New Jersey Biomonitoring Mercury Levels: A Comparison and Call to Action

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Introduction

** This lightbulb can contain up to 100mg of Hg

- Exposure to mercury (Hg) is associated with numerous adverse health outcomes in adults, including cardiovascular, reproductive, and developmental toxicity. [1]
- Prenatal exposure is particularly detrimental to fetuses and is associated with reduced anthropometric measures that can persist into adulthood. [1]
- Mercury (Hg) is found in three forms: elemental, inorganic **(InHg),** and organic (methylmercury **(MeHg)** or ethyl mercury **(EtHg)**).[2]
- While elemental mercury is not a significant contributor to the overall body burden of Hg, the others are. MeHg, EtHg, and InHg are readily tested in blood[2].
- Exposure to MeHg is primarily dietary (large fish, seafood).
- Exposure to InHg is primarily behavioral (occupational, cultural, etc.).[2]
- It is still unclear if any level of Hg in blood is safe; it is an active area of research.[2, 3]
- New Jersey has a unique chemical profile due to a high number of risk and demographic factors.[4,5]

- To better understand Hg risk in NJ, the NJ Biomonitoring team implements several projects that monitor chemical trends in the NJ population and selected subpopulations.
- Two case studies will be presented to highlight the efficacy of a mercury tracking and screening program.

*This lightbulb contains no Hg

Methodology

Description of Projects

Remnant Specimen Study (RSS) (2015-2018)

- Determine levels of environmental contaminants using deidentified clinical laboratory and blood bank remnant specimens
- NJ adults aged 20-74, n = 2,988

Prenatal Screening Program (PSP) Mothers (2019- Ongoing)

- Screen high-risk NJ expectant mothers for toxic metals at first visit and delivery.
- Standard-of-care at University Hospital, Newark (UH). All pre-/perinatal patients' blood tested. Elevated patients fill out an exposure questionnaire. n = 6,555

Prenatal Screening Program (PSP) Babies (2019- Ongoing)

- Screen high-risk NJ babies for toxic metals at delivery.
- Standard-of-care at UH. All perinatal patients' blood tested. n = 5,936

New Jersey Health and Nutrition Examination Survey (NJHANES) (2021 - Ongoing)

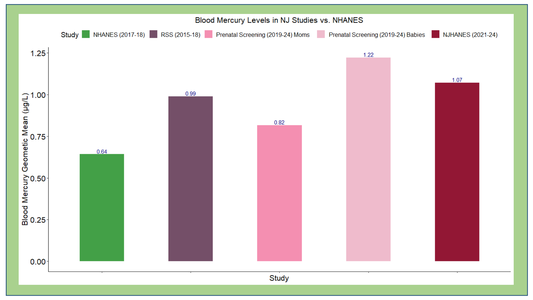
- Obtain NJ-specific health, nutritional, and exposure data for >120 chemicals.
- Questionnaires, basic physical, and biospecimen (blood and urine) collection.
- Randomly selected NJ households and recruited residents, aged 6+, n = 167

National Health and Nutrition Examination Survey (NHANES) (2017-2018 dataset)

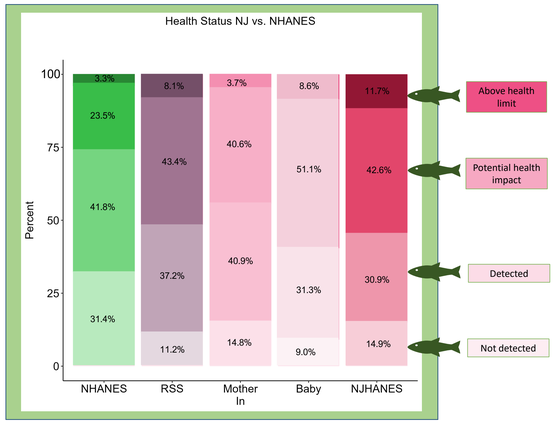
- CDC-led survey used as a national reference for comparison
- n = 12,102

Data collection, cleaning, merging, analysis and visualization were performed using R (version 4.3.1).

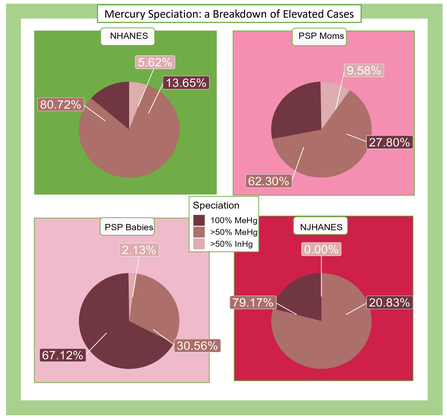
Results



- The geometric mean of Hg in RSS, NJHANES, and PSP were higher than NHANES, especially in PSP babies.
- Non-parametric Kruskal-Wallis multiple comparison tests confirmed that the median differences were significant between PSP babies and others ($p<0.05$)



- Overall, Hg has been detected at a higher percentage in the NJ population compared to the national average.
- The NJ population tended to higher exceedances of the health-based threshold (>5 µg/L).
- For a level that may cause adverse health effects in babies (defined as 1-5 µg/L), all NJ results showed higher exceedances compared to NHANES.



- MeHg is consistently the dominant Hg species for all four populations, and especially for babies.
- As MeHg primarily enters the body through consumption, behavioral intervention would be most effective at reducing overall Hg levels.

Results

A Review of Two Case Studies

Case Study 1		
	5/15/2023	1/30/2024
Mercury level (µg/L)	26.9 →	3.38

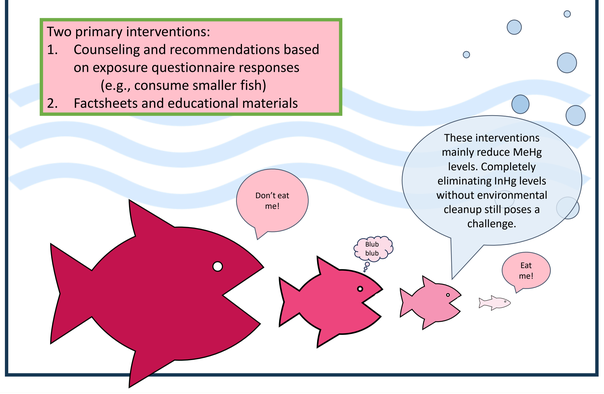
- Case 1 Hg levels detected as part of NJHANES study
- 87.4% decrease from 26.9 µg/dL to 3.38 µg/dL after intervention

- Case 2 was a mother in the PSP.
- 92.2% decrease in blood Hg concentration, from 45 µg/dL at week 10 of pregnancy to 3.5 µg/dL at delivery following similar intervention to Case 1
- ***Baby was born with 90-95% less than what would otherwise be expected without interventions.***

These cases highlight the importance of early Hg screening and intervention to minimize potential negative health outcomes and protect vulnerable populations, especially among pregnant women and babies.

What were the interventions?

Two primary interventions:
1. Counseling and recommendations based on exposure questionnaire responses (e.g., consume smaller fish)
2. Factsheets and educational materials



Conclusions

- Mercury exposure is prevalent throughout the NJ population at levels higher than the national average.
- The New Jersey population tended to have higher exceedances of the health limit and potential health impact range compared to NHANES averages.
- MeHg is the dominant form of Hg found in our populations; it is especially true for babies.
- This information highlights the urgency of implementing a mercury tracking and surveillance program akin to the currently well-established lead response/education program.
- The case studies demonstrate that in most cases, simple intervention (providing exposure questionnaires, counseling, and educational materials) would have far-reaching impacts.
- The challenge remains: establishing a program to effectively address InHg beyond source product removal (i.e., eradication from the indoor environment [air, furniture, carpeting, consumer products, etc.]).

References

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