Centers for Disease Control and Prevention

Immigrant and Refugee Health

Screening for Lead during the Domestic Medical Examination for Newly Arrived Refugees

Key Points

- Lead exposures among newly arrived refugees may include environmental and occupational exposures, as well as household and personal items.
- Table 1 describes the lead screening recommendations for newly arrived refugee infants, children, adolescents, and pregnant and lactating women and girls.
- In October 2021, CDC lowered the blood lead reference value (BLRV) to 3.5 micrograms per deciliter (µg/dL) to identify children with higher levels of lead in their blood compared to most children. Capillary screening results at or above 3.5 µg/dL should be confirmed with blood drawn by venipuncture. The previous BLRV was 5 µg/dL.
- This level is based on the on the 97.5th percentile of the blood lead distribution of US children aged 1–5 years from the National Health and Nutrition Examination Survey (NHANES). Children with blood lead levels at or above the BLRV are among the 2.5% of US children with the highest blood lead levels.

Table 1. Screening recommendations for all newly arrived refugee infants, children, adolescents, and pregnant and lactating women and girls

Recommended Screening Measures	Population
Initial lead exposure screening with blood test	• All refugee infants and children ≤ 16 years of age • Refugee adolescents > 16 years of age if there is a high index of suspicion, or clinical signs/symptoms of lead exposure • All pregnant and lactating women and girls*
Follow-up testing with blood test, 3-6 months after initial testing	• All refugee infants and children ≤ 6 years of age, regardless of initial screening result • Refugee children and adolescents 7–16 years of age who had BLLs at or above 3.5 µg/dL, and for any child older than 7 years of age who has a risk factor (e.g., sibling with BLL at or above 3.5 µg/dL, environmental exposure risk factors) regardless of initial test result. • Pregnant or lactating adolescents (<18 years of age) who had BLLs at or above 3.5 µg/dL at initial screening.

*All newly arrived pregnant or breastfeeding women should be prescribed a prenatal or multivitamin with adequate iron and calcium. Referral to a healthcare provider with expertise in high-risk lead exposure treatment and management may be indicated for EBLLs.

- See the CDC Childhood Lead Poisoning Prevention Program Recommended Actions Based on Blood Lead Level for information on confirmatory testing, clinical follow-up, and case management of children with BLLs at or above the BLRV of 3.5 µg/dL.

Background

Lead is a known neurotoxicant, and exposure can result in EBLL [4]. Around the world, including many countries where refugees originate or seek asylum, environmental lead hazards are common and may include leaded gasoline, industrial emissions, lead-based paint, and burning of waste containing lead. Other environmental and occupational exposures include living near or working in mines, ammunition manufacturing, smelters, or battery recycling facilities. Furthermore, household and personal use items have been associated with increased lead levels, both before and after US arrival, such as car batteries used for household electricity, lead-glazed pottery, pewter or brass utensils or cooking pots, pressure cookers, leaded crystal, and chipped or cracked dishes [5 – 8]. Additionally, refugees may use or consume products contaminated with lead such as traditional remedies, herbal supplements, spices, candies, cosmetics, and jewelries or amulets. Table 2 lists examples of traditional remedies, cosmetics, and foods that have been associated with EBLL in children.

Table 2. Examples of regional or culture-specific exposures associated with elevated blood lead levels in children

Exposure	Region or Culture of Origin	Reported Uses and Treatment	Description
Azarcon or *greta* (*alarcon*, *azoque*, *coral*, *liga*, *maria luisa*, or *rueda*) or *albayalde* [6 – 8]	Central America and Mexico	Treatment believed to alleviate digestive problems such as upset stomach, infantile colic, constipation, diarrhea, or vomiting. Also used to soothe teething babies.	Yellow or orange powder added to oil, milk, sugar, tea, or tortilla dough. It may also be present in lead-glazed ceramic ware or baby bottles.
Ba-baw-san, *Bo Ying* [9]	China	Believed to treat colic or respiratory symptoms	Herbal medicine or gray powder
Bint Al Zahab (Daughter of Gold) [10]	Iran	Believed to treat colic and trigger early passage of meconium after birth	Rock ground into a powder and mixed with honey and butter
Daw tway (*Daw Tway Go Mo Dah*), *gaw mo dah* [11]	Burma	General infant remedy believed to treat digestive symptoms	Brown pellets taken orally or topically
Kajal, *kohl*, and *surma* [12 – 13]	Afghanistan, India, Pakistan	Believed to improve eyesight, protect the eyes, and/or prevent the evil eye.	Black powder mixed into a liquid and applied at eyebrow or periorbitally
Litargirio [14]	Dominican Republic	Used as a deodorant or antiperspirant, or as a burn or fungal (usually foot) treatment	Yellow or peach-colored powder applied to the skin
Lozeena [15]	Iraq	Flavoring	Bright orange spice added to foods for flavor, particularly rice and meat dishes
Pay-loo-ah [16]	Southeast Asia	Treatment believed to treat fever and rash	Orange-red powder administered by itself or mixed in tea
Select Ayurvedic preparations [17 – 18]	India	Treatment for wide range of ailments	Preparations vary in appearance and how they are administered.

Exposure	Region or Culture of Origin	Reported Uses and Treatment	Description
Tamarind candies (and packaging) [19 - 20]	Mexico	Candies often consumed by young children	Candy often brought by visiting family members, sold by ethnic markets (embargoed in California), and available through itinerant vendors. “Bolirindo” lollipops by Dulmex™ are soft and dark brown. Candied jams are typically packaged in ceramic jars.
***Tiro* (*tozali* and *kwalli*)** [21]	Nigeria	Eye cosmetic used to improve vision or ward off the evil eye	Fine powder often applied to the eyelid

Mobile infants and young children are particularly at risk for lead exposure given their tendency to mouth objects, and often have increased contact with dust, dirt, and surfaces potentially contaminated with lead [1]. This tendency for mouthing, as well as ingesting non-nutritive substances (pica) contaminated with lead, is exacerbated by lead’s sweet taste. Infants and young children are predisposed to increased BLL at lower exposure levels because they have a greater ratio of body surface area to mass than adults [1, 22]. Malnourished children may also be at an increased risk for harm from lead exposure if their BLLs are at or above the BLRV of 3.5 µg/dL, likely through increased intestinal lead absorption mediated by micronutrient deficiencies such as iron, calcium, or zinc [23, 24].

The studies summarized below were conducted when the BLRV was 5 µg/dL. In October 2021, CDC updated the BLRV to 3.5 µg/dL. In one analysis of lead exposures in children <2 years of age (n=642) in a refugee camp in Thailand, moderate to severe anemia (hemoglobin <10 g/dL) was associated with BLL at or above 5 µg/dL; lead acid car batteries and traditional remedies were the most common sources of exposure [3]. Mouthing of cosmetic products was also a suspected contributor [3]. Certain subpopulations of women are also at increased risk for lead exposure; these include refugees and other recent immigrants. In one study, foreign-born pregnant women in New York City were 8.2 times more likely than non-foreign-born women to have a BLL at or above 5 µg/dL [25]. Among the groups studied, women from Bangladesh, Mexico, and Pakistan had the highest BLLs [25].

Refugee children arriving in the United States have higher average rates of BLLs exceeding the BLRV than US-born children. Analyses of domestic data have revealed that the prevalence of a BLL at or above 5 µg/dL among newly arrived refugee children may be in excess of 40% in certain groups [11, 26–30]. These reports suggest that country of origin, country of last residence, and age are strong predictors of BLLs at or above 5 µg/dL among newly arrived refugee children [30, 31]. In a recent assessment of refugee children 6 months to 16 years of age (n=27,284) resettled in 11 states (CO, ID, IL, KY, MA, MN, NC, NY [excluding New York City], TX, UT, and WA) and one county (Marion County, IN), the prevalence of BLL at or above 5 µg/dL at the initial domestic screening was 19.3% (n=5,275) [22]. BLL at or above 5 µg/dL was associated with younger age. Of those screened, 22.8% of children <7 years of age had BLLs at or above 5 µg/dL, while 16.5% of children ≥7 years of age had BLLs at or above 5 µg/dL. Of note, BLL at or above 5 µg/dL was higher in children examined in India, Afghanistan, Burma, and Nepal, as well as male children [22].

Refugee children are at continued risk for ongoing lead exposures after arrival in the United States. One analysis of lead exposure among refugee children (n=705) 0–16 years of age in Syracuse, NY, found that 17% of refugee children had BLLs at or above 5 µg/dL (≥5 µg/dL) upon initial screening [33]. Of those who had BLLs at or above 5 µg/dL at initial screening, and 30% were found to have an increased BLL at follow-up [33]. Among 1,121 refugee children (6 months–16 years of age) resettled in five jurisdictions (CO, IL, IN [Marion County], MN, and NY) who had both initial and follow-up lead screening results (3–6 months after initial screening), 183 (16.3%) had a BLL at or above 5 µg/dL at the initial and follow-up screening [22]. Additionally, 71 (6.3%) children had a BLL at or above 5 µg/dL at follow-up but had a BLL <5 µg/dL at the initial screening [22]. Although increases in BLL were more common in younger children, data suggest that older children (including adolescents) are also at risk for increases in BLL after resettlement to the United States [22]. Most often, lead exposures among children with new or increasing BLL after arrival include lead-based paints in older housing and lead-contaminated soil where children reportedly play [34]. Furthermore, certain behaviors, such as pica (e.g., eating soil or paint chips); picking or handling of loose contaminated paint chips, plaster, or putty; or chewing on contaminated painted surfaces can be sources of lead exposure [34].

Children, as well as adults, may also be at risk for BLL at or above the BLRV after arrival due to continued use of spices, candy, traditional cosmetic products, and cookware brought from overseas [35, 36]. Some of these products may also be purchased in the United States.

Clinical Presentation

Children

Scientific evidence has shown that BLLs <10 µg/dL are associated with adverse cognitive and behavioral development [38]. At higher BLLs, acute symptoms of toxicity may appear. Above 40 µg/dL, children may experience headaches, abdominal pain, anorexia, constipation, clumsiness, agitation, and lethargy [38]. At 70 µg/dL, children may develop severe neurological complications, including seizures, ataxia, mental status changes, coma, and death [24]. Although severe poisoning is rare in the United States, the death of a newly arrived 2-year-old Sudanese refugee with a BLL of 391 µg/dL in 2000—which was the first lead-poisoning-related death in the United States in a 10-year period—underscores the importance of early identification and management of cases in children with BLL at or above the BLRV in resettled refugee children [39].

Pregnant and Lactating Women and Adolescent Girls

Lead exposure (and associated toxicity) remains a public health concern for certain groups of women and girls of childbearing age (15–44 years), developing fetuses, and nursing infants [40]. Lead toxicity in pregnant women has been associated with an increased risk of spontaneous abortion, gestational hypertension, abnormal fetal neurodevelopment, and low birthweight. Additionally, strong evidence shows that prenatal lead exposure impairs children's neurodevelopment, placing them at increased risk for developmental delay, reduced IQ, and behavioral problems [40]. Because more than 90% of lead is stored in bone, it is thought that long-term exposure in women may cause lead accumulated in bone to be released during times of higher metabolism, such as pregnancy and lactation, potentially placing the fetus or nursing infant at risk of exposure [40].

Recommendations for Post-arrival Lead Screening

All refugee infants and children 0–16 years of age should be evaluated for lead exposure with a blood lead test. Older refugee adolescents should be tested if there is a high suspicion or clinical signs/symptoms of lead exposure, or if currently pregnant or lactating. A history of lead exposure includes questions about signs and symptoms (e.g., developmental history), behaviors (e.g., pica), and potential exposures such as use of cosmetics (purchased overseas), ceramics, spices, food, tobacco, or remedies [14, 15, 21]. An in-depth discussion of the clinical management of BLLs at or above the BLRV is beyond the scope of this document. Refer to Summary of Recommendations for Follow-up and Case Management of Children Based on Initial Screening Capillary and Confirmed* Venous Blood Lead Levels for additional guidance.

Standard Surveillance Definitions and Classifications

Please refer to the CDC Standard Surveillance Definitions and Classifications and Childhood Lead Poisoning Prevention Program for additional information.

Pediatric Recommendations

Given the neurodevelopmental and health complications associated with exposure to lead, all refugee infants and children ≤16 years of age should be evaluated for lead exposure at the domestic medical screening visit with a blood test. Adolescent refugees >16 years of age should be tested if there is a high index of suspicion (e.g., sibling with BLL at or above 3.5 µg/dL, environmental exposure risk factors), if there are clinical signs or symptoms of lead exposure, or if pregnant or lactating. Venous or capillary lead levels should be reported to state or local lead programs. Clinicians may refer to the CDC Summary of Recommendations for Follow-up and Case Management of Children Based on Confirmed Blood Lead Levels for additional information.

Within 3–6 months after initial testing, a blood lead test should be repeated for all refugee infants and children ≤6 years of age, ***regardless of initial screening BLL result***. Repeat testing is also recommended for refugee children and adolescents 7-16 years of age who had EBLL at initial screening. Repeat testing is also warranted in adolescents >16 years of age with specific

risk factors (e.g., sibling with EBLL, environmental risk factors). Additional information on case management and follow-up of EBLL is available in Managing Elevated Blood Lead Levels among Young Children: Recommendations from the Advisory Committee on Childhood Lead Poisoning Prevention [PDF – 152 pages]. Clinicians should also familiarize themselves with local lead resources, as well as state or local recommendations for treatment and prevention.

Recommendations for Pregnant and Lactating Women and Adolescent Girls

CDC does not recommend routine universal screening for BLLs for all pregnant or lactating women and adolescent girls in the United States. However, a risk evaluation of every pregnant or lactating girl or woman is encouraged, with screening recommended when one or more risk factors is identified [41]. Common risk factors for lead exposure in pregnant women and girls include pica behaviors, occupational exposure, use of traditional remedies or supplements, cosmetics manufactured overseas, use of traditional lead-glazed pottery, and nutritional status (e.g., low body mass index [BMI]) [40]. Importantly, recent emigration from or residency in areas where ambient lead contamination is high is an indication for screening [41]. Because refugees generally have lived in areas where ambient lead exposure is high, it is recommended that all newly arriving pregnant or breastfeeding girls and women be screened for lead exposure at the domestic medical screening with a blood test. Follow-up blood lead testing is recommended for those whose BLL is at or above 5 µg/dL upon initial screening. However, repeat testing (within 3-6 months of initial screening) should be considered in pregnant or lactating adolescents (<18 years of age) who had BLLs at or above 3.5 µg/dL at initial screening. Frequency of follow-up and actions taken are dependent on the BLL (see Table 1 in the ACOG Committee Opinion on Lead Screening during Pregnancy and Lactation). The provider should recommend a prenatal vitamin or multivitamin with adequate iron and calcium to pregnant or lactating girls and women [41]. Clinicians should consider a referral to a local healthcare provider with expertise in high-risk lead exposure or consult a high-risk Obstetrician provider for treatment and management. Those with a confirmed BLL at or above the BLRV should be reported as determined by local policies. Children in the household should also be tested for BLL. For interpretation of lead levels in pregnant and lactating girls and women, refer to the ACOG . Additional information on case management and follow-up of an elevated BLL in pregnant and lactating girls and women is available from the CDC Guidelines for the Identification and Management of Lead Exposure in Pregnant and Lactating Women [PDF – 303 pages].

Additional Resources

- CDC Lead Website
- State and Local Lead Programs

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Page last reviewed: February 23, 2022