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Susan Schultz

St. John Fisher College, sschultz@sjfc.edu

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Lead poisoning has long range effects on children, both physically and academically. Even small amounts of lead toxicity can cause harm. Lead poisoning can affect any geographic area, although the focus of research tends to be in urban areas. Currently, one in thirty-eight children in the United States is identified with lead poisoning, impacting health, cognitive abilities and behavior. Public awareness remains a critical factor in prevention as the problem has not gone away.

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Dr. Susan M. Schultz
St. John Fisher College
3690 East Avenue
Rochester, NY 14618

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Abstract

Lead poisoning has long range effects on children, both physically and academically. Even small amounts of lead toxicity can cause harm. Lead poisoning can affect any geographic area, although the focus of research tends to be in urban areas. Currently, one in thirty-eight children in the United States is identified with lead poisoning, impacting health, cognitive abilities and behavior. Public awareness remains a critical factor in prevention as the problem has not gone away.

Lead Exposure

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, 2014).

Although in the United States, lead has been banned from paint in 1978 and from in gasoline in 1996, it is still a health problem 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, 2014). Children who play on porches can be exposed to porch dust containing lead (Wilson, Dixon, Jacobs, Akoto, Korfmacher, and Breysse, 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, 2014).

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 (Merck, Sharp & Dohme, 2015).

Research shows that lead can also be transmitted prenatally (Merck, Sharp & Dohme, 2015; Ris, Dietrich, Succop, Berger, & Bornschein, 2004).

What Are Acceptable Lead Levels?

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 (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, the CDC threshold levels are considered by other agencies “when setting action levels for lead in dust, water, food, consumer products and in other environments” (p. 116).

Effects of Lead Poisoning

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 low 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, 2014).

Disproportionality by Income and Race

Currently, 1 in 38 children in the United States test positive for lead poisoning, with disproportionate numbers by income and race. Currie (2005) indicates that poor and black children are more likely to demonstrate unsafe lead levels, “increasingly correlated with minority status, poverty, and residence in decaying older neighborhoods” (p. 125). Zhang, Baker, Tufts, Raymond, Salihu, and Elliott (2013) assert that a significant number of 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, turning the clock back on years of national, state, and local successes” (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 (2014) also reports that parents may rely on home remedies of medications from foreign countries that are not regulated for lead. Greta or Azacon is a Hispanic remedy for upset stomach, Litargirio is used as a deodorant especially in the Dominican Republic, and Ba-baw-san is a Chinese herb used to treat colic. Ghasard, a tonic used in India and Daw Tray, a digestive aid used in Thailand, as well as other traditional cultural medicines and remedies have all been traced back to cases of lead poisoning (Mayo Clinic, 2015).

Lead Poisoning and Academic Achievement

The results from Ris et al. (2004) investigation indicates prenatal exposure to lead has an impact during the early years particularly for males in the area of attention and visuoconstruction (fine motor visual-spatial awareness and construction), with effects diminishing by the end of preschool, while post natal exposure for both males and females has more long term wide range developmental effects. Other studies show that even low levels of lead poisoning in early childhood can impede education in the elementary school years, and also contribute to the achievement gap.

The objective of Miranda, Kim, Overstreet Galeano, Paul, Hull and Morgan's research (2007) was to determine if blood lead levels in early childhood were related to educational achievement in elementary school, as measured by end of grade testing. Using the same sample population, they linked blood lead level surveillance data from a state registry in North Carolina to later academic achievement, controlling for limited English proficiency. They assert positive blood lead levels in early childhood are related to lower educational achievement, with more impact being noted in reading than mathematics. They also noted that a higher proportion of black children had higher lead levels, stating "low-income and minority children are systematically exposed to more lead in North Carolina and nationally" (p. 1247). Evens (2012) also notes that lead poisoning rates are consistently reported to be higher in urban geographic areas.

Zhang et al. (2013) assessed the long term effects of early childhood lead exposure by linking surveillance data from the Detroit Public Health Department and academic achievement, more specifically, standardized test scores in grades 3, 5, and 8, adjusting for racial and socioeconomic disparities. Their data set consisted of 21,281 students (8831 in grade 3, 7708 in grade 5 and 4742 in grade 8). The sample was 56% male, and 91% black. Zhang et al. found a significant association between lead exposure and the academic achievement scores as measured by the MEAP, a standardized test taken by Michigan public school students from elementary through junior high school. Applying multivariate logistic regression analysis to determine the effects of childhood lead exposure in respect to math, science, and reading scores, they found the response relationship suggests the higher a student's blood lead level was in early childhood, the worse he or she performed on the test. Their study also showed that lead levels less than 5 pg/dL was still adversely associated with academic achievement. Significant is the fact that their study looked at affects at grade 8, demonstrating that early lead exposure can have long term effects on cognitive outcomes.

Though the focus of studies tends to be centered on urban areas, lead poisoning can occur in any geographic location. Thatcher, Lester, McAlaster, Horst and Ignasias (1983) conducted one of the few studies with a rural population on the eastern shore of Maryland. Their sample of 149 children were primarily white (124), with 68 of them being males and 81 females. Although all students were in the public school system, participants were recruited via newspaper advertisements and with cooperation from the Somerset County Board of Education. The researchers were unaware of each student's academic standing and cognitive abilities. Psychometric tests were administered, with children 6 to 16 assessed using the Wechsler Intelligence Scale for Children (WISC-R) and the Wechsler Preschool and Primary Scale of Intelligence administered to 5 year olds. In addition, the Wide Range Achievement Test (WRAT) was used to assess school achievement; the Motor Impairment Test (MIT) was administered to assess gross body coordination and manual dexterity, and the Purdue Pegboard

Test to assess fine motor movements. Groups were established based on academic standing of gifted, normal, low achievers, and very low achievers, based on each child's WISC-R and WRAT scores. Using hair sample taken from the nape of the neck, Thatcher et al. discovered, by using regression analyses, a systematic and strong relationship exists between the concentration of lead in children's hair and their intelligence test performance. They assert that cognitive function is "affected before any signs of gross motor impairment are seen" (p. 355). Exposure to low levels of lead affected cognitive processes; however, motor movements were not affected, leading the researchers to believe cognitive functioning "seem to be more sensitive indicators of the effects of low levels of lead" (p. 358).

Lead Poisoning and Behavior

The Treatment of Lead Exposed Children study enrolled 780 urban children exposed to lead from four geographic areas (Baltimore, Newark, Philadelphia, and Cincinnati), measuring blood lead levels in the children periodically between age 2 and 7. At age 5, the Conners' Parent Rating Scale- Revised (CPRS-R) was administered, and at age 7, the Behavior Assessment System for Children (BASC) was administered. Controlling for IQ, data showed that lead exposure was associated with behavior problems, with "increased risk for teacher rated externalizing and school behavior problems and parent rated behavioral symptoms index" (Chen, Cai, Dietrich, Radcliffe, & Rogan, 2007, p. 654).

The effects of lead poisoning on behavior have been documented to go beyond the childhood years. In a longitudinal study conducted by Dietrich, Ris, Succop, Berger, and Bornschein (2001), they found both prenatal and postnatal lead poisoning was associated with antisocial acts and delinquency. The researchers recruited 216 adjudicated delinquent youths from the Cincinnati Lead Study. In a case control study, they found these youth had significantly higher concentrations of bone lead than a control group of socio-demographically youth from students who attended high school in Pittsburgh. The subjects, between 15-17 years of age, and their parents reported increased frequency of delinquent acts, not associated with other risk factors.

Wright, Dietrich, Ris, Hornung, Wessel, Lanphear, Ho, and Rae (2008) followed lead exposed children into young adulthood. In Cincinnati, Ohio, they compared the arrest records of 250 individuals aged 19-24, who were recruited at birth between 1979 and 1984. Prenatal blood exposure was measured in the late first or early second trimester, and the children were measured first quarterly, then biannually, through age 6.5 years old. Arrest records were obtained from Hamilton County spanning from age 18 to the participants current age. The sample was largely African American (90%), with relatively equal amounts of males and females, with 73% of the families having the lowest or second lowest socioeconomic status as measured by the Hollingshead Four Factor Index of Social Position. The researchers identified a total of 800 arrests, with 108 for violent offenses, with no significant difference by sex. The researchers' question whether "one factor in the disproportional representation of African-Americans in crime statistics could well be the historically higher exposure to lead in these communities" (p. 101). Needleman, McFarland, Ness, Fienberg, and Tobin (2002) conducted a similar study of 194 adolescents aged 12-18 in Alleghany County, Pennsylvania, and did not find delinquent behavior confined to one race or ethnicity. Their data showed an "association between lead at asymptomatic doses and adjudicated delinquency" (p. 716).

Prevention is Multifaceted

Zhang et al. (2013) asserts that delayed or missed identification of children with elevated lead levels impacts school achievement and child health. Newman, Lowry, Mall and Berger (2013) discuss an “environmental health gap,” noting that medical students and pediatricians “report low self-efficacy regarding environmental history taking, discussing environmental exposures with parents, and finding diagnostic and treatment resources related to environmental exposures” (p. 9). Ris, et al. (2004) alert us to the effects of prenatal lead exposure. Consistently completing an environmental assessment of expectant mothers and young children would identify children who are at risk of lead exposure sooner. Ducatman (2002) states that it can take greater than greater than 10 years to turn over one half the body’s stored lead, as lead in hair, nails and teeth has a very slow turn-over rate, which emphasizes the importance of early identification.

Maintaining a healthy and well balanced diet is important in the fight against lead poisoning. Children who have insufficient calcium, iron and zinc tend to absorb more lead (Currie, 2005). Simple hand washing before eating can also cut down on lead particles being transmitted to food, or children placing contaminated hands into their mouths. Early childhood teachers can teach young children proper hand washing techniques that, hopefully, will carry over into other environments.

Furthermore, consumers should take care when completing minor home repair projects. Attempting to remove paint by sanding generates a large amount of small particles, and painting over it may not seal in the lead. Removal of lead paint should be supervised by a lead safe certified contractor, who will dispose of hazardous waste appropriately, according to the Environmental Protection Agency (2014). A list of lead safe certified contractors can be found on the EPA website.

“Lead in porch dust can expose children through direct contact or track-in to the home” state Wilson, et al. (2015, p. 129). In Rochester, New York, they sampled 79 homes immediately after lead removal and found that the lead levels on the porches increased significantly, immediately after work was completed elsewhere in the home, but not on the porch. They assert that inadequate clean up after lead hazard removal can create areas that are more hazardous after the work was completed than before it was done. Wilson et al. advocate for guidelines or standards to be set for porch lead dust post clean up, “so lead hazard control activities do not inadvertently exposing children to Hazardous levels of lead dust” (p. 135).

Parents should also stay informed of product recalls, staying alert for product recalls by checking the Food and Drug Administration website, searching for product recalls related to lead. Another way to stay informed of product recalls is by searching www.recalls.gov website. Parents and consumers can search this site specific to lead.

Summary

Lead poisoning in childhood remains a critical health concern despite public awareness. Given what we know about lead poisoning, researchers posit that the primary way to control for it is through prevention, as not only does exposure to lead affect school readiness, academic functioning, and behavior, it can have long term consequences for health and wellness (Currie,

2005; Evens, 2010; Miranda et al., 2007; Schwartz, 1994; Thatcher et al., 1983; Wilson, et al., Zhang et al., 2013). Although recent literature can be found in health and medical journals, the absence of current literature in education data bases alludes that it is no longer on the radar of educational researchers. Considering the educational and societal implications, the lead problem warrants our attention.

References

- Center for Disease Control and Prevention (2014). *National lead poisoning prevention week, 2014*. Retrieved from <http://www.cdc.gov/features/leadpoisoning/>
- Chen, A., Cai, B., Dietrich, K. N., Radcliffe, J., & Rogan, W. J. (2007). Lead exposure, IQ and behavior in urban 5-7 year olds: Does lead affect behavior only by lowering IQ? *Pediatrics, 119*(3), 650-658.
- Currie, J. M. (2005, Spring). Health disparities and gaps in school readiness. *The Future of Children, 15*(1), 117-138.
- Dietrich, K. N., Ris, M. D., Succop, P. A., Berger, O. G., & Bornschein, R. L. (2001). *Neurotoxicology and Teratology, 23*(6), 511-518.
- Ducatman, A. (2002). *Lead- It's everywhere*. Association of Occupational and Environment. Retrieved from: <http://aoec.org/resources.htm>
- Environmental Protection Agency (2014). *Renovation, repair and painting program: Consumers*. Retrieved from: <http://www2.epa.gov/lead/renovation-repair-and-painting-program-consumers>
- Evens, A. (2010). *School performance and lead poisoning among Chicago Public School children*. University of Illinois-Chicago. ThesisEv21 2010c.2
- Mayo Clinic (2015). *Diseases and Conditions. Lead Poisoning*. Retrieved from: <http://www.mayoclinic.org/diseases-conditions/lead-poisoning/basics/symptoms/con-20035487>
- Miranda, M. L., Kim, D., Overstreet Galeano, M. A., Paul, C. J., Hull, A. P., & Morgan, S. P. (2007). The relationship between early childhood blood lead levels and performance on end-of-grade tests. *Environmental Health Perspectives, 115*(8), 1242-1247.
- Needleman, H. L., McFarland, C., Ness, R. B., Fienberg, S. E., & Tobin, M. J. (2002). Bone lead levels in adjudicated delinquents: a case control study. *Neurotoxicol Teratol, 24*, 711-717.
- Newman, N., Lowry, J., Mall, J., & Berger, M. (2013). An ongoing lack of knowledge about lead poisoning. *American Journal of Public Health, 103*(10), 9-10
- Ris, M. D., Dietrich, K. M., Succop, P. A., Berger, O. G., & Bornschein, R. L., (2004). Early exposure to lead and neuropsychological outcome in adolescence. *Journal of the International Psychological Society, 10*(2), 261-270.
- Schwartz, J. (1994). Low-level lead exposure and children's IQ: a meta-analysis and search for a threshold. *Environmental Research, 65*, 42-55/
- Thatcher, R. W., Lester, M. L., McAlaster, R., Horst, R., & Ignasias, S. W. (1983). Intelligence and lead toxins in rural children. *Journal of Learning Disabilities, 16*(6), 355-359.
- Wick, J. Y. (2013). Lead poisoning. Why won't this problem go away? *Pharmacy Times*. Retrieved from: <http://www.pharmacytimes.com/publications/issue/2013/March2013/Lead-Poisoning-Why-Wont-This-Problem-Go-Away>

- Wright, J. P., Dietrich, K. N., Ris, M. D., Hornung, R. W., Wessel, S. D., Lanphear, B. P., Ho, M., & Rae, M. N. (2008). Association of prenatal and childhood blood lead concentrations with criminal arrests in early childhood. *Plos Medicine*, *5*(5), 732-739.
- Wilson, J., Dixon, S., Jacobs, D. E., Akoto, J., Korfmacher, K. S., & Breysse, J. (2015). An investigation into porch dust lead levels. *Environmental Research* *137*, 129-135
- Zhang, N., Baker, H. W., Tufts, M., Raymond, R. E., Salihu, H., & Elliott, M. R. (2013). Early childhood lead exposure and academic achievement: Evidence from Detroit Public Schools, 2008-2010. *American Journal of Public Health*, *103*(3), 72-77.