# Screening for Lead at the Domestic Refugee Medical Examination

## Background

Epidemiology and Geographic Distribution:

Following the phase-out of leaded gasoline and the ban on lead-based paint, the prevalence of lead poisoning, as defined by a blood lead level (BLL) ≥10 µg/dL, among children in the United States has dramatically declined since the 1970s, decreasing from 78% in 1976-1980 to 1.6% in 1996-2002.[1] In contrast, refugee children arriving in recent years have much higher rates of elevated BLL on average, when they enter the United States, due to exposures prior to relocation. In addition, refugee children are at above-average risk for lead poisoning from exposures within the United States, because they typically settle into high-risk areas and substandard housing.

In areas of the world where many refugees originate, potential lead exposures include lead-containing gasoline combustion, industrial emissions, ammunition manufacturing and use, burning of fossil fuels and waste, and lead-containing traditional remedies, foods, ceramics and utensils.[2,3]

Among 299 refugee children under the age of 6 years from 25 different counties arriving to Minnesota during 2000--2002, 22% had a BLL of ≥10 µg/dL.[2] This finding indicates that the prevalence of lead poisoning in newly arrived refugee children may be 14 times greater than that of the general U.S. population of comparable age. Among the children with elevated BLLs, 29 (45%) had levels from 10 to 14.9 µg/dL, 15 (23%) had levels from 15 to 19.9 µg/dL and 21 (32%) had levels from 20 to 44.9 µg/dL. Of the children with BLLs from 20 to 44.9, 19 were from sub-Saharan Africa and two were from Bosnia and Herzegovina.

Although children from all regions of the world are at risk for having elevated BLL upon entering the U.S., this risk appears to vary to some degree. In an analysis of screening data from Massachusetts, the prevalences of elevated BLL among newly arrived refugee children under 7 years old were 7%, 25%, 27%, 37%, and 40% among those from Northern Eurasian countries, the Near East (predominately Iraq), Africa, Asia (predominately Vietnam), and Central America/Caribbean countries, respectively. None of 33 Bosnian children born in Germany had elevated BLL. This finding suggests that birthplace and other areas of residence are more important than ethnicity as predictors of elevated lead levels.[3]

Ongoing lead exposure among refugee children within the United States has been well documented. Reports from Massachusetts and New Hampshire indicate that from 6% to 29% of children who have normal BLL at new arrival screening may have elevated BLLs when retested several weeks to months later.[3,4] Malnutrition is a known risk factor for increased BLL. In New Hampshire, malnutrition was commonly identified in refugee children with elevated BLL (22 % had a low weight-for-height ratio and 35% had a low height-for-age ratio at the time of repeat testing). The median age of those with elevated BLL on repeat testing was 4.9 years (range 14 months to 13 years), which is considerably older than the ages of recommended screening for most children in the United States. The most common lead exposures identified among children with elevated BLL at repeat testing were lead-based paints and lead-contaminated soil where the children had played. Of the refugee children in New Hampshire with BLLs >15 µg/dL, 89% lived in rental homes built before 1978 when lead-based paints were still used. Furthermore, two-thirds of the parents reported witnessing behaviors by their children that may increase lead

exposure, such as frequently putting nonfood items into their mouths (pica), picking at loose paint, plaster or putty, or chewing on painted surfaces. Investigators also noted limited parental awareness of the dangers associated with lead exposure.[4]

In addition to exposure to lead-based paints and contaminated soil, refugee children are vulnerable to other unique sources of lead exposure. A variety of foods, candies, and traditional therapies have been found to be the source of exposure for many immigrant children (Table 1).

Refugee Populations at Risk:

- Refugee children originating in all regions of the world, especially those from resource-poor countries, are at risk of having lead poisoning upon arrival to the United States.
- Malnourished children may be at increased risk for lead poisoning, likely through increased intestinal lead absorption mediated by micronutrient deficiencies. The best-studied micronutrient deficiency related to lead levels is iron deficiency. Iron-deficient children are at increased risk for developing lead poisoning.[5] Deficiencies in calcium and zinc may also increase a child's risk.[6]

## Clinical Presentation

Since 1991, the value indicating elevated BLL has been ≥10 µg/dL. Above this value lead is known to impair intelligence and neurodevelopment.[6] However, more recent studies call into question whether levels <10 µg/dL are safe. The results of one study suggest that the magnitude of the decrease in intelligent quotient (IQ) for each incremental increase in BLL is greatest among those children with levels below 10 µg/dL.[7]

At levels higher than 10 µg/dL, more acute symptoms may appear. Above a level of 60 µg/dL, individuals may experience headaches, abdominal pain, anorexia, constipation, clumsiness, agitation, and lethargy.[8] At BLLs as low as 70 µg/dL, children may develop severe neurologic complications, including seizures, ataxia, mental status changes, coma and death.[6] Although such severe poisonings are rare in 2000, a 2-year-old Sudanese refugee girl with a BLL of 392 µg/dL died 5 weeks after arrival to the United States. This was the first lead-poisoning-related death in the U.S. in a 10-year period and underscores the unique vulnerability of refugee children to this condition.[9]

## Medical Screening

Screening and Testing Prior to Departure for the United States:

None

Recommendations for Post-Arrival Evaluation:

Driven by the above data specific to refugees, the U.S. Department of Health and Human Services, Centers for Disease Control and Prevention, Childhood Lead Poisoning Prevention Branch and Division of Global Migration and Quarantine, in collaboration with the U.S. Department of State, Bureau of Population, Refugees and Migration, developed recommendations specifically to address lead exposure among refugee children. (The full document is available at: www.cdc.gov/lead/factsheets/refugeechildrenfactsheet.htm.) [10]

*Identification of Refugee Children with Elevated Blood Lead Levels (pertinent to the new refugee medical screening examination)*

1. Check BLL of all refugee children 6 months to 16 years of age at the time of arrival to the United States.
2. Children younger than 6 years should undergo nutritional assessments as well as testing for hemaglobin or hematocrit level with one or more of the following: mean corpuscular volume (MCV) with the red cell distribution width (RDW), ferritin, transferrin saturation, or reticulocyte hemoglobin content.
3. Provide daily pediatric multivitamins with iron for refugee children 6 to 59 months of age.
4. Follow-up blood lead testing should be done 3-6 months after placement in a permanent residence.

The refugee status of most children entitles them to Medicaid, Women, Infants and Children's Program (WIC) and other social services for at least 8 months after their resettlement, regardless of the family financial status.

## Evaluation and Treatment of Refugees with Elevated Blood Levels

An in-depth discussion of management of lead is beyond the scope of this document. If a child has a BLL ≥10 μg/dL, clinicians should refer to the reference "Managing Elevated Blood Lead Levels Among Children" prepared by the CDC, which can be obtained at http://www.cdc.gov/lead/scientificandeducation.htm.[11] Further information on appropriate history taking, medical management, environmental assessments and follow-up testing are available from the Centers for Disease Control and Prevention (http://www.cdc.gov/nceh/lead).

Many of the questions typically asked of children in the U.S. are not a pertinent in refugees since they have recently relocated (moved) from the most likely source of exposure. However, children's lead levels may increase in a relatively short amount of time (within weeks) and so typical exposures should be solicited. These questions might include such exposures as peeling paint in their current residence and does the child spend significant amounts of time in play areas where there is bare soil. In addition, folk remedies, traditional therapies, pottery or metal vessels and imported foods may be of particular concern in this population and these risks should be assessed in a culturally sensitive manner (Table 1). In case reports, parents have denied giving "folk remedies" to their children with high BLL, even when the ultimately identified source is a cultural-specific remedy. This confusion may be explained by differences in what is considered "folk remedies" between clinicians and parents. If no lead sources can be identified in children with lead poisoning, clinicians should consider checking BLLs in other family members. If other family members of various ages have elevated levels, a shared source exposure, such as ceramic ware, spices, foods and remedies, may be present.[12, 13, 14]

Appropriate management of children with confirmed elevated blood lead levels is based on the extent of the elevation (www.cdc.gov/nceh/lead/CaseManagement/caseManage_chap3.htm). Follow-up testing is mandatory for all children with documented elevated venous blood lead levels in addition to the special refugee groups mentioned above, who should be re-evaluated regardless of their initial level. Trends are especially important in this population since, although they may have left the environment of exposure when they migrated, they are generally moving into high risk housing in the U.S.[4] It is not unusual for a child's lead

level to continue to rise after migration to the U.S. which would demand formal environmental evaluation. Information on recommended follow-up testing can be found at: http://www.cdc.gov/nceh/lead/CaseManagement/caseManage_main.htm. Children with elevated levels should be reported to State Childhood Lead Poisoning Prevention Programs (CLPPP) or appropriate State contact. State and local program contacts may be found at: www.cdc.gov/nceh/lead/grants.contacts/CLPPP%20Map.htm.

Sources of Additional Information:

CDC Lead Poisoning Prevention in Newly Arrived Refugee Children: Tool Kit
(This educational kit has modules intended for both Refugee Resettlement Workers and Medical Providers. It can be downloaded from
http://www.cdc.gov/nceh/lead/Publications/RefugeeToolKit/Refugee_Tool_Kit.htm
CD-ROM copies can be obtained by calling 1-800-CDC-INFO)

Centers for Disease Control and Prevention (CDC). Elevated blood lead levels in refugee children--New Hampshire, 2003-2004. *MMWR Morb Mortal Wkly Rep*. 2005;54:42-46.

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9. Centers for Disease Control and Prevention (CDC). Fatal pediatric lead poisoning--New Hampshire, 2000. *MMWR Morb Mortal Wkly Rep*. 2001;50:457-459.

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11. Centers for Disease Control and Prevention. Managing Elevated Blood Lead Levels Among Children: Recommendations from the Advisory Committee on Childhood Lead Poisoning Prevention. Available at: http://www.cdc.gov/nceh/lead/CaseManagement/caseManage_main.htm. Accessed 6/6, 2007.

12. Centers for Disease Control and Prevention (CDC). Lead poisoning associated with use of litargirio--Rhode Island, 2003. *MMWR Morb Mortal Wkly Rep*. 2005;54:227-229.

13. Centers for Disease Control and Prevention. Screening Young Children for Lead Poisoning: Guidance for State and Local Health Officials. Available at: http://www.cdc.gov/nceh/lead/guide/guide97.htm. Accessed 6/6, 2007.

14. Centers for Disease Control and Prevention (CDC). Lead poisoning associated with imported candy and powdered food coloring--California and Michigan. *MMWR Morb Mortal Wkly Rep*. 1998;47:1041-1043.

Table1. Examples of culture-specific exposures associated with elevated lead levels in children

| Exposure | Area of origin | Reported uses | Description |
|---|---|---|---|
| 'Pay-loo-ah' | Southeast Asia | Treatment of fever and rash | Orange-red powder. Administered by itself or mixed in tea. |
| Greta | Mexico | Treatment of digestive problems | Yellow-orange powder. Administered with oil, milk, sugar or tea. Sometimes added to baby bottles and/or tortilla dough. |
| Azarcon | Mexico | Treatment of digestive problems | Bright orange powder. Administered similarly to greta. |
| Litargirio | Dominican Republic | Deodorant/antiperspirant and treatment of burns and fungal infections of the feet. | Yellow or peach-colored powder. |
| Surma | India | Improve eyesight | Black powder administered to inner lower eyelid. |
| Unidentified ayuvedic | Tibet | Treatment for slow development | Small gray-brown balls administered several times a day. |
| Lozeena | Iraq | Added to rice and meat dishes for flavor | Bright orange spice |
| Tamarind candles (multiple brand names) | Mexico | Lollipops, fruit rolls, candied jams | 'Bolirindo' lollipops are soft and dark brown . Candied jams are typically packaged in ceramic jars. |
| Lead-glazed ceramics | Often made in Latin America | Bean pots, water jugs | |
| Make-up and beauty products | Multiple cultures | Decoration | Many types |

This table is modified from the one published in the Textbook of Immigrant Medicine, 1st Edition. Patricia Walker and Elizabeth Barrett (Eds). Rajal Moday, Preventive Healthcare in Children, page 517. 