HHS Public Access

Author manuscript

J Public Health Manag Pract. Author manuscript; available in PMC 2019 January 25.

Published in final edited form as:

J Public Health Manag Pract. 2019 ; 25(Suppl 1 LEAD POISONING PREVENTION): S1–S2. doi: 10.1097/PHH.0000000000000902.

Lead Poisoning Prevention: The Unfinished Agenda

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Overall, US population blood lead levels (BLLs)—as evidenced by NHANES (National Health and Nutrition Examination Survey) data—continue to fall.[1] This special issue of the *Journal of Public Health Management & Practice* on Lead Poisoning Prevention marks a turning point in the nation's "war on lead" that has spanned over a century and highlights the accomplishments of the Centers for Disease Control and Prevention (CDC) and its state and local partners in preventing and controlling lead poisoning. Ettinger et al in this issue outline CDC's long-standing role in protecting children from lead exposure.

This issue comes just shy of 5 years since the City of Flint, Michigan, in a cost-saving move under a state-appointed city manager, switched the drinking water source from the Detroit Water Authority to the Flint River, leading to lead in the drinking water. Ruckart et al describe the Flint water crisis response and recovery efforts including the development of the Flint Lead Exposure Registry funded through a grant from CDC. In addition to the direct impacts on Flint, this public health system's failure has brought to light equally troubling circumstances across the country.[2]

Unfortunately, by the time the events of the Flint water crisis occurred in 2014–2015, lead poisoning prevention had already been declared a public health success.[3] Over the past 40 years, the percentage of US children with BLLs of 10 μg/dL or more declined from88.2% to less than 1%. This substantial decrease in population lead exposure was due mainly to national policies aimed at controlling sources of exposure in gasoline, paint, and consumer products. Dignam et al discuss legislative and policy initiatives aimed at controlling lead sources in the United States. As a result of the decline in nationally estimated BLLs, in 2012—years before Flint gained national attention—CDC's Childhood Lead Poisoning Prevention Program (CLPPP), first authorized by the 1988 Lead Contamination Control Act, was essentially defunded by Congress and nearly eliminated. State and local public health capacity to identify and manage children with elevated BLLs was severely diminished.

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Disclaimer: The findings and conclusions in this report are those of the authors and do not necessarily represent the views of the Centers for Disease Control and Prevention/the Agency for Toxic Substances and Disease Registry.

The authors declare that they have no conflicts of interest.

Human Participant Compliance Statement: This information was reviewed and deemed not human subjects research by the Centers for Disease Control and Prevention.

There are still at least 500 000 children 1 to 5 years of age, or 2.5% of the population of children in that age range, above the CDC blood lead reference value who are exposed to more lead than the other 97.5% of children of the same age.[1] This estimate does not include younger or older children or other groups at high risk for adverse effects of lead exposure such as pregnant and lactating women or workers exposed on the job. Egan et al describe efforts to integrate CDC's adult and childhood blood lead surveillance systems to improve identification and intervention efforts, gain a better understanding of workplace take-home and maternal-child lead exposures, and make more efficient use of limited resources.

The 2017 Food and Drug Administration safety recall to discontinue using Magellan Diagnostics' Lead-Care Testing Systems for analyzing venous blood samples also highlighted the need for improved blood lead testing and surveillance. In this issue, Mason et al and Trinh and Mason describe how state public health agencies responded to the LeadCare recall and are strengthening their surveillance capacity as a result. To promote accurate measurements of BLLs, CDC sponsors a voluntary external quality assurance program for laboratories as described by Caldwell et al.

Following on the events in Flint, a renewed focus on identifying and removing lead from the environment led to passage of the Water Infrastructure Improvements for the Nation (WIIN) Act of 2016. The WIIN Act also authorized funding for CDC to enhance CLPPP activities by supporting additional state and local health departments in their efforts to strengthen blood lead testing, surveillance, processes to link lead-exposed children to appropriate services, and population-based interventions. In this issue, Lockamy-Kassim et al describe how CDC identifies and chronicles CLPPP achievements with "success stories."

Lead exposure is a local problem with local solutions. Several articles in this issue describe state and local efforts aimed at strengthening blood lead testing and surveillance: developing strategies to increase blood lead testing in high-risk areas of rural New Hampshire (Gettens et al); identifying which Medicaid-enrolled children had not received required tests and which Medicaid-billed tests were not reported in Wisconsin (Akbar et al); evaluating the impact of increased screening efforts to identify children with elevated BLLs in Nevada (Haboush-Deloye et al); understanding the implications of false-positive capillary tests in Minnesota (Wang et al); and creating a customized surveillance system in Arizona to improve data management (Asburry et al).

Although lead-based paint and dust in the home environment continue to be the predominant sources for lead exposure in children, exposure also occurs from lead in air, soil, water, and nontraditional sources including foods, folk remedies, and consumer products such as spices, toys, and cosmetics among others. In this issue, Hore et al and Bressler et al highlight some localized sources of exposure including a detailed investigation into lead in spices in New York City and consumption of wild game meat hunted with lead ammunition in Alaska, respectively. In addition, Cluett et al compare environmental inspection findings in Maine for children with BLLs at or above the current CDC blood lead reference value (5 μg/dL) versus the previous CDC level of concern (10 μg/dL) and found that home inspections for children with BLLs of 5 to 9 μg/dL are nearly as likely to identify lead hazards that require abatement as home inspections for children with BLLs of 10 μg/dL or more. These findings

have important implications as programs consider how best to identify and address lead hazards in light of lower population-based BLLs.

There is no known safe level of lead in children, and exposure to even low levels of lead can affect a child's growth and development. Sociodemographic and geographic disparities in exposure to lead, as measured by BLLs, still exist. There are several known factors that put children at higher risk for lead exposure including race/ethnicity, poverty status, and living in older housing. CDC's CLPPP is committed to the Healthy People 2020 goals of reducing BLLs and differences in average risk based on race and social class. In this issue, Whitehead and Buchanan explore the relationship between childhood lead poisoning and environmental justice.

Many high-risk children are not being tested by health care providers and therefore not receiving the opportunity for appropriate services. Public health professionals have an opportunity to better promote blood lead testing and improve surveillance and monitoring of children who may be exposed to lead. However, it is not enough to provide services to mitigate potential adverse health effects in children identified with elevated BLLs. Instead, innovative approaches to primary prevention—that control or remove sources of lead before children are exposed—are important to reach the goal of lead elimination in the 21st century as discussed in Breysse's commentary in this issue.

The key to reaching the Healthy People 2020 goals for childhood lead poisoning prevention remains in sustained efforts by CDC and its partners to strengthen blood lead testing, surveillance, population-based interventions, and processes to identify lead-exposed children and link them to services with a focus on high-risk children and early interventions. From this issue, it is clear that significant progress continues to be made in these areas and innovative ways to use data and resources are being developed and deployed.

We thank the editor of the *Journal of Public Health Management & Practice*, Dr Lloyd Novick, for his guidance and assistance with the curation and review of these articles. We would also like to thank Drs Justin Moore and Greg Kearney for their assistance during the entire publication process. We are delighted to be included as a part of the *Journal of Public Health Management & Practice's* 25th anniversary year collection.

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