

# Lead Guidelines for Primary Care Providers Caring for Migrant Children

## Background

Lead poisoning is the most common disease of toxic environmental origin among children in the United States today.<sup>1</sup> Based on studies that recognize adverse health effects in children with low blood lead levels (BLL), the Centers for Disease Control and Prevention (CDC) currently recommends treatment and case management for children with blood lead levels of 5 µg/dL or greater.<sup>b,c</sup>

Blood lead levels in the United States have declined dramatically over the past 3 decades. From 1999–2004 the prevalence of blood lead levels greater than 10 µg/dL was at an all time low of 1.6%.<sup>6</sup> This decline principally is due to removal of lead from gasoline and, additionally, to bans on the use of lead in household paint, food and drink cans, and plumbing systems.<sup>1,18</sup> Despite this decline in blood lead levels greater than 10 µg/dL between 1999–2002, an estimated 450,000 children aged 1–5 in the United States have blood lead levels > 5 µg/dL.<sup>b</sup>

Moreover, the risk of lead exposure remains disproportionately high among children who are poor, African American, and/or Hispanic.<sup>6</sup> Among those least studied, are mobile Hispanic children.<sup>7</sup> Migratory farmworkers have been shown to live in crowded conditions, in inadequate housing lacking basic facilities such as vacuum cleaners.<sup>8</sup> Because of mobility, migratory farmworkers and their families face unique conditions that can potentially exacerbate health disparities including inconsistent health care and exposure to a constantly changing environment. A recent study found that children living in rental property and belonging to a family of migrant farmworkers were more likely to have elevated blood lead levels.<sup>9</sup> Moving from place to place into different substandard housing units as well as nutritional deficiencies caused by an inconsistent diet were likely factors for both children and adults. Migrant farmworker children must, therefore, be considered a high-risk population for lead poisoning. Several older studies have documented increased lead exposure in migrant farmworker children, attributed to poor housing and soil contamination.<sup>10,11</sup>

## Sources of Lead

Because of their normal oral exploratory behavior, children are most likely to acquire lead through ingestion.<sup>18</sup>

- **Lead-based paint** continues to be the principal source of high-dose lead exposure for children. An estimated 57 million housing units in the United States contain lead-based paint. Children are at especially high risk of exposure to lead from paint in housing built before 1978; these conditions exist in an estimated 3.8 million US homes with young children.<sup>12</sup> Children may directly absorb lead from paint by ingesting paint chips (pica) or, more commonly, by ingestion and inhalation of lead-contaminated house dust.
- **Contaminated dust and soil** are pervasive sources of lead exposure.<sup>12</sup> Concentrations of lead in dust and soil range from near zero to many thousands of parts per million (ppm). Lead in dust and soil appears to produce elevated children's blood lead levels when the concentration exceeds 300 to 500 ppm.
- **Drinking water** is a common source of low-level lead exposure.<sup>12</sup> Although high concentrations of lead in drinking water occur only in unusual circumstances (such as storage of water in lead-lined tanks), lead in water contributes widely to background exposure. At its source, drinking water is almost always lead-free. Water can, however, become contaminated as it passes through lead pipes or comes into contact with lead solder or brass faucets. Soft water of lower pH poses the greatest hazard because it has the greatest capacity to dissolve lead from pipes and solder.
- **Home remedies, folk medicines, ethnic foods** can be a source of lead poisoning. Numerous case reports have documented this hazard,<sup>13</sup> and it appears to be especially common among ethnically isolated groups, including migrant children. Many ethnic products enjoyed by Hispanic families may be contaminated by lead. Seasonings may be contaminated due to the environments where they are processed and candies contaminated by the lead-ink wrappers they are packaged in. Other sources, such as grasshopper ingestion, have been linked to large "outbreaks" of lead poisoning in California Hispanic children.<sup>14</sup> It is unclear why the grasshoppers contained lead.
- **Imported lead-glazed ceramics and pottery** may contribute to lead exposure. The hazard becomes espe-

- **Toys, jewelry, and crafts** may also contain lead. The CDC website regularly posts recalled products. Examples include animal masks, pendants, plastic play sets, shoes, and fishing poles. The possibilities are numerous, so it is wise to check the CDC site periodically. Surface paints and coatings are the typical culprits.

## Effects of Lead Poisoning

Lead is now recognized to produce a wide range of toxicity. These toxic effects extend from acute, clinically obvious poisoning to subclinical effects.<sup>1</sup>

- **Acute poisoning** can be caused by intense exposure to lead, characterized by abdominal colic, constipation, fatigue, anemia, peripheral neuropathy, and alteration of central nervous system function.<sup>1</sup> In severe cases, a full-blown acute encephalopathy with coma, convulsions, and papilledema may occur. In milder cases, only headache or personality changes are evident.<sup>1</sup> Children who have recovered from acute lead encephalopathy often are left with permanent neurologic and behavioral sequelae.<sup>12,13</sup>
- **Lower-dose exposures** to lead produce toxic effects, which are typically asymptomatic and become evident only on special testing. These effects are evident principally in the following three organ systems: the developing red blood cells, the kidneys, and the nervous system. Hypochromic microcytic anemia, often associated with iron deficiency, is the classic hematologic manifestation of lead poisoning. High lead levels also can produce basophilic stippling in red blood cells. In the kidneys, acute lead poisoning can produce a full-blown, but reversible, Fanconi syndrome. Chronic, low-dose exposure can produce renal fibrosis and hypertension.
- **Asymptomatic impairment to the nervous system** has been shown by extensive research to be caused by lead at levels too low to produce obvious encephalopathy. Asymptomatic school-aged children with elevated lead levels have been found to have significant decrements in verbal IQ scores.<sup>12</sup> This finding was still strongly evident after adjusting for a wide range of socioeconomic, behavioral, and biologic factors. Long-term follow-up of asymptomatic school-aged children with elevated lead levels has shown that they are at increased risk during adolescence for dyslexia, failure to graduate from high school, and delinquency.<sup>1</sup>
- **Early developmental delays:** A series of prospective studies of newborns<sup>4,15</sup> has found associations between early developmental delays and umbilical cord blood lead levels as low as 10 to 20 µg/dL. These findings, which are highly credible, have been accepted by the CDC<sup>4</sup> and by the National Academy of Sciences,<sup>15</sup> and are the basis for the CDC recommendation that the blood lead level of concern in children is 10 µg/dL.<sup>4</sup>

## Medical Evaluation

Two fundamental principles must guide assessment of lead exposure in migrant farmworker children.

1. All migrant children 1 to 5 years of age must be considered to be at high risk of lead poisoning. Their high-risk status reflects their poverty and especially their residence in substandard housing that may contain lead paint. In addition, many migrant farmworker children come from cultures with unique risk factors for lead exposure. Mobility across borders escalates opportunities for exposures.
2. Because most pediatric lead poisoning today is asymptomatic, the only reliable means for establishing or excluding a diagnosis of lead poisoning is through determination of the blood lead level. Neither the medical history nor the physical examination can establish or exclude a diagnosis of lead poisoning. Blood for lead analysis may be obtained either by a finger prick or venipuncture. If a blood lead level greater than or equal to 10 µg/dL is found by a finger prick, it must be confirmed by venipuncture. The erythrocyte protoporphyrin (EP) test is no longer considered a reliable diagnostic tool for lead poisoning.

Note: All migrant farmworker children 1 to 5 years of age should receive blood lead testing. If never previously tested, consider testing even in later childhood. If the blood lead level is greater than or equal to 5 µg/dL in either of these evaluations, if a household member has elevated blood lead levels, or if the healthcare professional suspects that a child is exposed to lead, then additional and more frequent blood lead determinations are indicated.

## Diagnosis and Plan

A confirmed venous blood lead level in a child of 5 µg/dL or greater establishes a need for treatment and case management. The management of a child with an elevated blood lead level depends upon the magnitude of the elevation. Table 1 offers recommendations for children with confirmed elevated blood lead levels  $\geq 5$  µg/dL. These recommendations are excerpted from CDC and the American Academy of Pediatrics guidelines.<sup>a,b,16</sup> Table 2 offers the CDC schedule for follow-up blood lead testing.

CDC also recognizes that a blood lead level of 5 µg/dL does not define a threshold for the harmful effects of lead.<sup>b,c</sup> Recent studies offer strong evidence that physical and mental development of children can be affected at blood lead levels of less than 5 µg/dL. The CDC Advisory Committee on Childhood Lead Poisoning Prevention recommends providing anticipatory guidance to parents of all young children regarding sources of lead and helping them identify sources of lead in their child's environment.<sup>17,19</sup>

**Table 1. Summary of Recommendations for Children with Confirmed (Venous) Elevated Blood Lead Levels**

<b>Blood Lead Level (µg/dL)</b>			
<b>&lt; 5</b>	<b>5 - 14</b>	<b>15 - 44</b>	<b><math>\geq 45</math></b>
Perform routine risk assessment, physical and mental developmental evaluations	Perform measures for <5 AND	Perform measures for 5-14 AND	Perform measures for 15-44 AND
Lead education • Dietary • Environmental	Repeat test in 1-3 months	Confirm result within 1-4 weeks	Confirm result within 48 hours
Repeat 6-12 months if high risk	Perform complete physical exam	Abdominal X-ray (if particulate lead ingestion is suspected), with gut decontamination if indicated	Consider hospitalization or chelation therapy
	Perform environmental history to determine source of exposure	Contact pediatric environmental health specialty unit or Poison Control	
	Refer to local health department for environmental investigation, mitigation		
	Lab: CBC, ferritin, c-reactive protein		

<sup>5</sup> Centers for Disease Control and Prevention. Managing Elevated Blood Levels Among Young Children: Recommendations from the Advisory Committee on Childhood Lead Poisoning Prevention. Atlanta: CDC; 2002 and AAP Council on Environmental Health. Prevention of Childhood Lead Toxicity. Pediatrics. 2016;138(1)e20161493.

**Table 2 Schedule for Follow-Up Blood Lead Testing<sup>a</sup>**

<b>Venous blood lead level (µg/dL)</b>		
10-14	3 months <sup>b</sup>	6-9 months
15-19	1-3 months <sup>b</sup>	3-6 months
20-24	1-3 months <sup>b</sup>	1-3 months
25-44	2 weeks-1 month	1 month
> 45	As soon as possible	Chelation with subsequent follow-up

<sup>a</sup> Seasonal variation of BLLs exists and may be more apparent in colder climate areas. Greater exposure in the summer months may necessitate more frequent follow ups.

<sup>b</sup> Some case managers or PCPs may choose to repeat blood lead tests on all new patients within a month to ensure that their BLL level is not rising more quickly than anticipated.

Source: Centers for Disease Control and Prevention. *Managing Elevated Blood Levels Among Young Children: Recommendations from the Advisory Committee on Childhood Lead Poisoning Prevention*. Atlanta: CDC; 2002.

The long-term goal of management is to prevent recurrence of lead poisoning in the affected child and also to prevent poisoning in siblings and in playmates. The worst tragedy is to discharge a child home after treatment only to have lead poisoning recur because the child is re-exposed.

### **Resources for Referral and Consultation**

- Pediatric Environmental Health Specialty Units (PEHSU) offer medical information and advice on environmental conditions that influence children's health. PEHSUs are academically based, typically at university medical centers, and are located across the United States, Canada and Mexico. These PEHSU form a network that is capable of responding to requests for information throughout North America and offering advice on prevention, diagnosis, management, and treatment of environmentally-related health effects in children. To find your regional PEHSU, contact them at [www.pehsu.net](http://www.pehsu.net) or (888) 347- 2632.
- The CDC offers a listing of state and local lead programs and appropriate health department contacts at <http://www.cdc.gov/nceh/lead/programs.htm>

### **Resources for Education and Prevention**

- Centers for Disease Control  
(800-232-4636)  
24 Hours/Every Day  
[cdcinfo@cdc.gov](mailto:cdcinfo@cdc.gov)  
<http://www.cdc.gov/nceh/lead/>
- The Migrant Clinicians Network website has numerous lead resources—downloadable Spanish language patient education materials, clinical resources targeting primary care providers, and links to other organizations on its lead web page: <http://www.migrantclinician.org/toolsource/316/lead/index.html>

Updated November 2016. These guidelines were originally published in American Academy of Pediatrics and Migrant Clinicians Network, *Guidelines for the Care of Migrant Farmworkers' Children*. 2000: 83-89.



This resource supported by the Health Resources and Services Administration (HRSA) of the U.S. Department of Health and Human Services (HHS) under cooperative agreement number U30CS09742, Technical Assistance to Community and Migrant Health Centers and Homeless for \$1,094,709.00 with 0% of the total NCA project financed with non-federal sources. This information or content and conclusions are those of the author and should not be construed as the official position or policy of, nor should any endorsements be inferred by HRSA, HHS or the U.S. Government.

## Sources

- a AAP Council on Environmental Health. Prevention of Childhood Lead Toxicity. *Pediatrics*. 2016;138(1) e20161493.
- b Centers for Disease Control and Prevention. “Low Level Lead Exposure Harms Children: A Renewed Call for Primary Prevention.” January 2012. [http://www.cdc.gov/nceh/lead/acclpp/final\\_document\\_030712.pdf](http://www.cdc.gov/nceh/lead/acclpp/final_document_030712.pdf) (accessed 11/4/16)
- c CDC Response to Advisory Committee of Childgood Lead Poisoning Prevention Recommendations in “Low Level Lead Exposure Harms Children: A Renewed Call for Primary Prevention.” July 2012. [https://www.cdc.gov/nceh/lead/acclpp/cdc\\_response\\_lead\\_exposure\\_recs.pdf](https://www.cdc.gov/nceh/lead/acclpp/cdc_response_lead_exposure_recs.pdf) (accessed 11/4/16)
- 1 Landrigan, PJ, Todd AC. Lead poisoning. *Review West J Med*. 1994; 161: 153-159.
- 2 Centers for Disease Control and Prevention. Lead. <http://www.cdc.gov/nceh/lead/> accessed on 11/4/16.
- 3 Centers for Disease Control and Prevention. Recommendations for blood lead screening of Medicaid-eligible children aged 1—5 years: An updated approach to targeting a group at high risk. *MMWR*. 2009; 58:1-11.
- 4 Centers for Disease Control and Prevention. Screening Young Children for Lead Poisoning: Guidance for State and Local Health Officials. Atlanta, Ga: Centers for Disease Control and Prevention; 1997.
- 5 Centers for Disease Control and Prevention: Blood lead levels—United States, 1999-2002. *MMWR*. 2005; 54:513-6.
- 6 Jones RL, Homa DM, Meyer PA, Brody DJ, Caldwell KL, Pirkle JL, Brown MJ: Trends in blood lead levels and blood lead testing among US children aged 1 to 5 years, 1988-2004. *Pediatrics*. 2009; 123:e376-385.
- 7 Brown RW, Longoria T. Multiple Risk Factors for Lead Poisoning in Hispanic Sub-Populations: A Review. *J Immigr Minor Health*. 2009.
- 8 Early J. Housing characteristics of farmworker families in North Carolina. *J Immigr Minor Health*. 2006; 8:173–84. doi:10.1007/s10903-006-8525-1.
- 9 Schaffer SJ, Kincaid MS. Lead poisoning risk determination in a rural setting. *Pediatrics*. 1996; 97:84–90.
- 10 Perrin JM, Merken MJ. Blood lead level in a rural population: relative elevations among migrant farmworker children. *Pediatrics*. 1979; 64: 540-542.
- 11 Osband ME, Tubin JR. Lead paint exposure in migrant labor camps. *Pediatrics*. 1972; 49: 604-606.
- 12 Mushak P, Crocetti AF. Determination of numbers of lead-exposed American children as a function of lead source: integrated summary of a report to the US Congress on childhood lead poisoning. *Review Environ Res*. 1989; 50: 210-229.
- 13 Centers for Disease Control and Prevention. Lead poisoning from lead tetroxide used as a folk remedy. *Colorado, MMWR*. 1982; 30: 647-648.
- 14 Handley MA, Drace K, Wilson R, Croughan M, Hall C, Diaz E, Sanford E, Gonzalez-Mendez E, Villalobos M: Globalization, binational communities, and imported food risks: Results of an outbreak investigation of lead poisoning in Monterey County, California. *Am. J. Public Health*. 2007; 97: 900-906.
- 15 National Research Council. *Measuring Lead Exposure in Infants, Children, and Other Sensitive Populations*. Washington, DC: National Academy Press: 1993.