

Liberty University

Public and Community Health

**THE STANDARDS FOR WATER QUALITY TESTING:
PROTECTING THE PUBLIC FROM ANOTHER FLINT WATER CRISIS**

Naomi Sainval, Ifeoluwa Ogbonnewo, Candy Hernandez,

Olushola Olaitan Ogunleye, Joshua T. Brennan

Faculty Mentor: Dr. Robyn Anderson

March 1, 2017

Words: 708

Abstract

Lead is a well-recognized powerful neurotoxin, as high levels of lead have long been associated with lower scores on intelligence tests.^{1,2} The effects of lead poisoning are most detrimental in childhood, as the brains of children are still immature and are developing.³ Lead poisoning in childhood has an impact on many developmental and biological processes, most notably intelligence, behavior, and overall life achievement.¹ Lead in drinking water excessively affects children and pregnant women.¹ The absorption of an oral dose of water-soluble lead is 40-50% in children, compared to 3-10% in adults. For every 1 ppb increase of lead in drinking water consumed by children under 5 years old, blood lead levels increase by 35%.¹ Among pregnant women, elevated blood lead levels may induce abortions and may also raise the risk of stillbirth and low-birth weight infants. The current EPA standards require immediate action when water lead levels exceed 15 ppb.⁴ However, according to the CDC, about 25% of infants fed formula made from tap water with lead levels at 10 ppb would experience blood lead levels above 50 µg/liter, which is the upper limit recommended by the CDC. This finding urges an immediate revision to the current action value stated by the EPA. In 2014, after switching water source to the Flint river, the water of the homes in 6 of 9 wards had a lead concentration above 3 ppb (15 µg/liter), while some samples had concentrations above 200 ppb (1,000 µg/liter).⁵ In 2015, the 90th percentile lead value in Flint was 25 ppb (125 µg/liter), while some samples had values of 100 ppb (500 µg/liter), and one exceeded 1,000 ppb (5,000 µg/liter).⁷ Due to discontinuation of EPA requirements for water treatments to control corrosion⁶ as well as the addition of ferric chloride, the water became highly corrosive, leading to dissolution of lead from the plumbing and rising lead concentration in Flint's water supply. Studies report a doubling of the proportion of Flint children with elevated blood lead levels from 2013 to 2015, having risen

from 2.4% to 4.9%.^{1,5} Current regulations set by the EPA protect adult populations from lead exposure yet neglect the most susceptible demographic; children under 5 years old. Left unchanged, the restrictions allow children under 5 to be exposed to harmful levels of lead that may result in irreversible brain damage, hearing deficits, and anemia.^{3,6} Therefore, these regulations need to be strictly adjusted according to the health needs of children. These adjustments would result in protecting the entire population as a whole. The purpose of this study is to apply its findings to the planning of interventions to significantly reduce the likelihood of lead exposure in Lynchburg, Virginia and other places that appear to not be at risk.

Research Informed by Christian Worldview

As Christians, it is our responsibility to serve by Christ's example and to be stewards to those around us. As stewards, we are obligated to serve those around us. There are several Biblical precepts which overwhelmingly express the importance of serving our neighbors, no matter where they are or who they are. During His time on the earth, Jesus called us to love our neighbors as ourselves (Mark 12:30-31, Luke 10:27, NIV). Jesus further explains that everyone is our neighbor, not just our immediate family and close friends (Luke 10:29-37, NIV). As Christians, we are instructed to take care of the poor (Deuteronomy 15:7-11, Proverbs 31:8-9, NIV) and to show hospitality to strangers (Hebrews 13:1-3, NIV). By upholding these commands, we are honoring God by our actions (Proverbs 14:31, 1 Corinthians 10:31, NIV). In addition to serving others, God calls us to a high standard of protecting the environment to "cultivate and keep it" (Genesis 2:15, AMP). The findings presented in this study are not only intended to increase knowledge. Rather, heeding the counsel of Jesus in John 13:17 – "now that you know these things, you will be blessed if you do them" – the findings will be applied in an attempt to forestall a water crisis similar to that in Flint, Michigan from occurring in Lynchburg, Virginia. In doing this, we will assure the conditions for the promotion of the physical, social, and mental well-being of the 75,000 inhabitants of Lynchburg, Virginia, including nearly 5,000 children under 5 years old.

References

1. Hanna-Attisha M, LaChance J, Sadler RC, Schnepf AC. Elevated blood lead levels in children associated with the flint drinking water crisis: A spatial analysis of risk and public health response. *Am J Public Health*. 2016;106(2):283-290.
2. Trentacosta CJ, Davis-Kean P, Mitchell C, Hyde L, Dolinoy D. Environmental contaminants and child development. *Child Development Perspectives*. 2016;10(4):228-233.
3. Greydanus DE, Merrick J. From Nicander of Colophon, Ludwig van Beethoven, Vincent van Gogh, and now the children of Flint, Michigan, United States: The long, lethal legacy of lead neurotoxicity tragically lingers. *J Pain Manage*. 2016;9(1):23-31.
4. Environmental Protection Agency. Drinking water requirements for states and public water systems: Lead and Copper Rule. United States Environmental Protection Agency. <https://www.epa.gov/dwreginfo/lead-and-copper-rule#additional-resources>.
5. Bellinger DC. Lead contamination in Flint – an abject failure to protect public health. *N Engl J Med*. 2016;374(12):1101-1103.
6. Hegazy AA, Zaher MM, Abd el-havez MA, Morsy AA, Saleh RA. Relation between anemia and blood levels of lead, copper, zinc and iron among children. *BMC Res Notes*. 2010;3:133. doi: 10.1186/1756-0500-3-133.
7. Olson E, Fedinick KP. The Natural Resources Defense Council. What's in your water? Flint and beyond: Analysis of EPA data reveals widespread lead crisis potentially affecting millions of Americans. NRDC. <https://www.nrdc.org/sites/default/files/whats-in-your-water-flint-beyond-report.pdf>.