Early-life lead exposure and behavioral problems among children in the HOME Study

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OVERVIEW

- Lead exposure is associated with behavioral problems in children, but the ages when children are most susceptible to lead toxicity are unclear.
- Our objective was to evaluate the association of repeated blood lead concentrations with parent-reported behaviors and identify periods of heightened susceptibility.

STUDY DESIGN

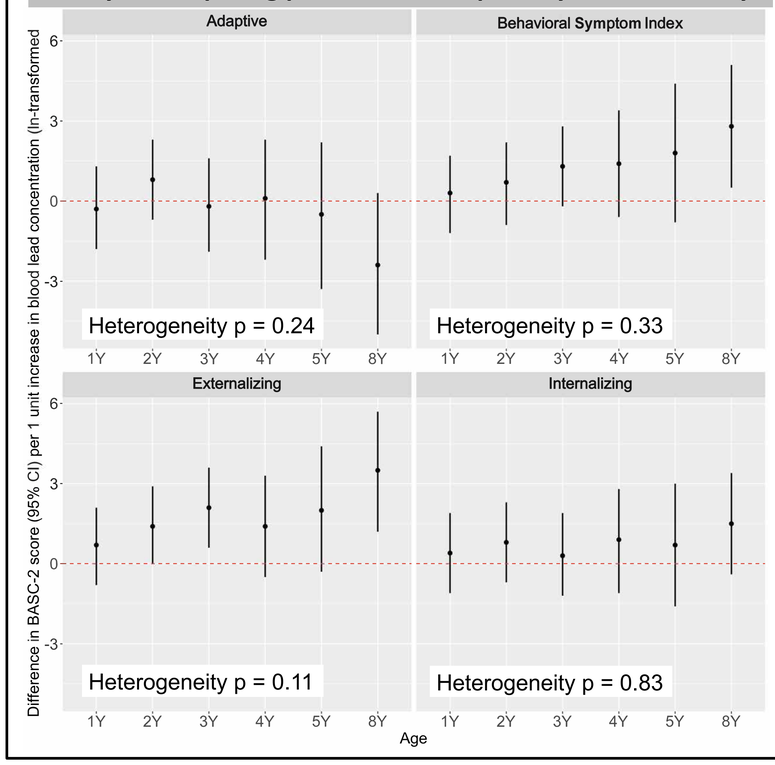
- Cohort: The Health Outcomes and Measures of the Environment (HOME) Study, a prospective pregnancy and birth cohort of women and children living in homes built pre-1978 in greater Cincinnati, Ohio (2003 – 2006). This analysis includes n = 241 children who completed study visits at ages 2, 3, 4, 5, and 8 years.
- Blood Lead Concentrations: Quantified in whole blood samples collected from children at ages 1, 2, 3, 4, 5, and 8 years (μg/dL) .
- Child Behavior: Parent-reported using the Behavioral Assessment System for Children-2 (BASC-2) when children were ages 2, 3, 4, 5, and 8 years.
- Statistical analysis: Using multiple informant models with generalized estimating equations adjusted for covariates, we estimated associations of time-varying blood lead concentrations (ln-transformed, μg/dL) with behavioral profiles using the BASC-2 composite scales, and assessed heterogeneity in these associations across exposure periods. We used modified Poission regression to estimate the association between blood lead concentration and relative risk of clinically-relevant scores of ≥ 60 on each scale.

RESULTS

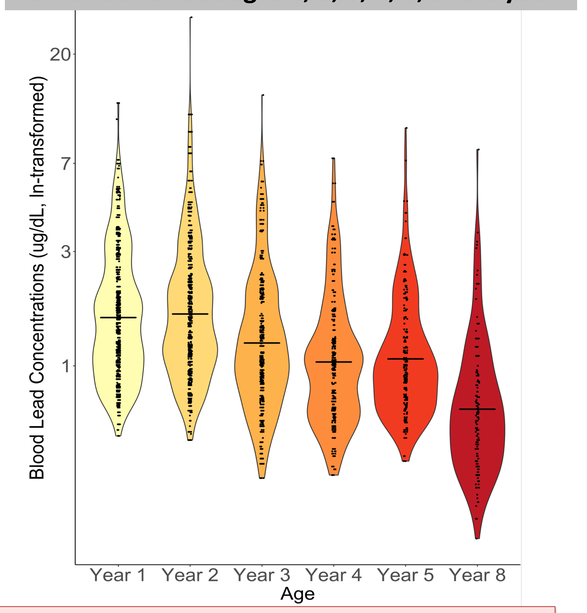
Main Finding: **Higher blood lead concentrations were associated with more externalizing problems, with periods of heightened susceptibility to lead occurring around ages 3 and 8 years.**

- Participant characteristics: The majority of children were white (80%), lived in households with an annual income of at least $45,000 (71%), and had a mother with a Bachelor's degree or higher (61%).

Adjusted difference in repeated BASC-2 scores per unit increase in ln-transformed blood lead concentration: Analysis comparing periods of susceptibility to lead toxicity



Distribution of children's blood lead concentrations at ages 1, 2, 3, 4, 5, and 8 years



Main Finding: **Higher blood lead concentrations were associated with a higher relative risk of externalizing and behavioral problems.**

Adjusted relative risk (RR) of BASC-2 scores ≥ 60 per interquartile range increase in ln-transformed blood lead concentration at ages 2-8 years

BASC-2 Scale	% with at least one clinically-relevant score	RR (95% CI)
Adaptive	25	1.25 (0.76, 2.03)
Behavioral Symptom Index	21	1.46 (0.95, 2.27)
Externalizing	22	1.48 (0.97, 2.24)
Internalizing	21	0.89 (0.54, 1.47)

Covariates include: child's age, gender, household income, lead intervention status, maternal education, race, maternal depression at time of evaluation, child's serum cotinine (observations = 780)

CONCLUSIONS

- Children with higher blood lead concentrations had more parent-reported hyperactive and aggressive behaviors. Future research could investigate if the periods of heightened susceptibility to lead toxicity around ages 3 and 8 years are due to neurodevelopmental characteristics which are specific to those ages.

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