Testimony to Subcommittee on Investigations & Oversight

House of Representatives Committee on Science, Space, and Technology

Field Hearing, October 15, 2019

Introduction

Good morning and thank you to Chairwoman Sherrill and the Members of the Subcommittee for inviting me to speak on the health effects and implications of lead exposure, with specific focus on drinking water. As a pediatric toxicologist and national expert on the management of lead poisoning in both adults and children, I have seen firsthand and managed many patients with the health effects of excess lead exposure. In addition, I have advised in a medical capacity in several drinking water lead contamination incidents, in healthcare facilities, schools, and municipalities. As director of the state's Poison Control Center, our 24/7/365 hotline manages many calls regarding treatment and prevention of lead poisoning, and I serve as the medical consultant to the State of New Jersey for all children requiring hospitalization for significantly elevated blood lead levels.

Executive Summary

1) The health effects of lead are proportional to elevations in blood lead level, but even small elevations in blood lead level are associated with intellectual deficits in young children that may carry into adulthood
2) In 2012, in response to new scientific evidence repeatedly demonstrating this fact, the Centers for Disease Control (CDC) has lowered the blood lead level (BLL) threshold for concern from 10 micrograms per deciliter (mcg/dL) to 5 mcg/dL, and it is anticipated this level will be lowered again in the future.
    a. BLL is negatively correlated with IQ, and the effects are steepest at the lowest levels of elevation.
    b. In children with BLL < 10mcg/dL, studies estimate a loss of seven IQ points. Further IQ loss is seen as levels rise beyond 10 mcg/dL.
    c. The threshold was loweredin response to studies demonstrating diminished IQ , and also in response to the decline in blood lead levels in the general population.
3) The effects of drinking water lead elevations on blood lead levels are variable, but several cities with elevated water lead levels demonstrate a concomitant rise in the number of children whose BLLs exceeded the CDC threshold.
    a. At the time of the Washington, DC water contamination incident, the CDC threshold was 10 mcg/dL.
    b. At the time of the Flint, MI water contamination incident, the CDC threshold was 5 mcg/dL.
    c. Both cities had demonstrated increases in proportion of children with levels above the threshold.
4) Statistics in New Jersey and greater Newark:
    a. The State of New Jersey has higher lead levels than the national average.

   b. The City of Newark exceeds every other large NJ municipality in the number of young children with elevated BLLs, and had the highest number of new cases in the most recent report. The role of drinking water in these elevations has not been established.
5) For every child with an elevated BLL, resources must be mobilized at the local and state health department level to determine and mitigate the source of exposure.
6) Preserving and improving the drinking water infrastructure to prevent and diminish further lead exposure is essential to mitigate adverse health effect in our children and prevent overwhelming existing systems in place to assist these children and their families.
7) Strategies to prevent lead exposure vary depending on the source of exposure, but include minimizing lead-based paint dust, removal of imported lead-contaminated toys, foods, and cookware, elimination of cultural sources of lead such as contaminated cosmetics and alternative medicines, and use of bottled water in the event of a drinking water contamination. Materials can be obtained from NJPIES or any regional Poison Control Center for more information.

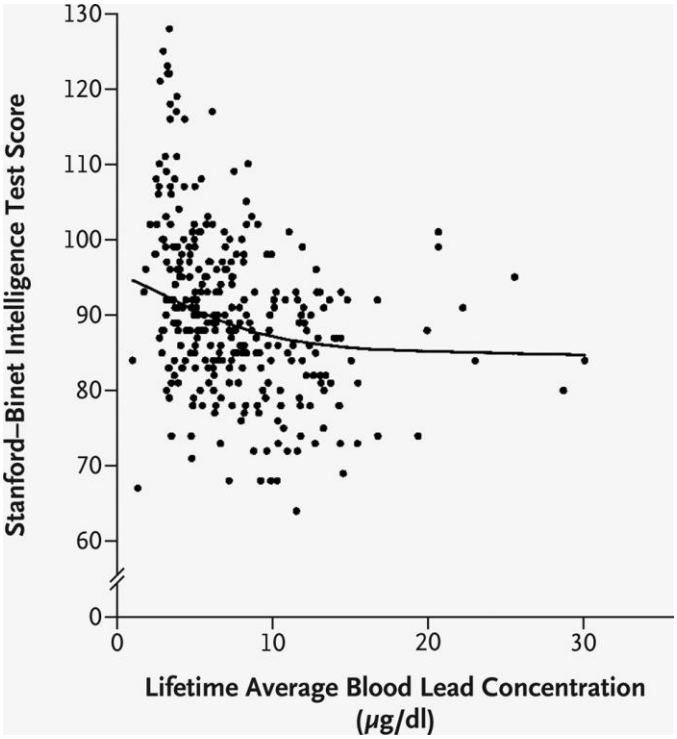
Testimony

Lead is an element which is ubiquitous in our environment, and exposure comes from a variety of sources. Much has been done to remediate these sources, including the prohibition of leaded automotive fuel, residential lead paint, and lead-soldered canned food. These measures have brought the average blood lead level in the population down significantly, however sources remain, particularly in the environment of the young child, which pose a persistent hazard. These are predominantly deteriorating residential lead paint in older homes, industrial contamination of soil, cultural sources (imported food, cosmetics, toys, and folk medicine), parental occupational hazards, and drinking water.

The majority of cases of lead poisoning which are managed through the New Jersey Poison Information and Education System (NJPIES), known to the public as the New Jersey Poison Control Center, are in children exposed to residential paint, who suffer adverse developmental consequences. These children have blood lead levels far above the CDC threshold of concern of 5 mcg/dL, and demonstrate developmental delays, attention deficit and hyperactivity, behavioral and cognitive challenges, school performance and reading readiness deficits, and conduct disorder. Children in this group usually have BLLs over 45 mcg/dL and are often admitted to the hospital for chelation therapy, which removes lead from their blood but has uncertain benefit in the aforementioned issues, which may be permanent.

However, it has become increasingly clear that even very low-level elevations in blood lead are associated with cognitive, intellectual and behavioral deficits in the young child. This has been demonstrated in the work by Canfield in the New England Journal of Medicine, who concluded that while a blood lead level >10 mcg/dL was associated with a quantifiable IQ loss per BLL rise, in children with BLL 1-10 mcg/dL the IQ drop-off per point of BLL was much steeper. This has been demonstrated by several other authors as well.

Fig 1. IQ as a function of Lifetime Average Blood Lead Concentration. From: Canfield RL, Henderson CR, Cory-Slechta DA, et al. Intellectual impairment in children with blood lead concentrations below 10 ug per deciliter. N Engl J Med 2003; 348:1517-1526.



This has led to a re-evaluation of low-level lead exposure. The Centers for Disease Control previously set the threshold of concern for blood lead level at 10 mcg/dL, but in 2012 the threshold was lowered to 5 mcg/dL. This was a reflection of the notion that there is no safe level of lead in young children, and also in response to population-based data in which 97.5% of the population have lead levels below 5.8 mcg/dL.

Low-level blood lead elevations are precisely what has been reported with lead-contaminated municipal drinking water. Both Washington, DC and Flint, Michigan demonstrated an elevated proportion of children with BLLs over the level of concern. This correlated in particular with high-risk regions within the cities for elevated water lead. Both Drs. Edwards and Hanna-Attisha demonstrated that, after drinking water contamination was detected, the prevalence of children with levels over the threshold doubled or even tripled. Notably, the magnitude of the blood lead level rise did not rise to the chelation threshold of 45 mcg/dL in either population.

Figure 2. Temporal variation of lead in water (90th percentile water lead) and key events related to lead exposure in Washington, DC (top). Trends in Elevated Blood Lead (EBL) incidence for children aged e1.3 years (bottom). From Edwards M, Triantafyllidou S, Best D. Elevated blood lead in young children due to lead-contaminated drinking water: Washington, DC, 2001-2004. Environ Sci Technol 2009; 43:1618-1623.

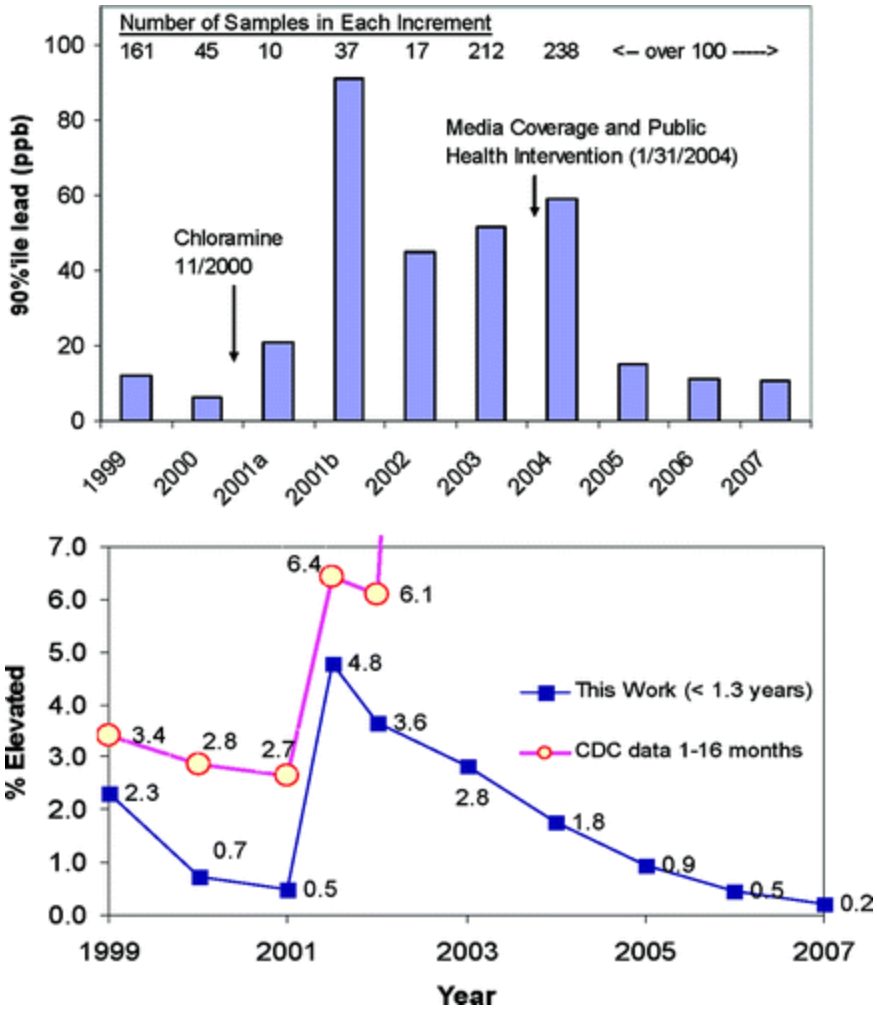
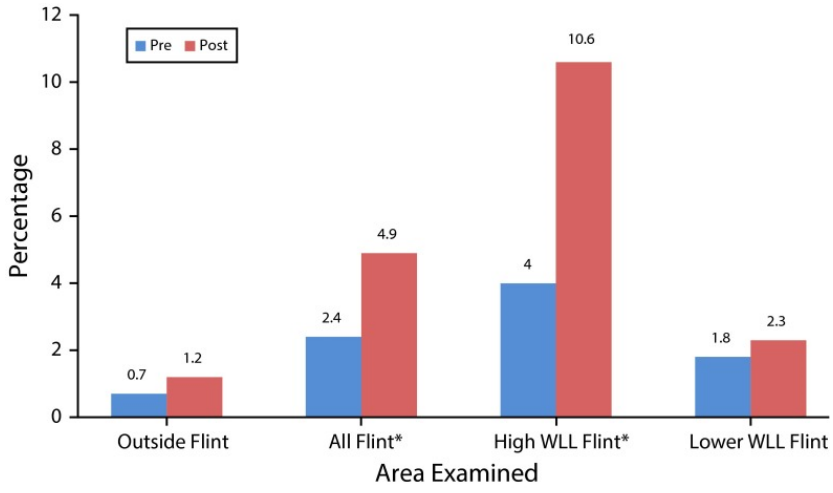


Fig 3. Comparison of Elevated Blood Lead Level Percentage, Before (Pre) and After (Post) Water Source Change from Detroit-Supplied Lake Huron Water to the Flint River. From Hanna-Attisha M, LaChance J, Sadler RC, Champney Schnepp A. Elevated blood lead levels in children associated with the Flint drinking water crisis: a spatial analysis of risk and public health response. Am J Public Health 2016; 106:283-90.



The effects of lead-contaminated drinking water can feasibly be expected to cause low-level blood lead elevations in many children, and subsequent loss of IQ. It is not, however, likely to cause severe elevations, require hospitalization, or be immediately threatening to life and health to any person. This is a common myth which complicates risk communication. Already exposed populations require reassurance yet careful guidance about how to best prevent further lead exposure in a child's environment. Recognition and anticipation of developmental challenges as they arise is also essential.

According to the 2017 report, in the State of New Jersey, average BLLs are higher than the national average (3.4 mcg/dL vs 1.8 mcg/dL), and the 97.5th percentile mark is 8.0 mcg/dL compared to the national 5.8 mcg/dL. These elevations are largely concentrated in urban areas, where many of the common sources of lead exposure are most prevalent. Moreover, the City of Newark has the greatest absolute number of children with elevated BLLs compared to other municipalities, and in the most recent report, had the highest number of new cases of elevated BLLs. The sources vary, but most cases can be attributed at least in part to residential lead paint. The contribution of drinking water is not clear, and more recent statistics are not yet available. Newark has a number of resources in place to address this disparity, including being the only NJ city with funded lead-safe relocation housing and a Partnership for Lead-Safe Children.

Any time a child has an elevated BLL within the State of New Jersey, local and state public health resources are deployed to determine and mitigate the source of exposure. This involves multiple property inspections, nursing visits, blood lead level testing, and case management to assist the family whose home may need remediation. This may also involve relocation housing, and the cost of remediation is significant. As programs struggle to meet the growing demands of risk assessment and mitigation, this predictably increases in the context of drinking water contamination. For example, at the New Jersey Poison Center our caseload of lead-exposed patients more than doubled in the past 8 months to over 300 calls, largely in response to the Newark water concern.

Removing the contribution of drinking water is imperative if the systems in place are to be able to respond to this public health threat. Other sources still predominate in more severely affected children, and the prioritization of lead hazard reduction is complex. The role of deteriorating housing stock must be emphasized and taken into account. However, given the scientific evidence that there is no safe level of lead for a child's environment, we must envision a future where our water, and our homes, are lead free.

References

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