Childhood Blood Lead Surveillance in Bihar, India

Executive Summary

Lead is a potent toxin that can severely affect the mental functioning and physical health of children and adults. Children are particularly vulnerable to lead poisoning because they absorb significantly more lead from their environments than adults and their central nervous systems are still developing. Lead exposure can affect children's brain development, even at a low level, and can result in behavioral changes, reduced intelligence quotient (IQ), and reduced educational attainment and lifetime earnings. (1,2)

According to estimates from the GBD study, India accounted for more than half of the total global morbidity and mortality attributable to lead, despite having only 18% of the global population. Based on modeled estimates, Bihar had the highest blood lead level among all Indian states. (3) However, no statewide monitoring data on children's blood lead level was available in Bihar to verify this concern. In 2023, Vital Strategies, in partnership with Pure Earth and Mahavir Cancer Sansthan and Research Center, conducted the first statewide study to understand blood lead levels (BLLs) in children under the age of 5 and in pregnant women in Bihar, India.

This study provides state-representative estimates of BLL among children and examines BLL among pregnant women in Bihar. High levels were found in both groups. Key factors linked to lead exposure at home were identified, including proximity to lead-related industries, cohabiting with someone working with lead, use of cosmetics that may contain lead, and pica behavior.

Findings from this study underscore the urgent need for a comprehensive strategy to protect children in Bihar from lead poisoning. Strengthening the local health system's capacity to address lead exposure should include ongoing monitoring of childhood blood lead levels, integrating lead exposure assessment into routine pediatric care for early prevention and timely treatment, increasing awareness among health professionals and parents, and regulating lead use in consumer products, industry and manufacturing.

Read the full report here:

vitalstrategies.org/resources/childhood-blood-lead-surveillance-in-bihar/

Read our published peer-reviewed study here:

sciencedirect.com/science/article/abs/pii/S0013935124014336

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Summary of Approach

The project aims to understand the baseline blood lead levels and prevalence of elevated blood lead levels among children under the age of 5 and pregnant women in Bihar. Using a multi-stage random sampling design, we selected a state-representative[1] sample of children (n=697) and their pregnant mothers (n=55) from eight districts in Bihar. We visited homes to obtain consent and tested the blood lead levels of participants using capillary blood and a portable analyzer. We collected information on factors related to lead exposures (e.g., take-home exposure, home environment, use of consumer products, behavior and nutrition) and home demographics through interviews with the primary caregivers. We used statistical models to identify factors that might be associated with elevated BLL among children. The results and recommendations for reducing lead exposure were shared with all participating families. The study received full ethical clearance from a local Indian institutional review board as well as a U.S.-based institutional review board.

Key Findings

Over 90% of the sampled children in Bihar had elevated BLLs (≥5 µg/dL), exceeding the level requiring intervention as recommended by WHO. One in four children had BLL ≥10 µg/dL, a level linked to clinical symptoms like anemia. We observed that the average level of children in Bihar (geometric mean=7.6 g/dL) is higher than the average level estimated for Indian children in previous studies. In all eight districts that were examined, more than 75% of the children tested had elevated BLLs. High prevalence of elevated BLL was observed in both urban and rural areas, in both boys and girls, and across different age groups. We also observed a high prevalence of elevated BLL among sampled pregnant women. Over 80% of these women had BLLs ≥5 µg/dL and more than 20% had BLLs ≥10 µg/dL.

Figure A: Distribution of BLL among sampled children in Bihar[2]

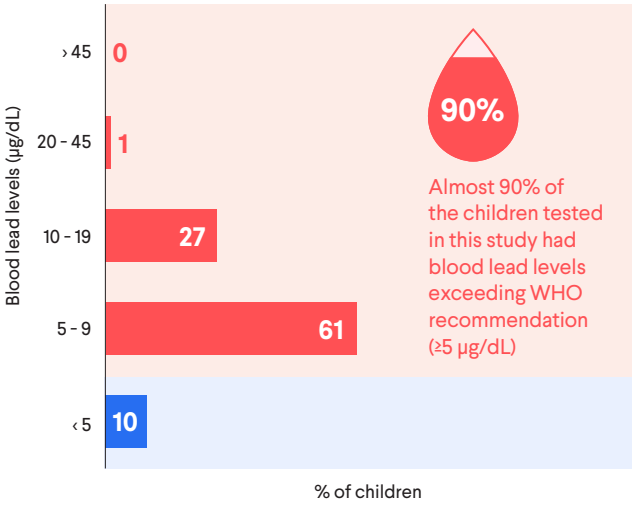
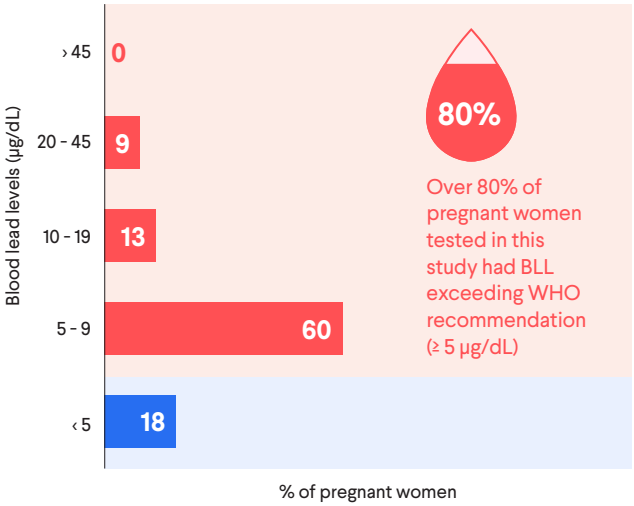


Figure B: Distribution of BLL among sampled pregnant women (n=55)



1 The state-representative sample only refers to children. This study is not intended to be representative for pregnant women and at district level.

2 Percentages may not total 100 due to rounding

Multiple factors were linked to lead exposure in children within the sampled households, even after controlling for age, sex, and demographics. These factors include living with a member with a lead-related occupation, living near a lead-related industry, having pica behavior involving soil consumption and using traditional eyeliners and skin lightening products.

Children with the following factors are more likely to have BLL above 5 µg/dL in Bihar

Live near lead-related industry

5 times
more likely

Lightening cream

5 times
more likely

Eating soil

5 times
more likely

Eye cosmetics

3 times
more likely

Children with the following factors are more likely to have BLL above 10 µg/dL in Bihar

Live near lead-related industry

3 times
more likely

Family member with lead-related occupation

2 times
more likely

Policy Recommendations

Enable regular screening and monitoring of risk factors for elevated blood lead levels among young children

The state health department is best positioned to consider establishing a statewide lead exposure surveillance system by instructing pediatricians to add lead exposure risk assessment into routine care for children or integrating lead exposure assessment into recurring statewide health surveys or programs that evaluate children's health or nutrition.

Strengthen laboratory capacity and accessibility to blood lead tests at public health facilities

It is important to improve the capacity for blood lead tests, especially at public health laboratories and hospitals that specialize in care for heavy metal poisoning. Using screening questions to identify high-risk children with lead exposure history can also help allocate limited testing capacity.

Raise public awareness of the toxic effects and sources of lead

Health education and communication programs related to lead exposure and health effects should be organized for the community in plain language to have tangible impacts.

Strengthen health workers' capacity to improve clinical management of lead poisoning

Familiarize healthcare providers (ASHAs, community health officers, medical officers) by adopting or adapting existing WHO clinical guidelines to facilitate early detection, intervention and treatment.

Identify and regulate sources of lead exposure affecting children in India

Strengthening the enforcement of existing and legally binding standards for lead in these products such as paint, spices and cosmetics can be effective in preventing the market circulation of lead-contaminated products and materials.

Monitor and regulate lead pollution from industrial processes

Existing standards should be enforced in industrial and other workplace settings. Monitoring lead in soil can also be important to protect children living in communities near these industrial sites from lead exposure.

References

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2. United Nations Environment Programme WHO International Labour Organisation. Inorganic Lead - Environmental Health Criteria 165. 1995; Available from: https://wedocs.unep org/20.500.11822/29465

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