SSRC Selections are brief, curated lists of research, evaluation reports, and additional publications and resources that inform the field about key issues in, and effective practices for, fostering economic self-sufficiency. The goal of SSRC Selections is to bring together relevant, seminal work on a topic for a focused read on the state of the field. This set of selections focuses on Lead Poisoning and Behavioral and Academic Outcomes. While these selections include information Lead Poisoning and Behavioral and Academic Outcomes, this is not an exhaustive list of resources in this area. To access over 7,000 reports, datasets, journal articles, conference papers, federal publications, and more, visit the SSRC Library.


https://www.opressrc.org/content/recent-developments-low-level-lead-exposure-and-intellectual-impairment-children

This article reviewed and summarized cross-sectional and longitudinal national and international studies that examine an association between low-level lead exposure and children’s intellectual development. The authors could not draw a conclusion based on the eight cross-sectional studies included in their review because the studies had different sample sizes, considered different blood lead levels (BLLs), and did not find consistent effects. The authors concluded that the epidemiological longitudinal studies they reviewed found that low BLLs, below 10 micrograms per deciliter (µg/dL), were associated with lower intellectual and cognitive ability in children. The longitudinal studies measured pre-natal BLL and/or post-natal BLL at different ages. The wide scope of research included in the review allowed for more insight into the effects of lead exposure on cognitive development as measured by IQ and confounding factors. For example, socioeconomic status (SES) was a confounding factor, because high SES was associated with higher prenatal BLLs in Boston, MA, and Yugoslavia, but not in the other locations identified by other studies. High SES was also a protective factor, however, as there was no relationship between BLL and IQ among children from high SES backgrounds while BLL was associated with IQ among children in low SES families. Children from high SES backgrounds with high BLLs also had lower IQ measures. The article also called for researchers to look beyond IQ as the sole measure of cognitive development and use multiple robust measures.

https://www.ohiossr.org/content/iq-and-blood-lead-2-7-years-age-are-effects-older-children-residual-high-blood-lead

This article described an analysis of data from the Treatment of Lead-exposed Children (TLC) study, a randomized controlled trial that tested whether succimer treatment for children with high BLLs impacted IQ scores and other behavioral and psychological outcomes. The study included 780 children with BLLs of 20-40 µg/dL, initially aged 12 to 33 months, 77 percent of whom were African American and 97 percent of whom received public assistance. In the study, participants were assigned to either the placebo group or the drug treatment group that received a succimer, which treats lead poisoning by binding lead, and outcomes were measured at baseline and various follow up points through age seven. There were no significant differences in IQ or BLLs between the succimer and placebo groups at the 36 or 60 month follow ups. This analysis of the TLC study data found that BLLs before 2 years of age were not predictive of IQ at older ages. Instead, the BLLs measured at older ages were negatively associated with IQs measured at those respective ages, suggesting that lead exposure continues to affect development beyond 2 to 3 years of age and that 6- to 7-year-olds may be as sensitive to lead as infants and toddlers. The results also suggested that the results of cross-sectional studies related to BLLs which include older children may not be due solely to early life exposure.


https://www.ohiossr.org/content/effect-residential-lead-hazard-interventions-childhood-blood-lead-concentrations-and

The study utilized a randomized control trial to investigate whether a residential lead exposure reduction intervention could reduce dust lead levels, prevent elevated blood lead levels (BLLs), and positively affect neurobehavioral outcomes. The study had 355 women who were put into either the control group or the intervention group. For the intervention group, at 32 weeks gestation, sources of lead in the intervention group’s homes were identified and installed tap water filters, repaired and repainted peeling or deteriorating lead paint, and installed window liners or replaced windows, if necessary. Following the repairs, the study tested dust lead loadings and ordered more cleaning, if necessary. The control group received an injury hazard intervention, meant to reduce the risk of
injuries for children. The study followed children from before birth to eight years old and measured their BLLs at nine points, 16 weeks, 26 weeks, the perinatal period, yearly until age 5, and finally at 8 years old. They also took a robust approach to neurobehavioral outcomes, using five different tests to measure the children during the course of the study. The study showed that children in the intervention group’s BLLs were not significantly lower and the differences in neurobehavioral outcomes between groups were statistically insignificant, although parents in the intervention group reported that their children were generally less anxious. The study noted that one reason these outcomes were observed was that children may have been exposed to lead in their diet or outside the home, showing a need for more robust initiatives to reduce lead exposure.


https://www.opressrc.org/content/association-childhood-blood-lead-levels-criminal-offending

The study utilized a prospective analysis to investigate the association between childhood BLLs and adult criminal convictions and recidivism using data from the nationally representative Dunedin Multidisciplinary Health and Development Study, which collected data from individuals born in New Zealand from 1972 to 1973. The study included 553 individuals whose BLLs were measured at 11 years old, which ranged from 4-31 µg/dL, with a mean of 11 µg/dL. The study analyzed the associations between BLLs and convictions at 21, 26, 32, and 38 years old using the New Zealand police’s computer system which consists of all convictions in Australia and New Zealand and self-reported criminality at 15, 18, 21, 26, 32, and 38 years old. The study showed that people with BLLs above 15 µg/dL had more convictions. While a BLL of 5 µg/dL the odds of having a criminal conviction was 1.29 times higher, but did not affect recidivism. The study noted that measuring BLLs at 11 years of age may be a limitation, since early childhood blood levels are unknown. Finally, the study noted that high BLLs were typically found to be associated with low SES since during the time of the data collection, high BLLs were observed in those from high and low SES backgrounds. The study disentangled the effects of low SES on high BLLs, as there was no association between SES and BLL in the dataset.


https://www.opressrc.org/content/association-childhood-blood-lead-levels-cognitive-function-and-socioeconomic-status-age-38

This study used data from the Dunedin Multidisciplinary Health and Development Study, a
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prospective cohort study in which children’s BLLs were measured from birth. Because children from all socioeconomic levels were exposed to lead in New Zealand, the data do not have the limitation of many cohort studies of lead exposure, in which children with high BLLs are more likely to come from a low SES background. The study authors used this data to examine the relationship between BLL and cognitive outcomes as well as later life SES. Cognitive abilities such as IQ, verbal comprehension, perceptual reasoning, working memory, and processing speed were assessed at age 38 along with socioeconomic status. They found that higher BLLs were associated with poorer adult cognitive performance such as likelihood of a lower IQ, and lower scores on perceptual reasoning and working memory. However, they found no statistically significant association between BLLs and verbal comprehension and processing speed. Higher BLLs were related to lower socioeconomic status in adulthood, as well as downward mobility, an association that was only partially mediated by IQ.


This study used data on lead exposure from the Detroit Department of Health and Wellness Promotion to assess the association between early childhood lead exposure and academic outcomes in Detroit, Michigan, a city with a high lead burden. The participants in this study were children born between 1990-2008, who took a blood test between birth to 6 years of age and took the math, science, and reading Michigan Educational Assessment Program when they were in grades 3, 5, or 8. The study showed that even after controlling for race, maternal education, and socioeconomic status (measured by receipt of school lunch), there was a statistically significant negative association between lead exposure and academic achievements, including a dose-response, where higher BLLs were associated with lower academic performance. The study recommended prioritizing interventions that help prevent lead exposure, because there is no effective treatment for children, although they recommended special education programs for students with lead poisoning.


https://www.oxpressrc.org/content/ethical-issues-using-childrens-blood-lead-levels-remedial-action-objective

This study used the Bunker Hill mine in Idaho as a case study of how to improve remedial action objectives (RAOs), which are the target outcomes, such as lead levels, that the Environmental
Protection Agency (EPA) attempts to achieve when cleaning up a Superfund mine site. The Bunker Hill mine was the site of a lead mine and smelter until 1981, and it had toxic effects on the residents of the surrounding town where generations of residents had high BLLs even after a dramatic decline in BLLs the smelter’s closing. The study argued that the EPA did not do all they could to rigorously measure the hazard level and eliminate lead exposure. The EPA used BLL as an indicator of lead exposure and determined 10 µg/dL as the standard to achieve. This is problematic according to the study because BLLs have been declining and the standard BLL is still quite high given that there is no safe level of lead exposure. The study argued that RAOs are reactive, not preventative, and the EPA needs to take a more complex approach to reducing exposure, since lowering BLLs after exposure has not been proven to improve later outcomes. The EPA also did not invest heavily in community engagement at the Bunker Hill site and lost community trust when they said the standards were met in 2002. The study argued that RAOs are not complex enough to address social and environmental injustices, but if used, the standards for BLL should be lowered significantly.

https://www.opressrc.org/content/childhood-blood-lead-levels-and-symptoms-attention-deficit-hyperactivity-disorder-adhd-cross

The study examined the association between early childhood lead exposure and specific ADHD subtypes in children ages 6 to 13 years old. The study used data from the Early Life Exposure in Mexico to Environmental Toxicants (ELEMENT) study participants, which included 578 children born in Mexico City, Mexico. The data set has missing BLL information for 29 percent of participations, and the study authors imputed missing BLL data by factoring in maternal education, age, marital status, and SES, among other factors. The authors assumed that parents declining a blood test for their child was not related to BLL. The study used the mother-report Conners’ Rating Scale-Revised (CRS-R) to assess symptoms for the ADHD subtypes hyperactivity, restless-impulsivity, and inattentiveness. BLL was significantly positively associated with hyperactive and impulsive subtypes of ADHD only for children with BLLs below 5 µg/dl, and was not associated with inattentiveness or overall ADHD. The study theorized that lead may be absorbed in the brain using the dopamine pathway, which is one of the main pathways involved in ADHD, though further research on the mechanisms of brain change is necessary.

https://www.opressrc.org/content/educational-interventions-children-affected-lead

This report summarized the evidence on the effects of lead exposure on children and highlighted policy recommendations to address the effects of lead in children. It identified vulnerable populations and risk factors and discussed how lead exposure affects the neurodevelopment of children and their learning and educational attainment. Since children are still being exposed to lead and no level of lead exposure is safe, the report addressed possible ways to minimize the effect of lead exposure on children. The report recommended expanding the Child Find system, which identifies, finds and tests infants and toddlers with disabilities, to include BLL. The report also recommended that schools maintain records which include BLL. Some potential interventions for lead-exposed children that the report recommended include early child education programs, which have reduced developmental risks in areas other than lead exposure, and state or local childhood lead poisoning prevention programs. The report also included resources for families, schools, and states, regarding obtaining services for lead exposed children.


https://www.opressrc.org/content/pew-health-impact-project-10-policies-prevent-and-respond-childhood-lead-exposure

This report presented a brief history of lead exposure in the United States and analyzed policies to prevent children’s exposure to lead and to provide support for exposed children. The report used quantitative modeling and qualitative focus groups in areas with high lead burdens to identify recommended policies. The report calculated the benefits of total prevention of lead exposure as 84 billion dollars over the lifetime of children born in 2018 as a result of improved educational and behavioral outcomes. The report argues that total prevention of lead exposure is a necessary goal, since no level of lead exposure is safe. Lead exposure is currently ubiquitous, however, so the report addressed the main sources of lead exposure: drinking water, paint, air emissions, and soil contamination and made policy recommendations for reducing lead from each source. The report also included measures to support lead-exposed children’s intellectual and behavioral development, including blood lead testing, academic interventions, special education, and nutritional interventions.