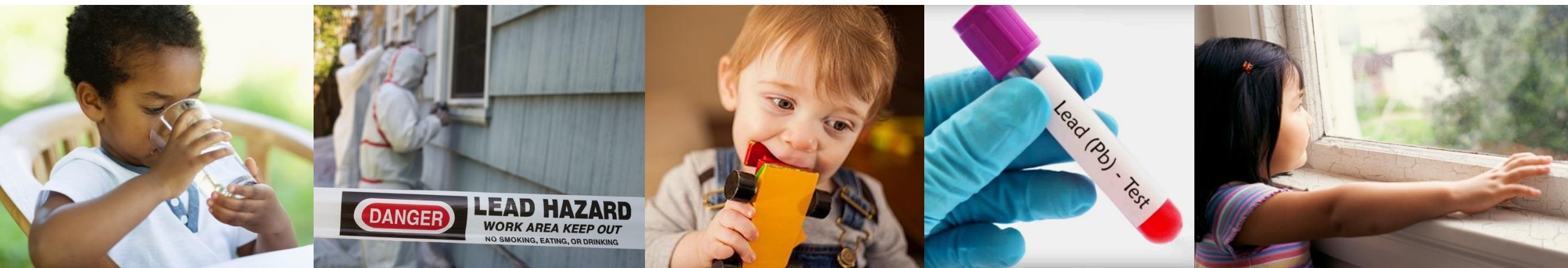


CDC PUBLIC HEALTH GRAND ROUNDS

A Renewed Commitment to Eliminate Childhood Lead Poisoning in the post-Flint Era



Accessible Version: https://www.youtube.com/watch?v=GQK0rrbzk_U

February 12, 2019



**U.S. Department of
Health and Human Services**
Centers for Disease
Control and Prevention

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Continuing education: www.cdc.gov/getce

- After creating a TCEO account, click the “Search Courses” tab on the left and use “Public Health Grand Rounds” as a keyword search.
- All PHGR sessions eligible for CE should display, select the link for today’s session and then Continue button. [Course Access Code is PHGR10](#).
- CE expires Mar. 12, 2019 for live and Apr. 12, 2021 for Web On Demand courses.
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Acknowledgments

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- Sheryl Driskell
- Paula Eriksen
- Julie Fishman
- Brenda Holmes
- Nicole Jones
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Childhood Lead Poisoning Prevention



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CDC's Childhood Lead Poisoning Prevention Program

Vision: To eliminate childhood lead poisoning as a public health problem.

Mission: CDC's Childhood Lead Poisoning Prevention Program is committed to the **Healthy People** goals of reducing blood lead levels in children and eliminating differences in risk based on race/ethnicity and social class.



Lead Can Be Found Throughout Our Environment

- 1) Paint and contaminated soil
- 2) Water pipes
- 3) Toys and jewelry
- 4) Foods, candies, or spices
- 5) Jobs or hobbies



The Impact

1,135,000

U.S. children ages 1 to 5 years
have blood lead levels ≥ 2 $\mu\text{g/dL}$



24 million

homes in the U.S. contain
significant lead hazards



At least 3.6 million of
these are home to
young children,
as indicated in blue.

6 million

lead service lines in the U.S.

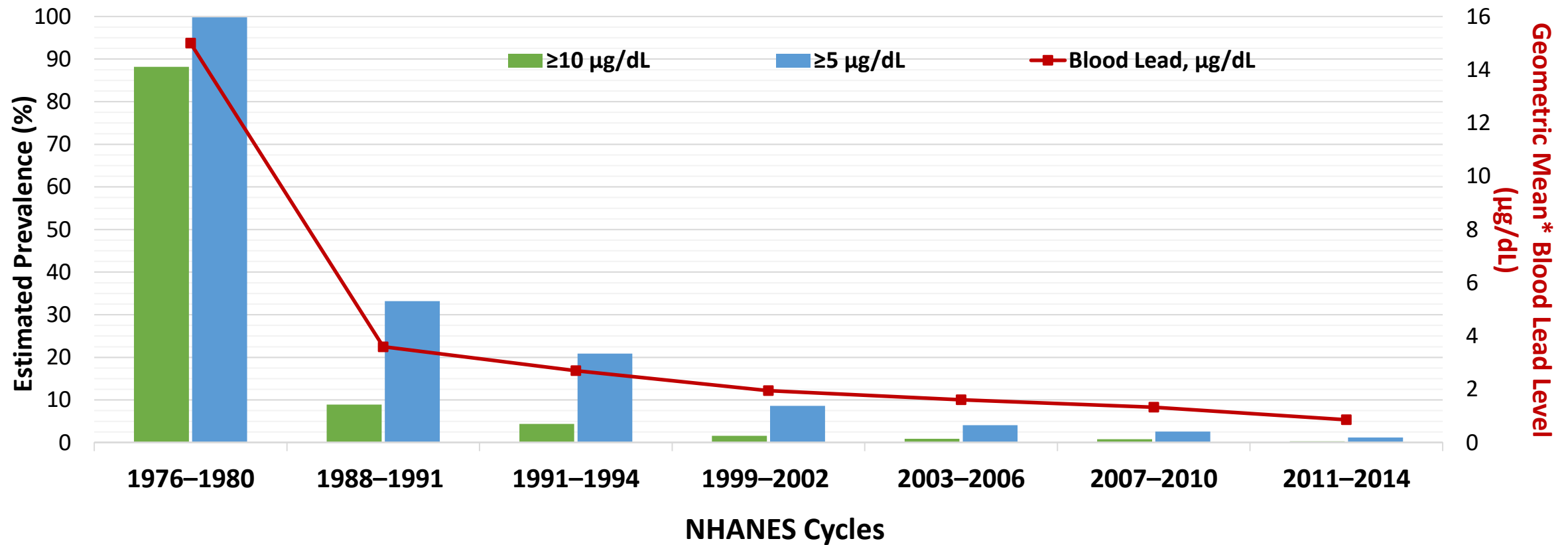


No Safe Level of Lead Has Been Identified



Impact of Policies to Control Lead in the Environment

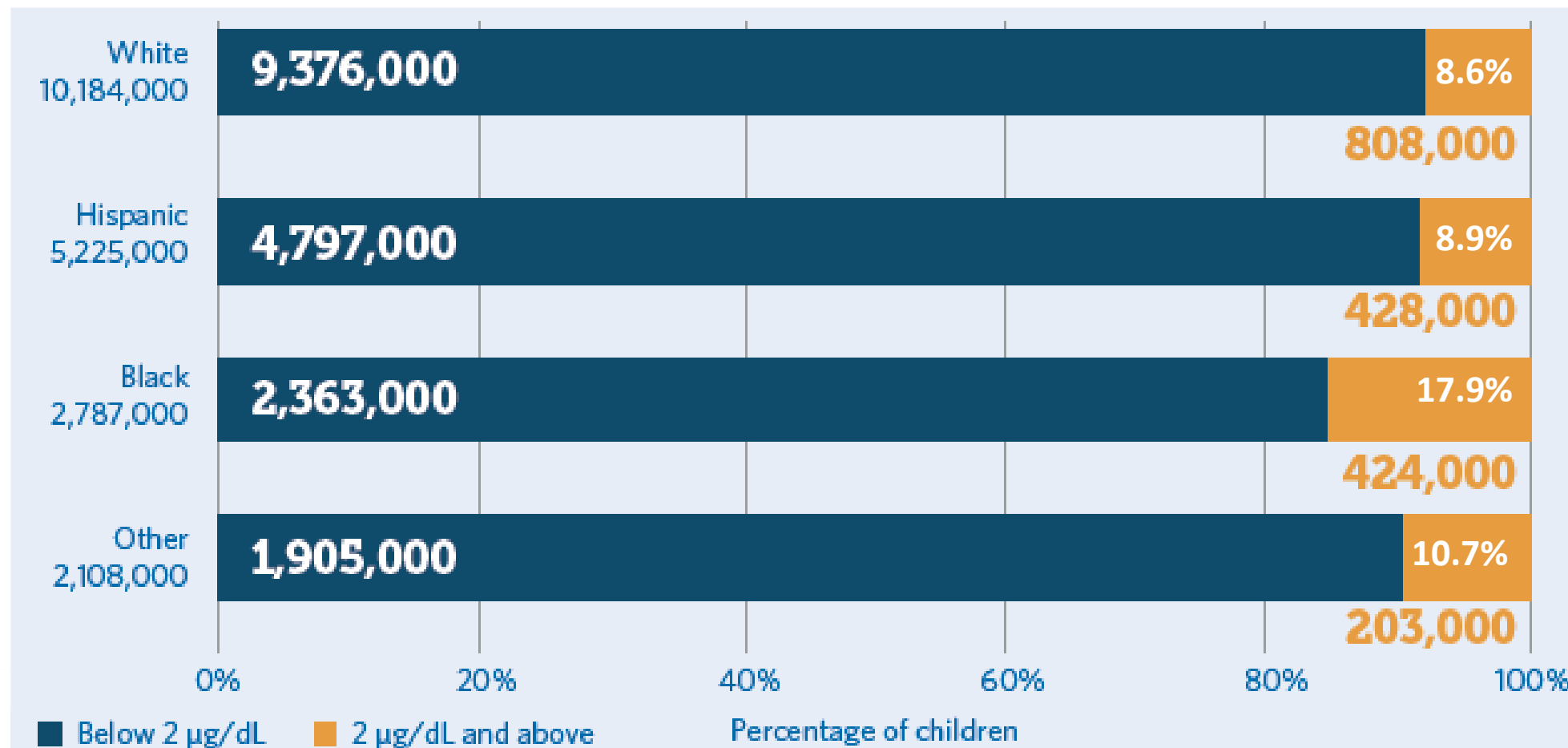
Blood Lead Levels in U.S. Children Aged 1–5 years, NHANES (1976–2014)



*Geometric mean is a special type of mean, or average, that is used for a skewed, or off-centered, distribution. Geometric means better reflect blood lead levels for the individuals in the middle of the population. Arithmetic means are generally used for more normally distributed populations.

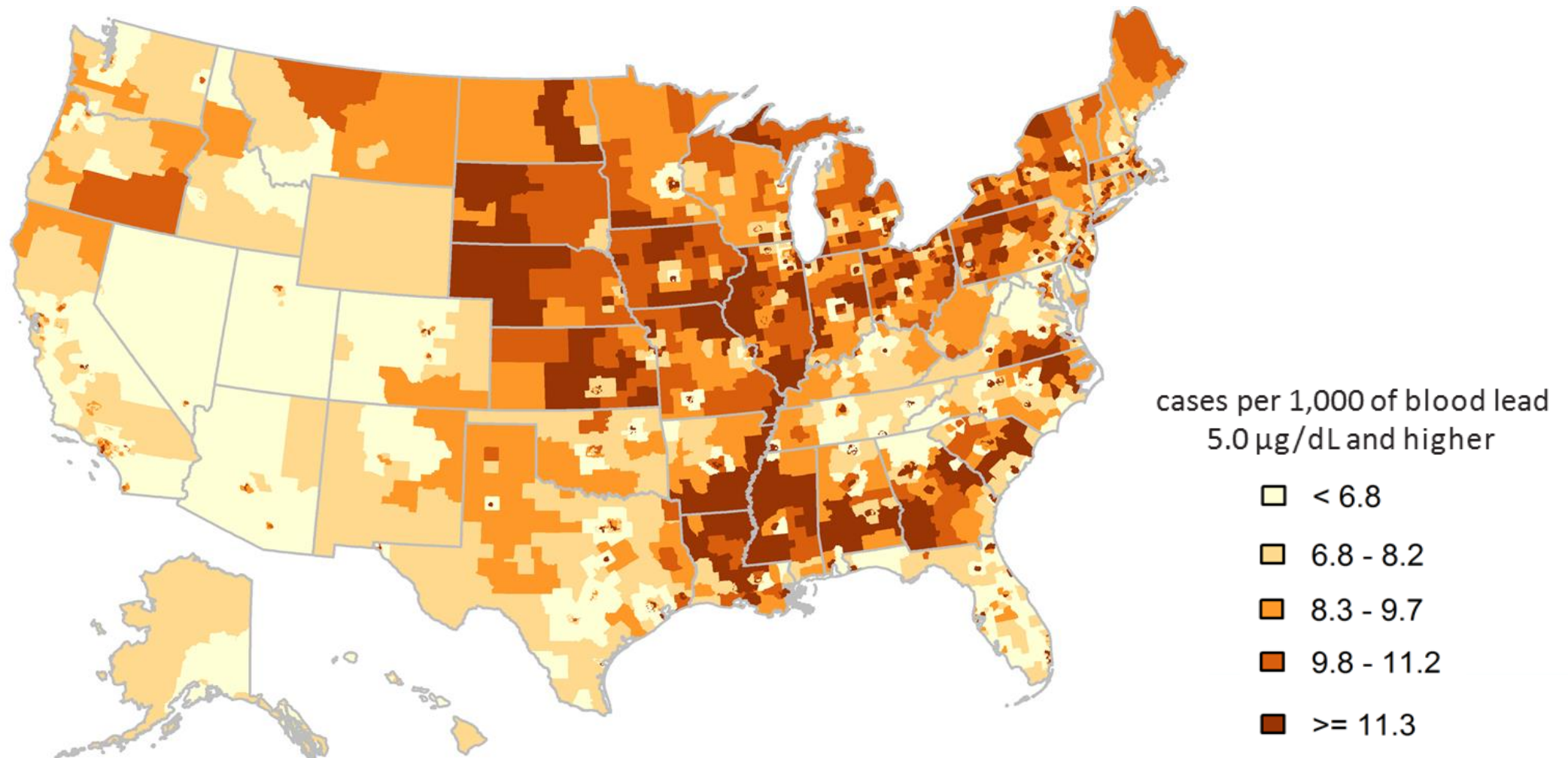
All Children Face Some Exposure Risk, but Racial and Ethnic Disparities Persist

Share and Number of 1–5-year-olds with Blood Levels Below and Above 2 $\mu\text{g/dL}$ by Race and Ethnicity, 2011–2014



Lead is Local: Distribution of Risk Varies by Location

Estimated Distribution of Children's Blood Lead Levels $\geq 5.0 \mu\text{g}/\text{dL}$ (2010)







Estimated Percent of Children with Blood Lead Levels ≥ 10 $\mu\text{g}/\text{dL}$ Missed by State, 1999–2010



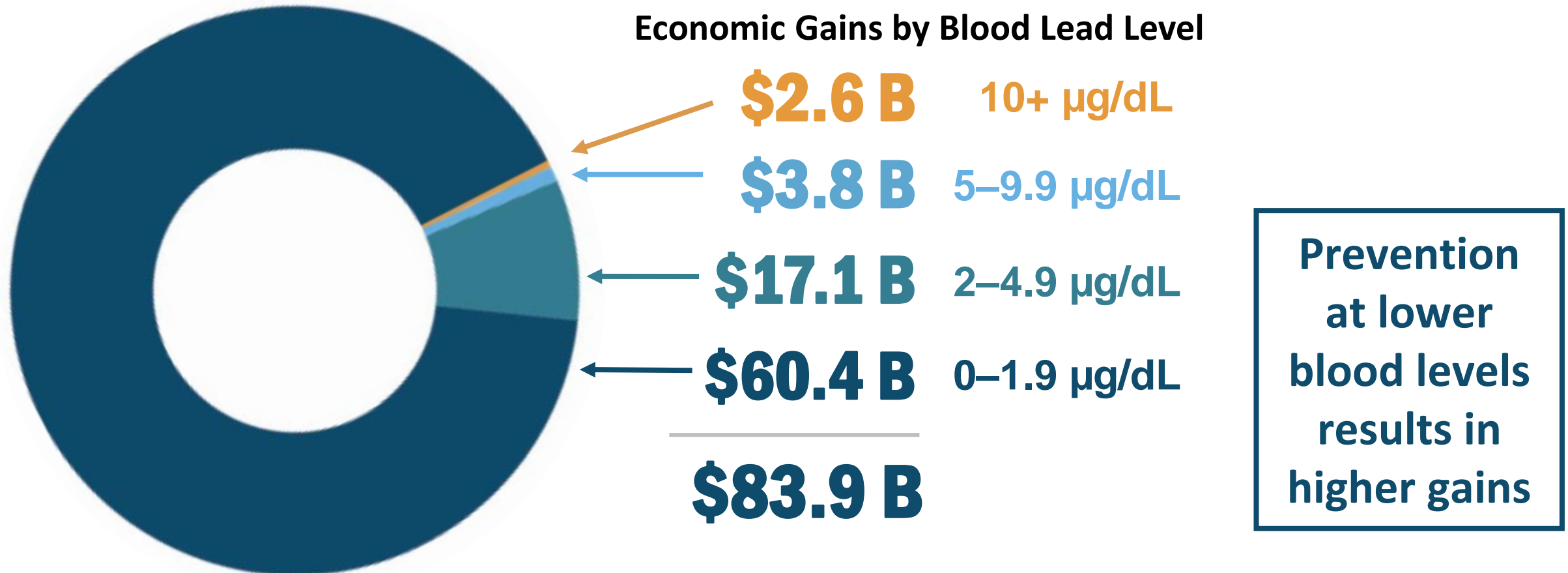
CDC's Childhood Lead Poisoning Prevention Program

Core Strategies

-  Strengthen blood lead testing and reporting
-  Strengthen surveillance
-  Strengthen linkages of lead-exposed children to recommended services
-  Strengthen targeted, population-based interventions

Preventing Childhood Lead Exposure Is Cost-Effective

Economic Gains by Avoided Blood Lead Levels in Children Ages 1–5, Born in 2018



For More Information



**Special Supplement
to the
*Journal of Public Health
Management and Practice*
(January/February 2019)**

journals.lww.com/jphmp/toc/2019/01001

CDC Lead Poisoning Prevention Program

www.cdc.gov/nceh/lead/

Flint and Lilly



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Meet Lilly....



Flint History



Crisis



April 2014: Switch to Flint River



Summer 2015: Reports of Lead in Water



Flint WATER STUDY UPDATES

Home Articles in the Press Information for Flint residents Share your story About

Home Information for Flint residents Lead testing results for water sampled by residents

Lead testing results for water sampled by residents

FLINT HAS A VERY SERIOUS LEAD IN WATER PROBLEM

Note: We will update results from the remaining 25 samples by 10/8/15



Pb = *Plumbum* = Plumbing



Lead in water levels:

- 0 ppb = EPA maximum contaminant level goal
- 1 ppb = American Academy of Pediatrics recommendation for schools/child care
- 5 ppb = FDA standard for bottled water
- 10 ppb = World Health Organization action level
- 15 ppb = EPA action level for water system
- 22,000 ppb = Flint home

Lilly



**Electronic Medical
Records**

September 24, 2015 Press Conference



Immediate Response

- **City “lead” emergency (September 25, 2015)**
- **Water switch back to Great Lakes (October 2015)**
- **City → county → state → federal emergency (January 2016)**
- **Coordinated crisis response: water delivery/stations, filters, risk communication, water and blood testing**

Elevated Blood Lead Levels in Children Associated With the Flint Drinking Water Crisis: A Spatial Analysis of Risk and Public Health Response

Mona Hanna-Attisha, MD, MPH, Jenny LaChance, MS, Richard Casey Sadler, PhD, and Allison Champney Schnepf, MD

Objectives. We analyzed differences in pediatric elevated blood lead level incidence before and after Flint, Michigan, introduced a more corrosive water source into an aging water system without adequate corrosion control.

Methods. We reviewed blood lead levels for children younger than 5 years before (2013) and after (2015) water source change in Greater Flint, Michigan. We assessed the percentage of elevated blood lead levels in both time periods, and identified geographical locations through spatial analysis.

Results. Incidence of elevated blood lead levels increased from 2.4% to 4.9% ($P < .05$) after water source change, and neighborhoods with the highest water lead levels experienced a 6.6% increase. No significant change was seen outside the city. Geospatial analysis identified disadvantaged neighborhoods as having the greatest elevated blood lead level increases and informed response prioritization during the now-declared public health emergency.

Conclusions. The percentage of children with elevated blood lead levels increased after water source change, particularly in socioeconomically disadvantaged neighborhoods. Water is a growing source of childhood lead exposure because of aging infrastructure. (*Am J Public Health.* 2016;106:283–290. doi:10.2105/AJPH.2015.303003)

See also Rosner, p. 200.

In April 2014, the postindustrial city of Flint, Michigan, under state-appointed emergency management, changed its water supply from Detroit-supplied Lake Huron water to the Flint River as a temporary measure, awaiting a new pipeline to Lake Huron in 2016. Intended to save money, the change in source water severed a half-century relationship with the Detroit Water and Sewerage Department. Shortly after the switch to Flint River water, residents voiced concerns regarding water color, taste, and odor, and various health complaints including skin rashes.¹ Bacteria, including *Escherichia coli*, were detected in the distri-

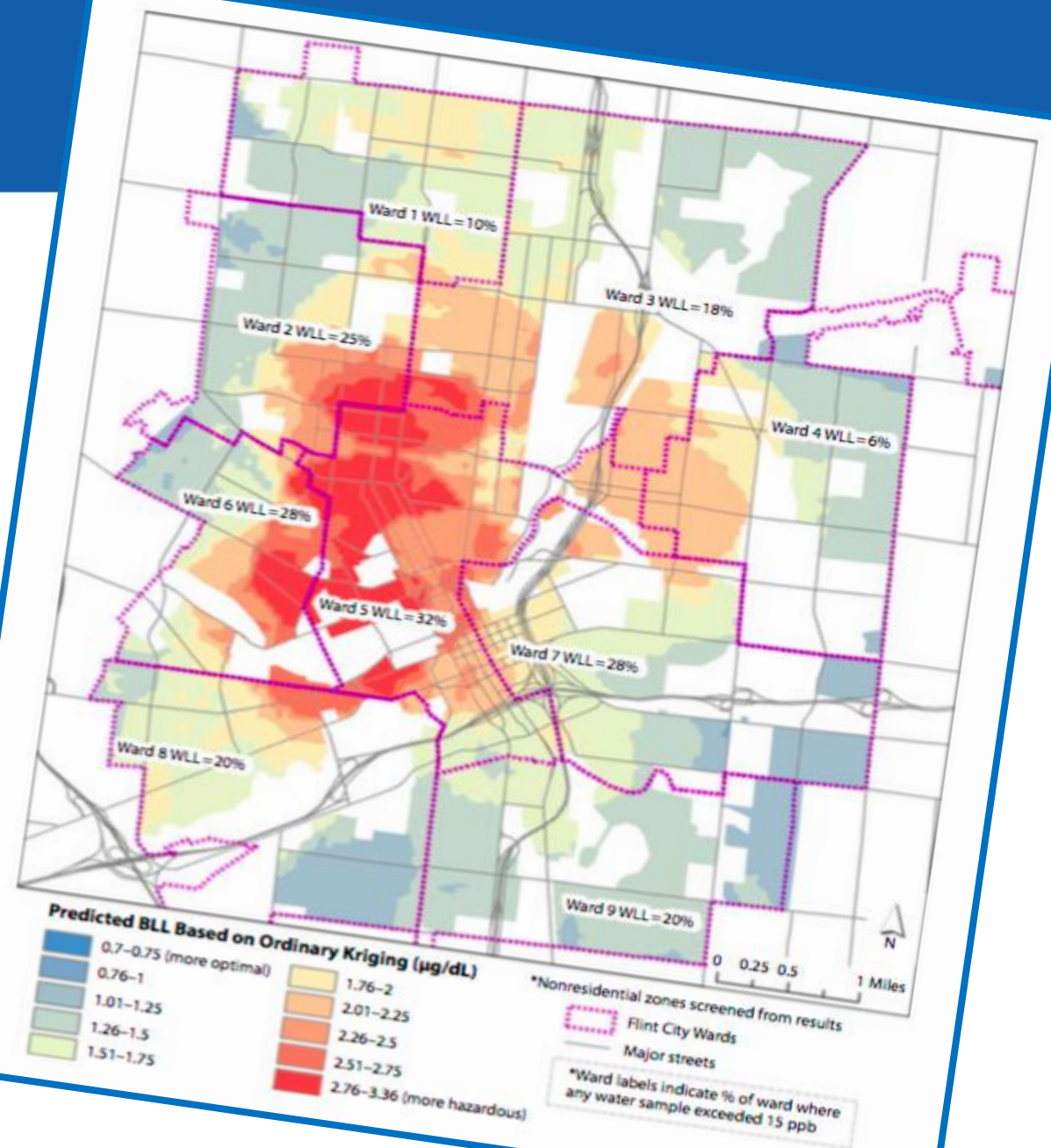
Water from the Detroit Water and Sewerage Department had very low corrosivity for lead as indicated by low chloride, low chloride-to-sulfate mass ratio, and presence of an orthophosphate corrosion inhibitor.^{3,4} By contrast, Flint River water had high chloride, high chloride-to-sulfate mass ratio, and no corrosion inhibitor.⁵ Switching from Detroit's Lake Huron to Flint River water created a perfect storm for lead leaching into drinking water.⁶ The aging Flint water distribution system contains a high

percentage of lead pipes and lead plumbing, with estimates of lead service lines ranging from 10% to 80%.⁷ Researchers from Virginia Tech University reported increases in water lead levels (WLLs),⁸ but changes in blood lead levels (BLLs) were unknown.

Lead is a potent neurotoxin, and childhood lead poisoning has an impact on many developmental and biological processes, most notably intelligence, behavior, and overall life achievement.^{9–11} With estimated societal costs in the billions, lead poisoning has a disproportionate impact on low-income and minority children.¹² When one considers the irreversible, life-altering, costly, and disparate impact of lead exposure, primary prevention is necessary to eliminate exposure.¹³

Historically, the industrial revolution's introduction of lead into a host of products has contributed to a long-running and largely silent pediatric epidemic.¹⁴ With lead now removed from gasoline and paint, the incidence of childhood lead poisoning has decreased.¹⁵ However, lead contamination of drinking water may be increasing because of lead-containing water infrastructure, changes in water sources, and changes in water treatment including disinfectant.^{16–18} A soluble metal, lead leaches into drinking water via lead-based plumbing or lead particles that detach from degrading plumbing components. ("Plumbing" is derived from the Latin word for lead,

ABOUT THE AUTHORS



Elevated Blood Lead Levels With the Flint Water Analysis of

Mona Hanna-Attisha, MD, MPH

Objectives. We analyzed data before and after Flint, Michigan, switched its water source from Lake Huron to the Flint River without adequate corrosion control.

Methods. We reviewed blood lead level data from 2013 and after (2015) water source change, and percentage of elevated blood lead levels by geographical locations through GIS.

Results. Incidence of elevated blood lead levels increased after water source change, with a 6.6% increase in the percentage of elevated blood lead levels. This analysis identified disadvantaged areas with higher lead level increases and information for a public health emergency.

Conclusions. The percentage of elevated blood lead levels after water source change, along with other factors, suggests that lead exposure is a growing public health problem. Water is a growing public health concern. (Am J Public Health 2016;106:1778–1783.)

See also Rosner, p. 20

In April 2014, the postindustrial city of Flint, Michigan, under state emergency management, changed its water supply from Detroit-supplied water to the Flint River as a cost-saving measure, awaiting a new pipeline to Lake Huron in 2016. Intended to change in source water severed a century relationship with the Detroit Water and Sewerage Department. Switch to Flint River water, however, raised concerns regarding water quality, odor, and various health complaints, including skin rashes.¹ Bacteria, including *Escherichia coli*, were detected in the distribution system.

AJPH RESEARCH

Blood Lead Levels Among Children Aged <6 Years — Flint, Michigan, 2013–2016

Weekly / July 1, 2016 / 65(25)



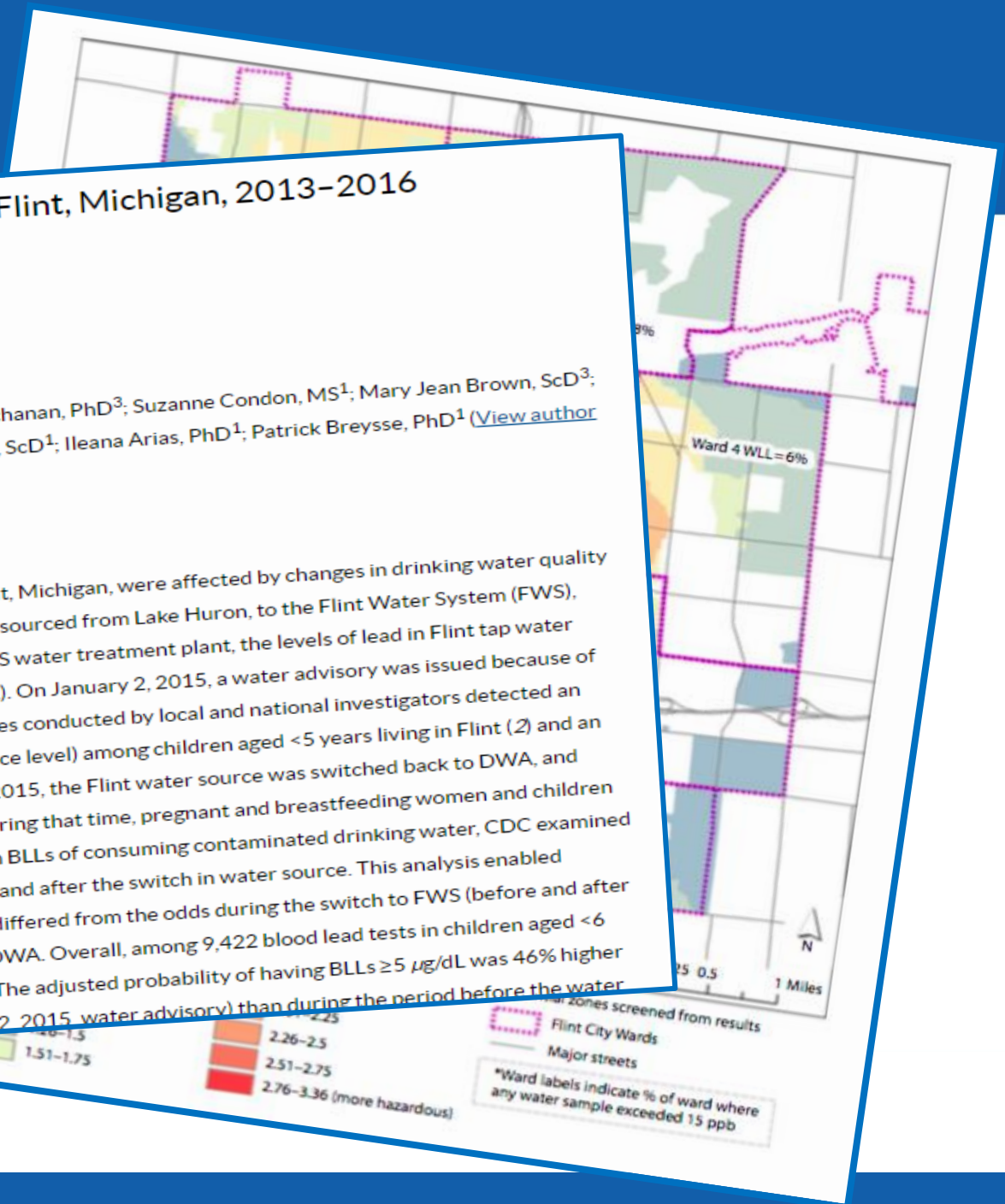
On June 24, 2016, this report was posted online as an MMWR Early Release.

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[View suggested citation](#)

During April 25, 2014–October 15, 2015, approximately 99,000 residents of Flint, Michigan, were affected by changes in drinking water quality after their water source was switched from the Detroit Water Authority (DWA), sourced from Lake Huron, to the Flint Water System (FWS), sourced from the Flint River.* Because corrosion control was not used at the FWS water treatment plant, the levels of lead in Flint tap water increased over time. Adverse health effects are associated with lead exposure (1). On January 2, 2015, a water advisory was issued because of detection of high levels of trihalomethanes, byproducts of disinfectants.^{†,‡} Studies conducted by local and national investigators detected an increase in the prevalence of blood lead levels (BLLs) ≥ 5 $\mu\text{g}/\text{dL}$ (the CDC reference level) among children aged <5 years living in Flint (2) and an increase in water lead levels after the water source switch (3). On October 16, 2015, the Flint water source was switched back to DWA, and residents were instructed to use filtered tap water for cooking and drinking. During that time, pregnant and breastfeeding women and children aged <6 years were advised to consume bottled water.[†] To assess the impact on BLLs of consuming contaminated drinking water, CDC examined the distribution of BLLs ≥ 5 $\mu\text{g}/\text{dL}$ among children aged <6 years before, during, and after the switch in water source. This analysis enabled determination of whether the odds of having BLLs ≥ 5 $\mu\text{g}/\text{dL}$ before the switch differed from the odds during the switch to FWS (before and after the January 2, 2015, water advisory was issued), and after the switch back to DWA. Overall, among 9,422 blood lead tests in children aged <6 years, 284 (3.0%) BLLs were ≥ 5 $\mu\text{g}/\text{dL}$ during April 25, 2013–March 16, 2016. The adjusted probability of having BLLs ≥ 5 $\mu\text{g}/\text{dL}$ was 46% higher during the period after the switch from DWA to FWS (and before the January 2, 2015, water advisory) than during the period before the water

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Flint Response

- **Government, academic, philanthropic/non-profit partnerships**
- **Community informed/driven/participatory**
- **Grounded in science**
- **Trauma-informed**
- **Focused on secondary prevention**
 - Home visiting, breastfeeding, childcare, literacy, school health, Medicaid expansion, behavioral health, nutrition support, mindfulness, etc

Flint Response

➤ **Lead elimination – FLINT LEAD FREE**

- Pipe replacements, lead safe home (Medicaid CHIP), HUD, Flint Registry

➤ **Beyond pipes and people**

- Economic development, restorative justice, self-determination, participatory democracy

➤ **Flint ripples**

- Lead, drinking water, environmental justice, children's health



Lilly's Lessons

➤ Flint is not isolated

- Legacy of lead lingers
- Ongoing environmental injustices
- Deteriorating infrastructure
- Disrespect of science and facts
- Lax regulations
- Crisis vs. prevention
- Child-phobic

➤ Flint's prescriptions for hope



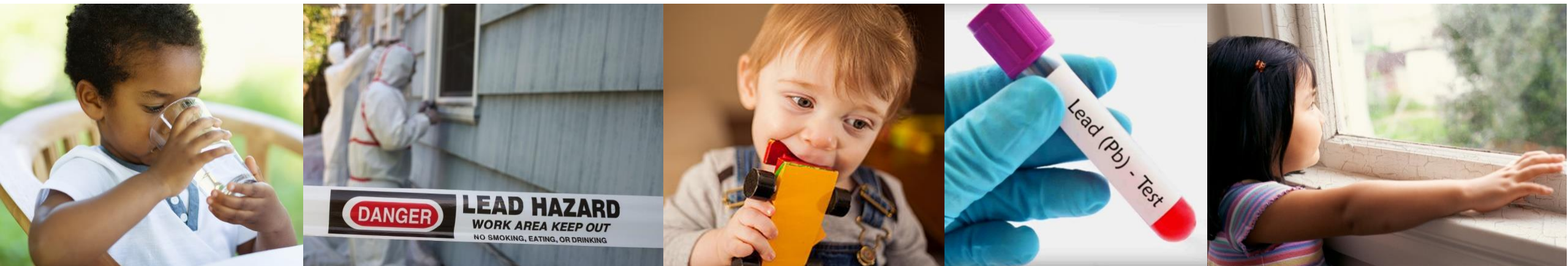
Tragedy to Beauty



THANK YOU!

@MonaHannaA

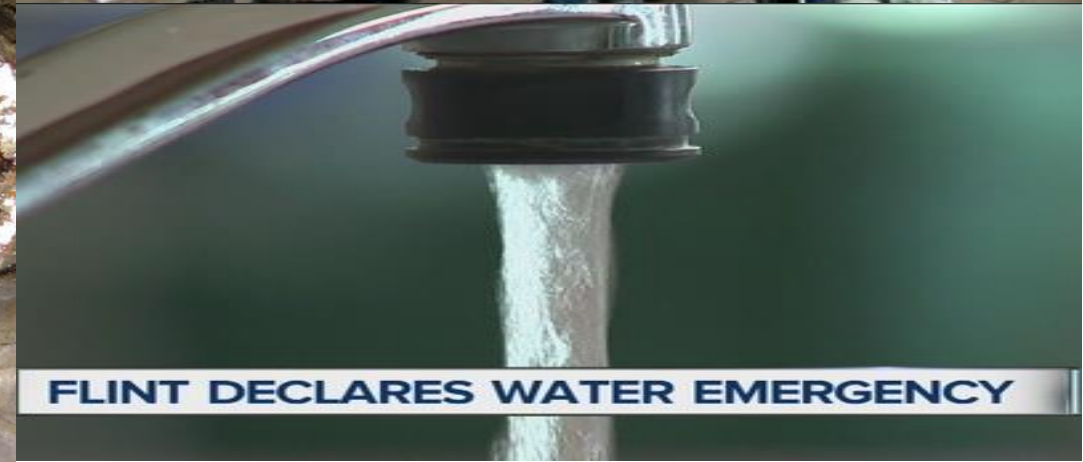
Opportunities for Lead Elimination



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National Center for Environmental Health/Agency for Toxic Substances and Disease Registry

Increased Awareness in the Aftermath of Flint



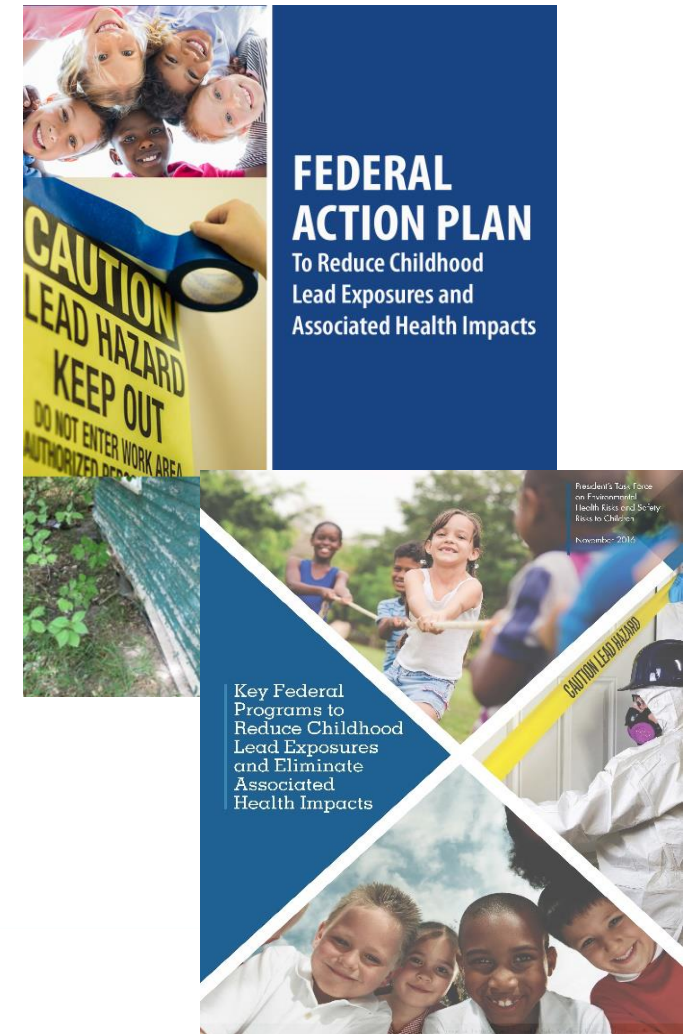
Water Infrastructure Improvements for the Nation (WIIN) Act, 2016

- **Enhance lead poisoning prevention and surveillance**
 - 14 new state and local health department partners
- **Flint Lead Exposure Registry**
 - Consortium led by Michigan State University
- **Federal Advisory Committee**
 - Lead Exposure and Prevention Advisory Committee (LEPAC)

Increased Collaboration between Federal Agencies to Protect Children's Environmental Health

Goals are:

1. Reduce children's exposure to lead sources
2. Identify lead-exposed children and improve their health outcomes
3. Communicate more effectively with stakeholders
4. Support and conduct critical research to inform efforts to reduce lead exposures and related health risks



Public-Private Partnerships



Ongoing “Lead-Free” City Initiatives



Let's Eliminate Harmful Lead from Children's Environments

**“The problem is so well defined,
so neatly packaged,
with both causes and cures known, that if we don't
end this social crime,
our society deserves all the
disasters that have been forecast for it.”**

—René Dubos (1967)