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Educational Interventions for Children Affected by Lead

Executive Summary and Decision Chart for Children Affected by Lead are included here.

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This paper was developed by an expert panel that included CDC and non-CDC authors.

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National Center for Environmental Health
Division of Emergency and Environmental Health Services



Executive Summary

Lead is a developmental neurotoxicant, and high blood lead levels (HBLLs) in young children can impair intellectual functioning and cause behavioral problems that last a lifetime. Primary prevention of HBLLs remains a national priority and is the only effective way to prevent the neurodevelopmental and behavioral abnormalities associated with lead exposure. Unfortunately, hundreds of thousands of children already have experienced blood lead levels known to impair academic performance. To ensure that such children are provided with the services that may help improve academic and other outcomes, in 2008 the CDC Advisory Committee on Childhood Lead Poisoning Prevention convened a work group charged with describing specific action steps parents, clinicians, educators, lead poisoning prevention programs, and others who work with children may be able to take to ensure that children affected by lead receive timely and appropriate educational interventions. This report was drafted by these experts, who were chosen for their diverse perspectives and technical expertise and reflects their insight, knowledge, and practical expertise.

The body of evidence cited in this document demonstrates the effects that low-level lead exposure has on the brain's learning systems: overall intellectual ability, speech and language, hearing, visual-spatial skills, attention, executive functions, social behavior, and fine and gross motor skills. It details the significant negative consequences of lead on learning and educational attainment found in study after study (see Table 1) and the costs associated with those consequences. It describes the challenges children face as they advance through the school system and how lead interferes with development and learning.

There are no studies that specifically examine the impact of early childhood educational interventions on cognitive or behavioral outcomes for children who have been exposed to lead. However, there are studies of educational interventions improving developmental outcomes for children who have conditions other than lead. This research demonstrates that children with developmental delays or at high risk for developmental delays benefit most from interventions that start at an early age.

This document reviews current knowledge and practice of the early care and educational systems and describes key ways that these systems can support improved outcomes for lead-exposed children, such as

- 1) Streamlined access to developmental assessment, intervention and special education services, and by conducting a neuropsychological assessment of executive function in addition to a developmental assessment to identify cognitive and functional deficits in lead-exposed children with HBLLs.
- 2) Consistent interpretation of provisions in the Individuals with Disabilities Education Act (IDEA) and Americans with Disabilities Act (ADA) that require provision of assessment and educational interventions, including mechanisms to ensure that children with a history of HBLLs receive the services to which they are entitled.
- 3) Technical advice on the implications of the connection between lead exposure and educational results for educators, state and local governments, parents, pediatric health care providers, lead poisoning prevention programs, and others who work with young children.

The document is designed to serve multiple audiences including public health and education professionals, decision makers, health care providers, and others who work with children. It delineates specific strategies for improved collaboration across disciplines and programs in terms of providing services to children affected by lead. In addition, it describes a research agenda to develop the evidence base regarding the effectiveness of educational interventions particularly for children with blood lead levels at or above the Centers for Disease Control and Prevention upper value of the reference range for blood lead in young children established in 2012 as 5 micrograms per deciliter ($\mu\text{g}/\text{dL}$).

Lead poisoning prevention has been correctly characterized as a U.S. public health success story due to the rapid and sustained decreases in the number of children affected by lead. But the rate of decrease in cases has slowed and research shows that no safe blood lead level has been identified. Although efforts continue to successfully shrink the incidence of lead poisoning, continued vigilance and collaboration are necessary to ensure that those children negatively affected by lead exposure receive services designed to compensate for lead’s effect on the brain and behavior of children.

Table 1. Studies on Lead and Educational Outcomes

Blood Lead Levels	Educational Impact	Size of Study	Location of Study
$\leq 3 \mu\text{g}/\text{dL}$	Decreased end of grade test scores	More than 57,000 children	North Carolina (Miranda et al. 2009) ¹
4 $\mu\text{g}/\text{dL}$ at 3 years of age	Increased likelihood learning disabled classification in elementary school	More than 57,000 children	North Carolina (Miranda et al. 2009) ¹
	Poorer performance on tests	35,000 children	Connecticut (Miranda et al. 2011)
5 $\mu\text{g}/\text{dL}$	30% more likely to fail third grade reading and math tests	More than 48,000 children	Chicago (Evens et al. unpublished data)
	More likely to be non-proficient in math, science, and reading	21,000 children	Detroit (Zhang et al. 2013)
5-9 $\mu\text{g}/\text{dL}$	Scored 4.5 points lower on reading readiness tests	3,406 children	Rhode Island (McLaine et al. 2013)
$\geq 10 \mu\text{g}/\text{dL}$	Scored 10.1 points lower on reading readiness tests	3,406 children	Rhode Island (McLaine et al. 2013)
10 and 19 $\mu\text{g}/\text{dL}$	Significantly lower academic performance test scores in 4th grade	More than 3,000 children	Milwaukee (Amato et al. 2012)
$\geq 25 \mu\text{g}/\text{dL}$	\$0.5 million in excess annual special education and juvenile justice costs	279 children	Mahoning County, Ohio (Stefanak et al. 2005)

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Figure 3: Decision Chart for Children Affected by Lead

