The Long Term Implications of Lead Poisoning

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Abstract
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THE LONG TERM IMPLICATIONS OF LEAD POISONING

Abstract

Despite efforts by the United States and the World Health Organization to decrease lead exposure in children, lead poisoning continues to exist in industrialized and developing countries. Any amount of lead can cause toxicity, and even low levels are associated with learning and behavioral problems. While Blood Lead Levels (BLLs) have continued to decrease in industrialized/developed countries, they continue to pose a major health hazard to marginalized populations, where 90% of children with elevated lead levels reside. Population-wide loss of IQ points leads to decreased productivity and loss of earning potential.

What is Lead Poisoning and What are the Effects?

Lead poisoning occurs by swallowing or inhaling a substance with lead in it. Lead gets into the blood stream and the body stores it in organs, tissues, bones, and teeth. Lead poisoning can occur suddenly when an individual is exposed to a large quantity of lead, but it usually builds up in the body slowly over months or even years when a child is exposed to small amounts of lead (Center for Disease Control and Prevention, 2015).

Despite initiatives by the United States to ban lead from paint in 1978 and from gasoline in 1996, lead poisoning still remains a problem in the nation today. Imported products such as candies, toys, children’s jewelry, and products like mini blinds continue to expose consumers to lead. Drinking water can also be contaminated when lead leaches into the water as it flows through lead pipes, solder, valves or brass fixtures. The most common sources of children’s lead exposure occur from paint chips or dust even when paint is not peeling, and contaminated soil. When paint becomes old or worn from activity like rubbing (such as doors, windowsills, painted cupboards or stairs), lead can get ground and scattered, and dust and soil can become contaminated. The same happens when paint is disturbed during remodeling or destruction (Center for Disease Control and Prevention, 2015). Children who play on porches can be exposed to porch dust containing lead (Wilson et al., 2015).

Parents may also bring home lead particles on their clothing, or bring scrap materials home from work environments (construction, repair shops) or hobbies (fishing weights, bullets, or stained glass). Exterior dust can be tracked in or blown in, contaminating floors and surfaces. Communities with high traffic areas and/or industrial pollution may have soil contaminated with lead (Center for Disease Control and Prevention, 2015).

Children under six are most at risk because they crawl on the floor, often put their hands in their mouths, and may eat non-edibles. Young children experience more significant effects of lead as growing bodies absorb lead at a higher rate, and children’s brains are developing quickly throughout the time when they are most likely to be exposed (O’Malley & O’Malley, 2015).
Research shows that lead can also be transmitted prenatally (O’Malley & O’Malley, 2015; Ris, Dietrich, Succop, Berger, & Bornschein, 2004).

Wick (2013) reports lead exposure causes irreversible cognitive and neurobehavioral abnormalities that reduce IQ. Schwartz (1994) estimates a 2.6 point decrease in IQ for every 10 pg/dL. Even lower levels of 3–8 can cause mild IQ decreases and/or attention deficit disorder. Additional effects of lead exposure can be smaller size than same aged peers, lack of energy, lack of appetite, anemia, neuropathy, central nervous system damage, seizures, delayed development, learning problems, behavior problems, and/or renal dysfunction (Center for Disease Control and Prevention, 2015).

What Are Acceptable Lead Levels?

Although the guideline for concern varies by country, any amount of lead can cause toxicity, and even low levels are associated with learning and behavioral problems. Subsequently, in June 2012, The Center for Disease Control (CDC) decreased the reference value from 10 micrograms to a marker of 5 micrograms per deciliter (5 pg/dL). Currently, over 450,000 children in the United States have blood lead levels greater than 5 micrograms per deciliter.

Evens (2012) posits that often the assigned level by the CDC is interpreted as an acceptable or safe level of lead, that does not warrant action or concern, unduly allowing children to continue to be exposed to lead. Additionally, not all countries follow the CDC guideline. Germany set a more aggressive guideline at 3.5 micrograms per deciliter (3.5 pg/dL).

In contrast, Canadian researchers O’Grady and Perron (2011) claim “Canadian public health discourse portrays this [lead] issue as a problem of the past or a US problem” thwarting public concern, however, they explain political power struggles resulted with Health Canada as the “dominant authority, thereby regulating important research initiatives to obscurity and also shaping a vastly weaker regulatory response to lead than occurred in the United States” leaving no legislative protection for Canadian children (p. S176). Canadian lead issues were thought to be a problem of the past since lead was removed from paint and gasoline, however, children are still living in lead contaminated environments. O’Grady and Perron assert Canada has “unfinished business with lead-based paint” (p. S182). Further, monitoring is inconsistent or non-existent across Canadian communities, and when monitoring does occur, higher guidance levels of 10 micrograms per deciliter identify less lead exposed children.

Taylor, Winder, and Lanphear (2014) assert policies that aim to keep lead below a particular bar are “obsolete and will inevitably fail to protect children from the toxic effects of lead” (p. 114). Taylor et al. (2014) also state that in Australia, there is overwhelming evidence that the lead level set (10 pg/dL) is too high, and “procrastination on this issue will be the thief of an equitable and healthy start to life for Australia’s lead exposed children” (p. 116).

Why and Where Does Lead Poisoning Occur?

Industrialized Countries. Childhood lead exposure occurs in industrialized countries, where poor government decisions and environmental accidents have negatively affected or potentially affect the well-being of their children. Simply overlooking geographic pockets where there are residual high levels of lead is also problematic.
The Gold King Mine waste spill in 2015 created an environmental disaster near Silverton, Colorado when workers accidentally released three million gallons of mustard yellow colored toxic waste water from the mine into Cement Creek, a tributary of the Animas River. The acid mine waste water contained lead, and other metals and toxic elements. The Environmental Protection Agency (EPA), who took responsibility for the spill, was criticized for not letting the residents of Colorado and New Mexico know until the day after the spill. Local residents were warned not to drink, bathe in or fish in the waters. Environmental impact included contaminated wells in flood plains, and fishing, farming, and implications for animals including livestock until sedimentation dilutes the pollutants. Although the mustard color of the water disappeared, invisible toxins remained. The EPA continues to monitor the water, irrigation waterways have been flushed and water has returned to pre-spill levels. While short term consequences have been addressed, the long term effects are yet to be determined (Chief, Artiola, Wilkinson, Beamer, & Maier, 2015).

In April 2014 in Flint, Michigan, as a cost saving measure, the state switched the water supply for the city of Flint from Lake Huron to the Flint River. The decision proved dangerous and costly to the residents of Flint, exposing over 100,000 residents (over 9,000 children six and under) to lead and other contaminants when corrosive Flint River water caused lead to leach from pipes and fixtures into the water. Data collection indicated lead levels doubled and in some cases tripled in toddlers who were tested. The city of 100,000 no longer has a grocery store, which compounds access to clean bottled water. As exposure to lead has a long term effect, local pediatrician Hanna-Attisha (in Ganim and Tran, 2016) states:

If you were to put something in a population to keep them down for generation and generations to come, it would be lead. It's a well-known, potent neurotoxin. There's tons of evidence on what lead does to a child, and it is one of the most damning things that you can do to a population. It drops your IQ, it affects your behavior, it’s been linked to criminality, it has multigenerational impacts. There is no safe level of lead in a child. (Long term health consequences, para. 2)

Currently, 1 in 38 children in the United States test positive for lead poisoning, with disproportionate numbers by income and race. This exposure is not due to environmental accidents but poor environmental living conditions where children are exposed to lead where properties in low income areas have been poorly maintained, and “inadequate attention to this issue may lead to the reemergence of this preventable environmental problem” (p. 72). They note that with the dwindling of public resources, lead poisoning is placed low on public health and education agendas. Evens (2010) states that children who were born outside the country or those who lived outside the country within six months before their blood tests showed particularly elevated risks for lead poisoning, in comparison to their U.S. born peers (p. 19). The CDC (2015) also reports that parents may rely on home remedies of medications from foreign countries that are not regulated for lead.

**Developing Countries.** While Blood Lead Levels (BLLs) have continued to decrease in industrialized/developed countries, they continue to pose a major health hazard to marginalized populations, where 90% of children with elevated lead levels reside. Population wide loss of IQ points leads to decreased productivity and loss of earning potential. Attina and Trasande (2013) report an estimated total cost of $977 billion of international dollars lost by low and middle income countries based on the “relationship between lead exposure and dose-related decrements in IQ score, the latter in turn being associated with decreased lifetime earning power” (p. 1099). Public
awareness of the harmful effects of lead are low in many of these communities, and the rest of the world is not paying attention (Kessler, 2014). Sources of lead exposure can come from environmental circumstances such as living near lead mining, smelting, battery recycling, or gold-ore processing plants. Despite some mine closures, scavenging of metal scraps in abandoned mines and wastes continue to serve as sources of metal pollution.

In Kabwe, the capital of Zambia’s central province, extensive soil contamination from lead-zinc mining poses a significant health hazard (Yabe et al., 2015). Yabe et al. (2015) also report that few studies investigating the impact of mining and processing plants in developing countries occur. Their study focused on identifying high lead levels in children under the age of seven who need medical intervention, in two towns where high BLLs were found. The townships were selected due to high levels of lead in the soil, likely due to vehicle traffic and mine dust. Of the 246 children tested, all had alarming BLLs of toxicity, eight children demonstrating levels of 150 through 427 micrograms per deciliter, well above the guidance level of 5 micrograms per deciliter (Yabe et al., 2015).

In Nigeria, more than 400 children died, and others were left with numerous long-term neurological impairments as a result of gold-ore mining and processing. Exposure to lead dust through ingestion and/or inhalation caused widespread outbreaks of childhood lead poisoning in Nigeria villages where gold-ore processing occurs (Yo et al., 2012). As the world-wide demand for gold has increased, rural communities have adopted small scale gold ore processing. Yo et al. (2012) investigated an outbreak of lead poisoning in children in two rural Nigerian villages. In these villages, 25% of the children under the age of five died from confirmed lead poisoning in the previous 12 months, with 82% experiencing convulsions before death. In response, their “objective was to rapidly identify and prioritize villages with childhood lead poisoning for interventions” (p. 1451). They collected indoor environmental samples from household floor dust from areas in villages where children ate and slept, and outdoor environmental soil samples from public areas.

One hundred thirty one villages were identified, and the team focused on 114 of them due to time and logistical restraints; however 40 of these villages were not visited due to poor road conditions that made them inaccessible. Yo et al. (2012) assert that the environmental impacts of small scale gold-ore processing are often overlooked, illustrating the need for monitoring and prevention. Even with interventions such as public education about ways to reduce lead exposure, recontamination can occur when exposure factors are not eliminated (p. 1454).

As awareness about the implications of lead poisoning is spread by the World Health Organization and other international health organizations, many countries are attempting to decrease lead exposure. Research in Pakistan demonstrates the need to further explore sources of lead, after lead in petrol has been eliminated, but other sources such as lead based paints, traditional health care remedies, occupational hazards, lead in water sources, and cosmetics continue to be a major source of elevated lead levels among children. Further, maintenance of houses is relatively poor (Kadir, Janjua, Kristensen, Fatmi, & Sathia Kumar, 2008). Kadir et al. (2008) report that it is difficult to garner a complete picture of the status of lead exposure in Pakistan as most studies were a result of convenience sampling.

Attempts to decrease lead exposure occurred in China in 2011 with the implementation of strict lead control policies state Chen, Huang, Yan, Li, Sun, and Bi (2014). China’s childhood lead levels were significantly higher than developed countries, and Chen et al. (2014) assert still remain a common public health problem. Lead mines, lead processing plants, electronic waste recycling
centers, and wire rope factories were cited as potential causes of lead exposure for children living near these sources. Chen et al. followed 106 children, ages one through 14 years old, each with a median time of four years of residence near a wire rope factory in the Zhuhang subdistrict. Environmental sampling included dust and soil sampling, vegetable and rice sampling, and drinking water sampling to measure lead exposure before and after lead usage control policies were implemented. Chen et al. posit there is widespread “disregard for environmental control” in lead related industries “in pursuit of economic growth” leading to weak and limited control by some local governments in China. Chen et al. found that strict lead pollution controls on the wire rope industry demonstrated success in decreasing lead levels in area children, and “given the high childhood BLL in China, strict environmental control regulations in lead-related industries should be implemented to prevent lead poisoning in millions of Chinese children” (p. 12935). Li, Cao, Xu, Cai, Shen, and Yan (2014) agree that although the Chinese government has made strides in improving and preventing lead poisoning, “lead pollution and its adverse effects are still common in China” (p. 116).

**Summary**

Low levels of lead poisoning in early childhood can impede education in the elementary school years, contribute to the achievement gap, and affect behavior. According to Kessler (2014), public health workers in the United States, who have been working to decrease lead levels across the nation, simply assumed that the rest of the world had followed suit. However, lead based paints continue to be freely sold in at least 40 countries, and although lead in gasoline/petrol has been eliminated in many countries, the residual effects of leaded gasoline remain. The news is not all bad though. As evidenced by changing policies and research initiatives, momentum is building in the war against lead.
References


