, and 8th grade (Zhang, 2013).

Autism spectrum disorder is a condition suspected to have an association with in-body lead levels. A meta-analysis of 52 studies calculated a 55% greater risk of these disorders in children with elevated lead levels, nearly identical to the 56% increased risk for elevated mercury concentration (Saghazadeh, 2017). A systematic review and meta-analysis found that even children with relatively low levels of lead in their blood ($< 3 \text{ mg}/\text{dl}$) also had an elevated risk of attention deficit and hyperactivity symptoms, significant at $P < .0001$ (He, 2019). A systematic review/meta-analysis of 37 articles found inconsistent results in lead exposure levels and risk of autism in children (Wang, 2019).

A review of 1,987 Americans age 20-39 found a link between lead in blood and elevated risk of panic disorder ($P < .02$), major depression ($P < .05$), but not generalized anxiety disorder (Bouchard, 2009).

A systematic review comparing cases ($n = 3,744$) and controls ($n = 33,012$) noted that in each of the 12 studies, lead exposure was associated with cardiovascular end points (relative ratios varied from 1.1 to 1.89), including both mortality and morbidity measures. Authors concluded that results were suggestive, but not enough to infer a cause and effect relationship, calling for additional studies (Navas-Acien, 2007).

A review of 15,604 U.S. children age 2 – 19 in the period 2011 – 2014 showed that those who did not drink tap water had a significantly lower rate of elevated blood lead than those who drank tap water (adjusted prevalence ratio 0.62), suggesting that tap water may be one vector for children ingesting lead (Sanders, 2018).

Prenatal dietary supplements can affect post-natal blood lead levels in the child. In a systematic review/meta-analysis of 28 studies, adding calcium to the prenatal diet significantly reduced lead levels, while taking iron supplements revealed similar (mostly negative) associations (McElroy, 2020).

A systematic review of 49 studies ($n > 5,000$) from 28 nations (1983-2017) explored the factors that affect lead in breast milk. The major factors identified included place of residence, maternal age, stage of lactation, smoking habits, maternal dietary intakes, and parity, but authors noted that results are “very controversial” (Cherkani-Hassani, 2020).

Household interventions to reduce lead exposure to children were analyzed in a Cochrane review of 14 studies (n = 2,643). Dust control interventions were found to have no effect on reducing lead levels in blood, while the

quality of evidence for soil abatement efficacy is low (Nussbaumer-Streit, 2016; Yeoh, 2012).

A study of National Health and Nutritional Examination Survey data maintained by the Centers for Disease Control and Prevention showed that from 1999 to 2010, 607,000 cases of children with elevated blood lead levels were reported to the organization, only half of the estimated 1.2 million cases. Of the states and years with the highest reporting, completeness was only 64%. Authors assert that under-testing of blood for lead levels by pediatric providers is “endemic” (Roberts, 2017).

A systematic review determined that a questionnaire prepared by the Centers for Disease Control and Prevention in 1991 was not a good predictor of lead poisoning risk among children, based on 17 reviews showing low rates of sensitivity (0.61) and specificity (0.52); accuracy was relatively high at 1.12 (Ossiander, 2013).

References

On May 10, 2021, we searched PubMed and the databases of the Cochrane Library, the U.K. National Health Services Centre for Reviews and Dissemination, the Agency for Healthcare Research and Quality, and the Centers for Medicare & Medicaid Services. Search terms were “lead/blood,” “lead/adverse effects,” “lead poisoning,” “screening,” and “testing.” We included the best available evidence according to established evidence hierarchies (typically systematic reviews, meta-analyses, and full economic analyses, where available) and professional guidelines based on such evidence and clinical expertise.

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Policy updates

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