

PEDIATRIC LEAD EXPOSURE IN FLINT, MI: CONCERNS FROM THE MEDICAL COMMUNITY

THANK YOU'S

Introducing Makayla*



- 12 month old girl (DOB 8/15/2014) presented last week for her 1 year old check up. No concerns.
- Lives with single mom and 2 older siblings in west side (48504). Formula from WIC; powder mixed with warm tap water.
- Physical exam and development are normal. Makayla receives her 1 year old vaccines and routine lead and hemoglobin screening.
- *A couple days later, lead level comes back as 6 ug/dL.*

*Hypothetical scenario

Blood lead level of 6 ug/dL.....

- Blood lead levels (BLL) above 5 ug/dL are considered elevated blood lead levels (EBL)
- Just a few years ago (2012), 10 ug/dL was cutoff
- Increasing evidence shows NO safe blood lead level
- Disproportionately impacts low income children
- Primary prevention is most important
 - Prevents exposure before it occurs!

Primary Prevention

- “Because no measurable level of blood lead is known to be without deleterious effects, and because once engendered, the effects appear to be irreversible in the absence of any other interventions, public health, environmental and housing policies should encourage **PREVENTION** of all exposure to lead.”

“Low Level Lead Exposure Harms Children: A Renewed Call for Primary Prevention.” 2012 CDC Advisory Committee on Childhood Lead Poisoning Prevention.

What will happen to Makayla?

- Vast evidence supports increased likelihood of:
 - Decrease in IQ
 - An increase in BLL from 1 to 4 ug/dL, drops mean IQ -3.7 points
 - Small change in mean IQ, shifts entire population IQ distribution
 - Reduces high achievers IQs (>130) and increases kids with low IQs (<70)
 - Implications for early intervention, special education services, employment, incarceration, life achievement, etc

Lanphear BP et al., Low-level environmental lead exposure and children's intellectual function: an international pooled analysis. *Environ Health Perspect*, 2005. 113:894-9.

Fewtrell LJ, Pruss-Ustun A, Landrigan P, and Ayuso-Mateos JL, Estimating the global burden of disease of mild mental retardation and cardiovascular diseases from environmental lead exposure. *Environmental Research*, 2004. 94:120-33.

Behavioral Burden

- Increased likelihood of :
 - ADHD behaviors
 - Delinquent behaviors and arrests
 - Total arrests and increased rates of arrests involving violent offenses
- Other health effects: hematologic, cardiovascular, immunologic, endocrine, etc

Wright, JP, KN Dietrich, MD Ris, et al. 2008. Association of prenatal and childhood blood lead concentrations with criminal arrests in early adulthood. *PLoS Med* 5(5): e101

Chen, A, B Cai, KN Dietrich, et al. 2007. Lead exposure, IQ, and behavior in urban 5-7 year-olds: Does lead affect behavior only by lowering IQ? *Pediatrics* 119(3): e650-e658.

Needleman, HL, C McFarland, RB Ness, et al. 2002. Bone lead levels in adjudicated delinquents: A case control study. *Neurotoxicology and Teratology* 24(6):711-717.

The Cost

- “For childhood lead poisoning, \$5.9 million in medical care costs, as well as an additional **\$50.9 billion** (sensitivity analysis: \$44.8–\$60.6 billion) per year in lost economic productivity resulting from reduced cognitive potential from preventable childhood lead exposure.”
- “The present value of Michigan’s economic losses attributable to lead exposure in the 2009 cohort of 5 year-olds ranges from \$3.19 (using U.S. blood lead levels) to **\$4.85 billion** (using Michigan blood lead levels) per year in loss of future lifetime earnings.”

Leonardo Trasande and Yinghua Liu. Reducing The Staggering Costs Of Environmental Disease In Children, Estimated At \$76.6 Billion In 2008. *Health Affairs*, 30, no.5 (2011):863-870

The Price of Pollution: Cost Estimates of Environment-Related Childhood Diseases in Michigan. 2010 Report by Michigan Network of Children’s Environmental Health

Lead in Water

- Increasing as source of lead because of success in controlling other sources.
- Increasing due to aging water infrastructures, change in water sources, disinfectant uses, etc
- Lots of variability in water lead levels depending on internal and external pipes, use of water, temperature, etc
- Disproportionally impacts developmentally-vulnerable formula-fed infants and pregnant mothers
 - Formula preparation

Role of the Pediatrician

- Prevention of everything to optimize children's health
- Lead screening as recommended by CDC and AAP at 1 and 2 years of age
- Inquiry and advocacy

RESEARCH FINDINGS

Results of Pediatric Blood Lead Levels

• **Methods**

- Data from all blood lead levels processed at Hurley Medical Center
- HMC Institutional Review Board (IRB) approved
- All children under 5 years of age
- Zip codes 48501-48507
- Two periods of comparison:
 - PRE-SWITCH: January 1, 2013 – September 15, 2013
 - **WATER SWITCH APRIL 2014**
 - POST-SWITCH: January 1, 2015 – September 15, 2015

Results of Pediatric Blood Lead Levels

• **Methods**

- Analyzed % Elevated Blood Lead (EBL)
 - EBL = Blood lead Levels > 5 g/dL
- EBL analysis conducted based on scientific literature (most notably DC lead in water exposure)

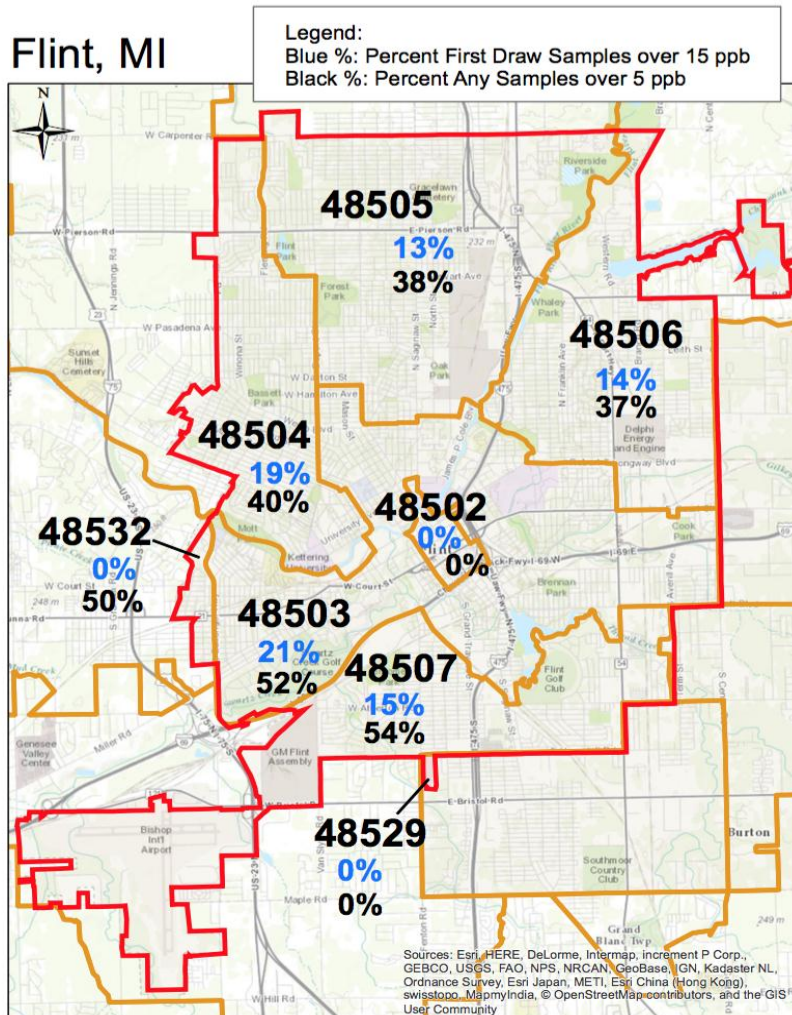
Blood Lead Level Analysis

- Large sample size
 - N= 1746 for Flint children (pre n=906, post n=840)
 - N= 1670 for non-Flint children (pre n=943, post n=727)

Flint results for children 5 years and under:

- PRE-SWITCH % EBL: **2.1%** (consistent with MDHHS data 2.2)
- POST-SWITCH % EBL: **4.0%**
- **p < 0.05; STATISTICALLY SIGNIFICANT CHANGE**

Zip Codes With High Water Lead



- Focus on zip codes (48503 and 48504) with high water lead levels
- Total n=742, pre n=394, post n=348

Results:

- PRE-SWITCH % EBL: **2.5%**
- POST-SWITCH % EBL: **6.3%**
- **p < 0.05; STATISTICALLY SIGNIFICANT CHANGE**

What was rest of county doing?

- Analysis of same time periods for Genesee County children who live outside of City of Flint zip codes (non 48501-48507)
 - N=1670 for non-Flint children (pre n=943, post n=727)

Non-Flint results for children 5 years and under:

- PRE-SWITCH % EBL: **0.6%**
- POST-SWITCH % EBL: **1.0%**
- **p = 0.637; NO STATISTICAL CHANGE**

Blood Lead Level Analysis

- % EBL all children less than 5 years of age

	ALL FLINT (n=1746)	HIGH- water lead FLINT (n=742)	REST OF FLINT (n=1004)	NON- FLINT (n=1670)
PRE-SWITCH	2.1%	2.5%	1.8%	0.6%
POST-SWITCH	4.0%	6.3%	2.4%	1.0%

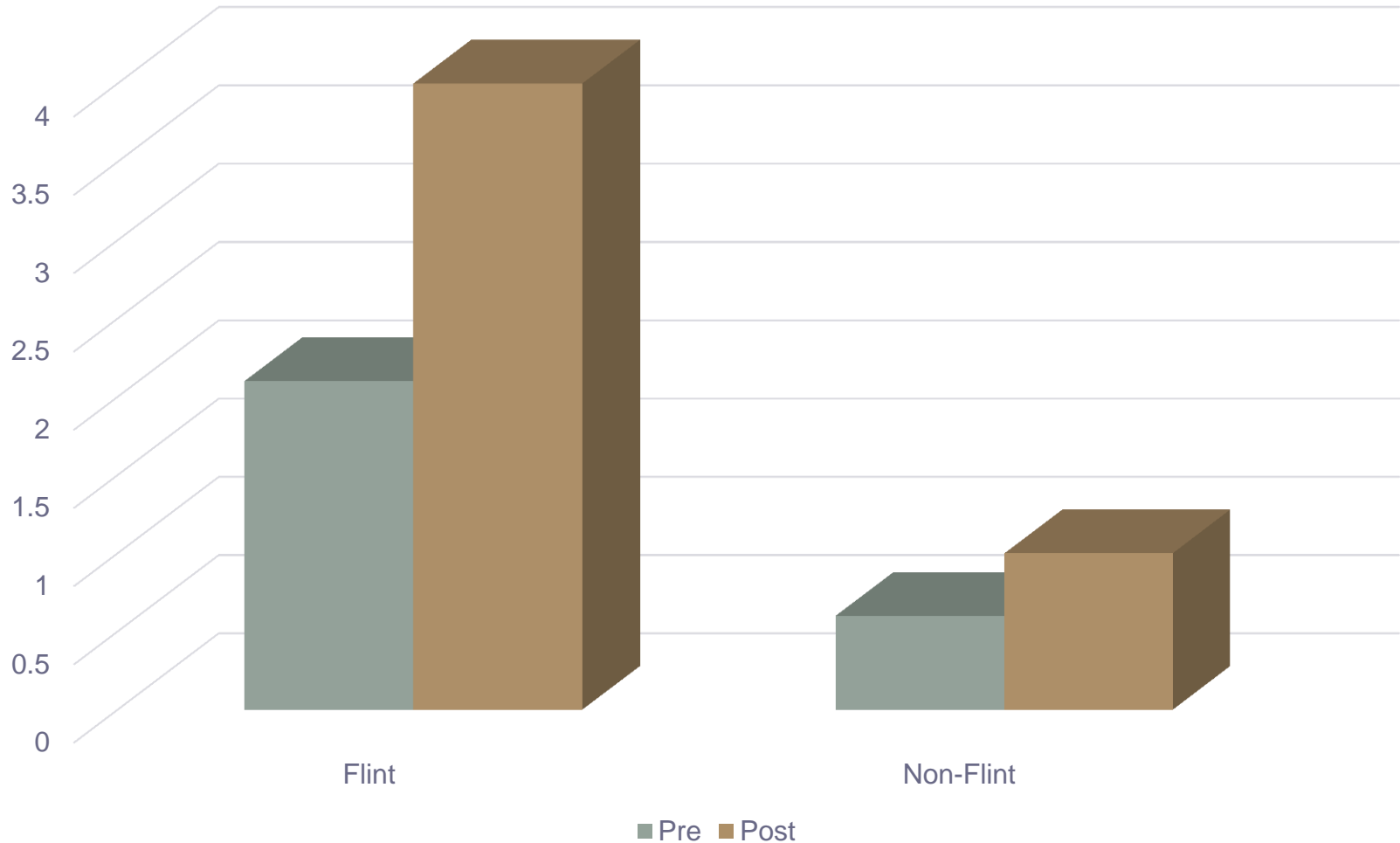
Blood Lead Level Analysis – 15 month

- % EBL children 15 months or less
 - Total Flint n=619, pre n=295, post n=324 (smaller sample size)
 - Total Non-Flint n=816, pre n=443, post n=376

	ALL FLINT (n=619)	HIGH- water lead (n=269)	REST OF FLINT (n=350)	NON- FLINT (n=816)
PRE-SWITCH	1.0%	1.5%	0.6%	0.5%
POST-SWITCH	2.5%	4.4%	1.1%	0.5%

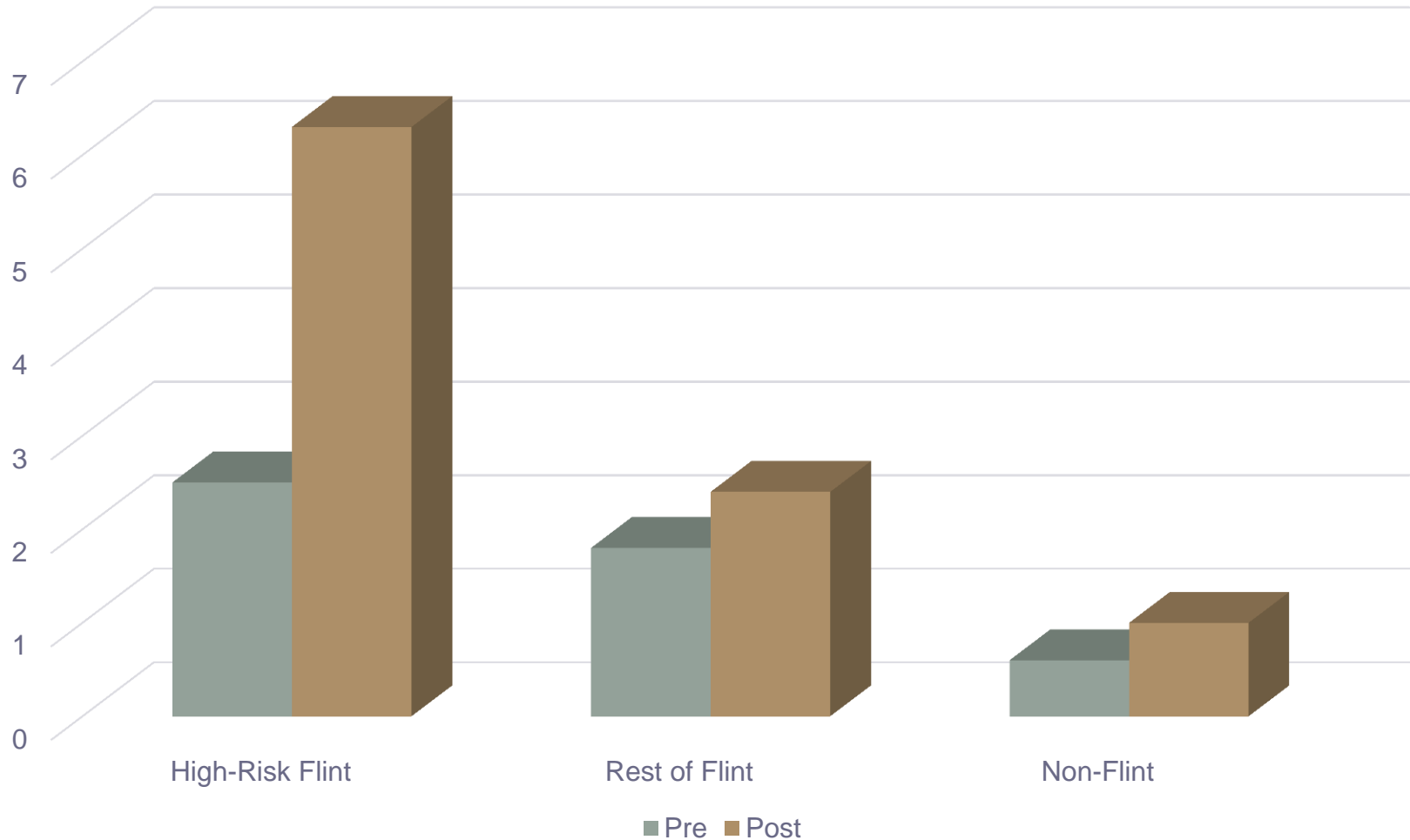
Graphical Summary

Change in % EBL Flint vs Non-Flint



Graphical Summary

Change in % EBL by area



Conclusions from BLL analysis

- Based on our research, % of children with EBL in Flint has increased
 - Most striking increase in zip codes with highest water lead levels
 - Also saw an increase in kids less than 15 months, sample small
- Results underestimate risk:
 - Infants not screened for lead
 - BLL may have peaked before being measured
 - Water usage has dropped

Recommendations

- AAP and CDC recommendation of primary prevention
- Limit further exposure
 - Encourage breast feeding
 - No tap water for high risk groups: infants on formula & pregnant mothers
 - Distribution of lead clearing NSF-approved filters
 - Public education regarding precautions (flushing, cold water, etc)
 - Connect to Lake Huron water source
- Support city's health advisory and health department's public education efforts

And Makayla...

- Asymptomatic now
- But what will her future hold and an entire generation of Flint children if we don't err on the side of safety?

