

REPORT TO THE BOARDS OF HEALTH
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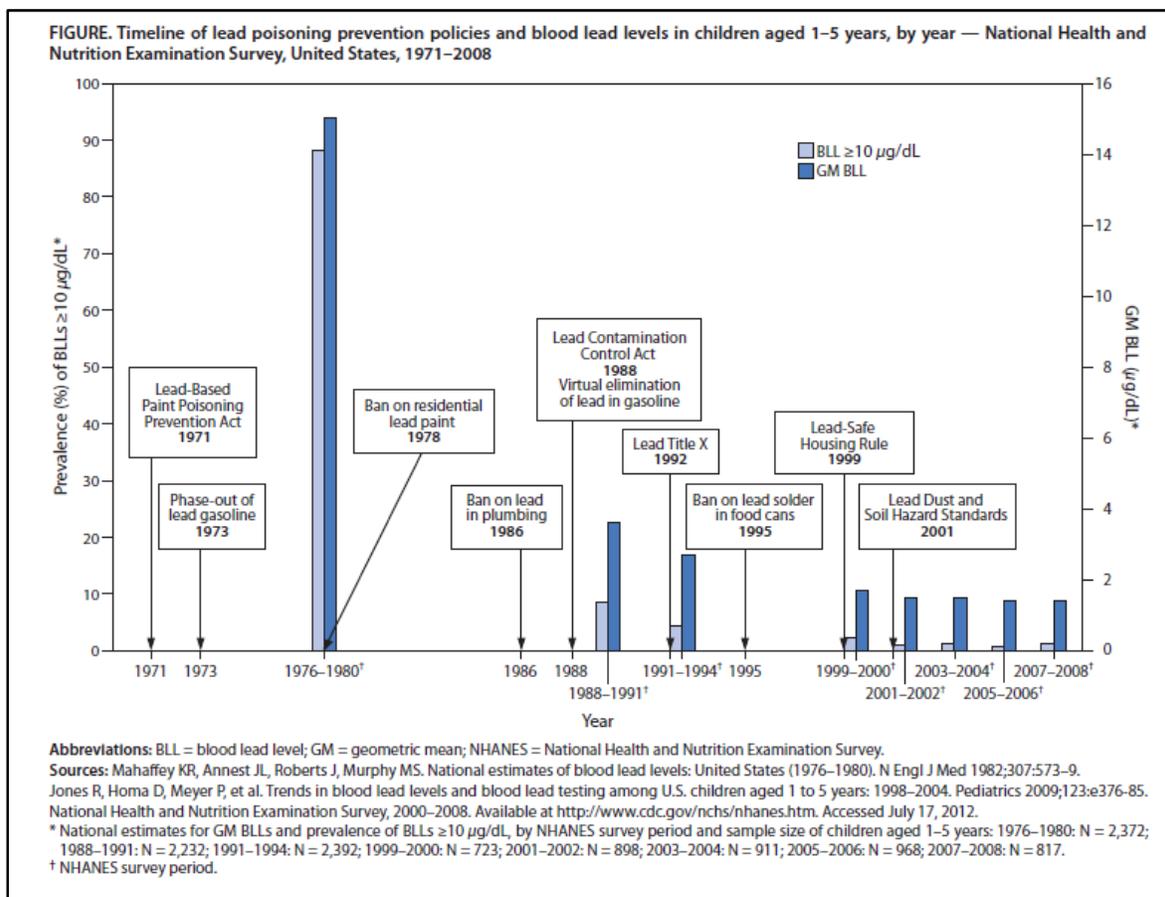
Mid-Michigan District Health Department, Wednesday February 24, 2016
Central Michigan District Health Department, Wednesday February 24, 2016
District Health Department #10, Friday, February 26, 2016

Overview of Lead and Lead Poisoning

Lead is a naturally occurring element. Since it is an element, it cannot be broken down further to any other compound. Because it is easy to extract and it has useful properties such as having high density, softness, ductility, malleability, poor electrical conductivity compared to other metals, and high resistance to corrosion, lead has been used for centuries in many ways. It has been used in roofing material, cladding, flashing, gutters and gutter joints, and on roof parapets. It has been added to paint to make the colors more vibrant, added to gas to prevent engine knocking, and used in pesticides before the 1950s. It has also been used in pipes, solder, valves, and fixtures. It has been used in natural remedies, cosmetics, candy, toys, cookware, jewelry, window blinds, bullets, fishing sinkers, among other things.

Lead does not occur naturally in the human body and blood lead concentrations are quite low in the absence of industrial activities or other sources of contamination. The toxic nature of lead and lead poisoning has been recognized since at least the second century BC. Due to the use of lead pipes, cookware, and other lead products, lead poisoning may have contributed to the fall of the Roman Empire¹. In the United States, the two biggest sources of industrial lead that children have been exposed to are: airborne lead, mostly from the combustion of gasoline containing tetraethyl lead; and leaded chips and dust, mostly from old lead paint. Both of these sources contribute to lead in the soil. There are other sources of lead, as mentioned above, as well as some take-home exposures, based on the occupation of parents and family members.

Before 1970, lead exposure was defined as having a blood lead level of 60 µg/dL or higher. Federal legislation in the 1970s began removing lead from gasoline and decreased factory emissions. From 1976 to 1980, US children 1 to 5 years of age had an average blood lead concentration of 15 µg/dL. From 1988–1991, the average decreased



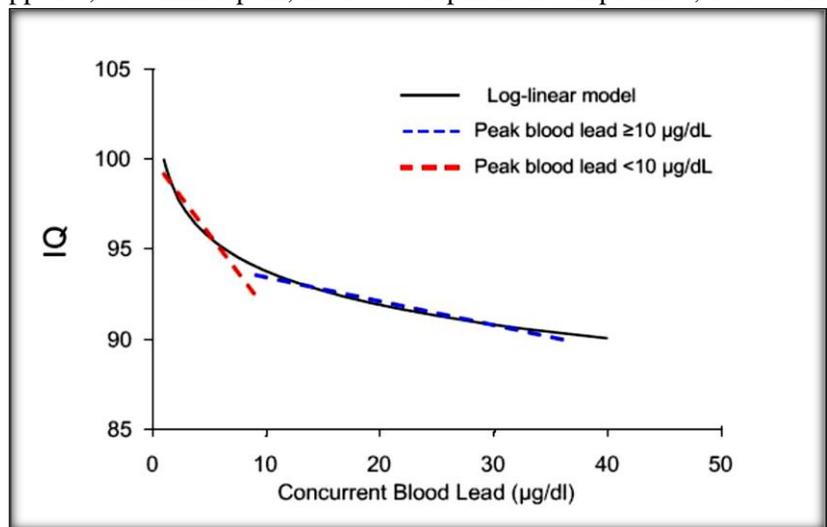
further to 3.6 $\mu\text{g}/\text{dL}$ and by 1999, it was down to 1.9 $\mu\text{g}/\text{dL}$, which is where it remains today². Levels below 2 $\mu\text{g}/\text{dL}$ are below the lower limit of reporting for many clinical laboratories.

The main absorption of lead in children is through the gastrointestinal tract. It is absorbed in a similar way as iron and calcium, which is why nutrition plays a role. If a child is ingesting lead while eating a diet low in iron and/or calcium, more lead is able to be absorbed. In children, approximately 73% of the total body lead volume is stored in the bones. The half-life of lead in blood is only about one month; the half-life in bone however is 10 to 30 years. Iron deficiency anemia is often found in conjunction with elevated blood lead levels since decreased iron intake increases the absorption of lead. Lead also interferes with hemoglobin synthesis (the oxygen carrying part of red blood cells) which further contributes to anemia.

Lead also substitutes for calcium in the brain. Calcium is part of the neurotransmitter or communication process in our nervous system. Lead is therefore a neurotoxin and prevents the neurologic system from being able to function properly. Elevated blood levels result in reduced development of neurons, or nerves, in the first two years of a child's life. In young children, lead also affects early development of the blood-brain barrier. This further increases the risk of other toxins crossing the blood brain barrier and affecting critical periods of early brain development.

There is no known safe blood lead level^{3,4,5}. For this reason, in 2012 the CDC and Advisory Committee on Childhood Lead Poisoning Prevention (ACCLPP) abandoned use of the term "level of concern" when referring to elevated blood lead levels and now refers to reference ranges⁵. The CDC currently recommends that providers monitor and provide follow-up for children with blood lead levels at or above a reference range of 5 $\mu\text{g}/\text{dL}$. This level was selected as it should identify the top 2.5% of the population with the highest lead levels, as determined by the most recent data from the National Health and Nutrition Examination Survey (NHANES). These guidelines will be reevaluated every four years when new data is available⁶.

Most children today will not have clinical symptoms from lead poisoning. When clinical symptoms do develop, the earliest to appear will be: anemia, decreased appetite, abdominal pain, neurodevelopmental compromise, reduction in IQ, reading difficulties, hearing loss, and constipation. Symptoms can also include learning issues, ADHD type behaviors, violence, aggressive behavior, juvenile delinquency, and higher than average school drop-out rates. Reduction in IQ is inversely related to rising lead levels (as illustrated in the graph at right) and early lead exposure has persistent, nonreversible effects. Toxicity is very rare and tends to be clinically evident when the blood lead level is over 70 $\mu\text{g}/\text{dL}$. Signs of toxicity are: changes in mentation from encephalopathy (diseased and malfunctioning brain,) confusion, ataxia (unsteady walking,) seizures, coma, and even death.



Universal blood screening for lead poisoning is suggested for communities in the United States with one or more of the following: inadequate data on the prevalence of elevated blood lead levels in that community; ≥ 27 percent of housing built before 1950, or; ≥ 12 percent of children 12 to 36 months of age with blood lead levels $\geq 10 \mu\text{g}/\text{dL}$ ($0.48 \mu\text{mol}/\text{L}$). The CDC also recommends universal blood lead screening upon entering the United States for recent immigrant, foreign adoptee, and refugee children between the ages of six months and 16 years⁸. When screening is done, it should ideally be performed at 12 and 24 months of age.

In Michigan, blood lead screening has always been recommended for children residing in Flint. It is now also recommended that all children who lived in the city of Flint or were exposed to the city's water at any time since 2014 have blood lead levels tested. So not only children who lived in the city, but also any who lived in homes that used Flint water, or who attended school or childcare, or often spent time with a caregiver, in the city. Blood lead testing is also recommended for all children living in Battle Creek, Benton Harbor, Dearborn, Detroit, Grand

Rapids, Hamtramck, Highland Park, Jackson, Kalamazoo, Lansing, Muskegon, Muskegon Heights, Pontiac, or Saginaw. CMS requires lead screening at 12 and 24 months for children receiving Medicaid services and MDHHS requires participants of WIC to also be tested.

Targeted screening for lead poisoning is recommended in communities with: <27 percent of the houses built before 1950, or; <12 percent of children 12 to 36 months of age with blood lead levels $\geq 10 \mu\text{g/dL}$ ($0.48 \mu\text{mol/L}$). Targeted screening can be accomplished by first asking the parent or guardian specific exposure questions to assess the risk of lead poisoning. These questions include the following: does your child live in or regularly visit a house, preschool, home of a relative, or child care facility built before 1950; does your child live in or regularly visit a house or child care facility built before 1978 that is being or has been renovated or remodeled within the last year; does your child have a sibling or playmate who has or did have lead poisoning; does your child live with an adult whose job or hobby involves lead, and; does your child’s family use any home remedies or cultural practices that may contain or use lead? If any of these questions are answered “yes” or “don’t know,” then blood lead testing should be done.

Below is an overview of the management of blood lead results.

CHILDHOOD LEAD POISONING

Blood Lead Level (BLL) Quick Reference for Primary Care Providers

Not Yet Tested	BLL <5	BLL 5-14	BLL 15-44	BLL >44
Consider screening ALL children between ages 1-6	Review lead levels with family			
Need for testing can be based on risk factors	Provide anticipatory guidance	Confirm results with venous blood sample	Confirm results with venous blood sample	Confirm results with venous blood sample
REMINDER: Medicaid requires all children to be tested at ages 1 & 2. Children who were not tested between 1 & 2 must be tested at least once between 3 & 6.	REMINDER: Medicaid requires all children to be tested at ages 1 & 2. Children who were not tested between 1 & 2 must be tested at least once between 3 & 6.	Review venous sample with family	Perform environmental history. Consider other children who may be exposed	Review venous sample with family
		Perform environmental history. Consider other children who may be exposed	Consider if a specific evaluation of the child is necessary such as an abdominal x-ray. Gut decontamination may be needed if leaded foreign bodies are visualized in x-ray	Any treatment at this level should be performed in consultation with an expert at Children’s Hospital of Michigan in Detroit.
		Consider iron sufficiency, provide nutritional counseling r/t calcium and iron	Consider iron sufficiency, provide nutritional counseling r/t calcium and iron	FOLLOW UP: As directed by expert. Monthly venous samples will be required.
		Provide anticipatory guidance	Refer to case management	REMINDER: Medicaid requires all children to be tested at ages 1 & 2. Children who were not tested between 1 & 2 must be tested at least once between 3 & 6.
		Refer to case management	FOLLOW UP: Retest venous sample within 1-3 months to ensure BLL is not rising	
		REMINDER: Medicaid requires all children to be tested at ages 1 & 2. Children who were not tested between 1 & 2 must be tested at least once between 3 & 6.	FOLLOW UP: Retest venous sample monthly until levels are <15, repeat every 1-3 months until levels are <5	
			REMINDER: Medicaid requires all children to be tested at ages 1 & 2. Children who were not tested between 1 & 2 must be tested at least once between 3 & 6.	

**Questions? Contact us
at (888) 322-4453
or (517) 335-8885**



MDHHS
Michigan Department of Health & Human Services
RICK SNYDER, GOVERNOR | NICK LYON, DIRECTOR



**Childhood
LEAD POISONING**
prevention program

Recommendations:

1. Call your local health department if you have any questions regarding lead or lead testing.
2. Be sure 12- and 24-month old children are at least assessed for risk of lead poisoning using a targeted screening questionnaire; and preferably receive universal blood lead level testing.

References

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