Indianapolis Neighborhood Housing Partnership

Exposure to Toxins & Housing

RESEARCH COMPLETED IN JULY 2019, IN PARTNERSHIP WITH REINVESTMENT FUND

STATE OF THE RESEARCH

There are multiple streams of literature examining the relationship between housing and exposure to toxins. A well-developed literature in multiple fields documents the adverse effects of exposure to within-home toxins on residents at every stage of life — in-utero babies, infants, children, adults, and the elderly. Another growing body of research has begun to document the relationship between the presence of environmental toxins on residential health and the desirability of nearby homes. Finally, a third body of literature documents the disproportionate exposure to within-home and environmental toxins among historically underserved populations and their communities.

BACKGROUND

A number of studies have examined the numerous negative effects that toxins in the home (e.g., lead, tobacco, mold, mercury, and asbestos) have on the health of residents. Additionally, environmental toxins from nearby industry, contaminated water sources, and other polluted sites have been found to contribute to poorer health of local residents and exert downward pressure on housing prices on homes located near these hazards. Historically, minority and lower-income families and their communities have been exposed to in-home and environmental toxins more frequently than those in more affluent, predominantly white communities.

SUMMARY OF RESEARCH FINDINGS

The existing literature is generally divided into three broad orientations to understand the relationship between exposure to toxins and housing: in-home health hazards; environmental health hazards; and the unequal distribution of exposure to in-home and environmental hazards. People who are exposed to toxins, such as lead, exposed asbestos, or contaminated water in their homes are at dramatically elevated risks of a range of adverse health outcomes including cancer, neurological impairment, developmental delays, asthma, and others. People who live in close proximity to sites that emit toxins into the air, ground, and water are also at elevated risks of similar ailments. Many of these risks are particularly elevated for babies and children whose bodies and minds are still developing.

Exposure to toxins, whether in your home or outside your home, can directly influence the quality of life and overall health of individuals living in toxic housing conditions and/or hazardous neighborhoods.

There have not been many studies that directly assess differences in exposure to toxins for renters and homeowners — although there are demonstrable benefits that can accrue from efforts to remediate hazardous conditions regardless of housing tenure.

RECENT STUDIES HAVE FOUND:

- Exposure to toxins, both within the home and in the environment, is generally understood to pose risks to individual health.
- Exposure to toxins within the built structure of a home that are detrimental to residential health are known, preventable, and fixable.
- The costs of within-home lead remediation may be offset by increased values.
- The negative impact of environmental exposure to toxins on home values has been observed for a number of different environmental hazards.
- There are multiple pathways through which in-home and environmental toxins impair individual health — some are well understood (i.e. prolonged exposure to toxic waste or radiation, inhalation of asbestos) while others (i.e. prolonged exposure to mold) are still being understood.

EXPOSURE TO TOXINS — SUMMARY OF KEY STUDIES

Hanna-Attisha, M., LaChance, J., Sadler, R. C., & Champney Schnepp, A. (2016). Elevated blood lead levels in children associated with the Flint drinking water crisis: a spatial analysis of risk and public health response. *American journal of public health, 106*(2), 283-290.

STUDY FOCUS	An analysis of elevated blood levels in children before and after the introduction of a new water source in Flint, Michigan; the study analyzed children and geographic patterns of impact to assess the influence of neighborhood disinvestment.
METHODOLOGY	The researchers examined blood lead levels for children under five in Genesee County (Flint), Michigan, before and after the city changed its water source, precipitating widespread exposure to lead among city residents. Children outside Flint but within the county, who were not exposed to a change in water source, served as a control group. The researchers used geospatial analyses to assess variability of impact across geography, and how that impact was associated with neighborhood socioeconomic indicators.
SUMMARY OF FINDINGS	The researchers identified a statistically-significant finding of elevated blood levels among children in Flint, with high led levels doubling from 2.4 to 4.9 percent. Distressed neighborhoods, as identified across a range of census measures, had the highest incidences of elevated blood lead levels, both before and after the introduction of the new water source; these areas also experienced greater increases in elevated lead levels with the introduction of the new water supply.
IMPLICATIONS FOR PRACTITIONERS	While national efforts have been successful in reducing some risks of lead exposure — notably exposure from lead-based paint and automobile exhaust — our nation's aging water infrastructure, coupled with limited municipal resources to address these challenges, may pose an ongoing existential threat to eliminating exposure to lead. This threat may be especially acute in disadvantaged neighborhoods.

Currie, J. (2013). Pollution and Infant Health. *Child development perspectives, 7*(4), 237-242.

STUDY FOCUS	A synthesis of recent research examining the relationship between pollution and infant health.
METHODOLOGY	A literature review focusing on recent studies that attempt to identify a causal relationship between pollution and infant health.

SUMMARY OF FINDINGS	Assessing a potential causal relationship between toxic pollutants and infant health is difficult due to data limitations, selection bias, and confounding factors. Nevertheless, recent studies have found that poor and minority infants are more likely to experience health challenges related to environmental hazards from particulate matter. When these hazards are mitigated or the family moves away from the hazards, these negative impacts are lessened, suggesting the impact is attributable to environmental causes, not familial factors.
IMPLICATIONS FOR PRACTITIONERS	Much of the research on the impact of environmental toxins on infant health outcomes have focused on air pollutants controlled through the Clean Air Act; more research on other air pollutants and other sources of pollution (water, hazardous waste, and home toxins) is needed. Further, researchers currently lack a systemic way of directly measuring exposure on fetal health and/or measuring the long-term consequences. Nevertheless, these, relatively unexplored connections may pose an important key in addressing inequalities and health outcomes.

Ratnaseelan, A. M., Tsilioni, I., & Theoharides, T. C. (2018). Effects of mycotoxins on neuropsychiatric symptoms and immune processes. *Clinical therapeutics*, 40(6), 903-917.

STUDY FOCUS	An examination and synthesis of the research investigating the negative impact of exposure to mycotoxins in mold.
METHODOLOGY	A literature review of articles in *PubMed* with relevant terms; a total of 150 articles were identified and 16 articles in which the authors identified relevant data were reviewed.
SUMMARY OF FINDINGS	Exposure to mold is a known contributor to health challenges, namely allergies and asthma. Recent studies have established potential connections between mold — especially those containing mycotoxins — to several other complex health challenges in both adults and children. These studies suggest that exposure to mycotoxins may negatively impact multiple organs, including the lungs, musculoskeletal system, and the nervous system. In adults, exposure to mold may contribute to malaise, fatigue, and cognitive impairment. Children, with developing immune systems, may have more acute and adverse health outcomes given exposure to mycotoxins; children with exposure to mold may exhibit respiratory challenges, reduced cognitive ability, and may contribute to autism spectrum disorder. The negative impacts of mycotoxin exposure is dependent, in part, upon the type of mold, how long a person is exposed, and the age and health of the person who is impacted.

IMPLICATIONS FOR PRACTITIONERS	Exposure to mold, and mycotoxins specifically, may have negative health consequences across a spectrum of bodily systems for children and adults. While the relationship between mold and these complex health outcomes are not yet fully understood, the prevention of moisture intrusion and treating existing mold can be an important step in preventing negative health outcomes.

Lanphear, B. P. (2015). The impact of toxins on the developing brain. *Annual Review of Public Health, 36*, 211-230.

STUDY FOCUS	A summary and synthesis of the existing research on population-level impacts of toxins on brain development.
METHODOLOGY	This study presents a literature review of existing research examining the impact upon brain development in children exposed to toxins.
SUMMARY OF FINDINGS	Across the United States, nearly everyone is routinely exposed to modest amounts of confirmed or suspected toxins, including but not limited to heavy metals (mercury, lead, cadmium, and arsenic), persistent pollutants (PBDEs, PCBs, and DDT), and non-persistent chemicals (triclosan, pyrethroids, organophosphate insecticides, bisphenol A, and phthalates). While individual level outcomes due to modest exposure may be limited, this exposure can be considerable when aggregated to the population level. Lead, PCBs, and mercury are widely recognized as contributing to cognitive defects. While individual-level outcomes — on measures such as IQ tests — it is estimated that a five-point reduction in the population-level IQ would result in a 57 percent increase in children with IQs below 70 (the lower-bound threshold at which a child is considered to have an intellectual impairment). Lead exposure has identified as a contributor to anti-social behavior as well. Attention Deficit and Hyperactivity Disorder (ADHD) is the most common brain disorder of childhood; exposure to lead and tobacco — as well as other toxins — have been associated with brain alterations consistent with those seen in children with ADHD. Historically, research into autism spectrum disorder (ASD) has focused on genetic causes; nevertheless, the role of environmental factors in the development of autism is increasingly recognized.
IMPLICATIONS FOR PRACTITIONERS	Given the widespread presence of toxins, and the resulting low-level exposure most Americans face, these toxins likely impact brain development and may lead to lifelong impairments. At the population level, the aggregate impact of exposure to toxins is considerable. To address these issues at the population level, wide-ranging steps including increased regulation and enhanced monitoring will be necessary.

ADDITIONAL RECENT RESEARCH

Currie, M. A., & Sorensen, J. (2018). Repackaged "urban renewal": Issues of spatial equity and environmental justice in new construction, suburban neighborhoods, and urban islands of infill. *Journal of Urban Affairs*, 1-22.

Lanphear, B. P., Rauch, S., Auinger, P., Allen, R. W., & Hornung, R. W. (2018). Low-level lead exposure and mortality in US adults: a population-based cohort study. *The Lancet Public Health, 3*(4), e177-e184.

Korda, R. J., Clements, M. S., Armstrong, B. K., Di Law, H., Guiver, T., Anderson, P. R., ... & Kirk, M. D. (2017). Risk of cancer associated with residential exposure to asbestos insulation: a whole-population cohort study. *The Lancet Public Health, 2*(11), e522-e528.

Benfer, E. A., & Gold, A. E. (2017). There's No Place like Home: Reshaping Community Interventions and Policies to Eliminate Environmental Hazards and Improve Population Health for Low-Income and Minority Communities. *Harv. L & Pol'y Rev. Online S1, 11*.

Billings, S. B., & Schnepel, K. T. (2017). The value of a healthy home: Lead paint remediation and housing values. *Journal of Public Economics, 153*, 69-81.

Tilburg, W. C. (2017). Policy approaches to improving housing and health. *The Journal of Law, Medicine & Ethics, 45*(1_suppl), 90-93.

Kravitz-Wirtz, N., Crowder, K., Hajat, A., & Sass, V. (2016). The Long-Term Dynamics of Racial/Ethnic Inequality in Neighborhood Air Pollution Exposure, 1990-2009. *Du Bois review: social science research on race, 13*(2), 237-259.

Sampson, R. J., & Winter, A. S. (2016). The racial ecology of lead poisoning: Toxic inequality in Chicago neighborhoods, 1995-2013. *Du Bois Review: Social Science Research on Race, 13*(2), 261-283.

Ard, K. (2015). Trends in exposure to industrial air toxins for different racial and socioeconomic groups: A spatial and temporal examination of environmental inequality in the US from 1995 to 2004. *Social Science Research, 53*, 375-390.

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Tuttle, C. M., & Heintzelman, M. D. (2015). A loon on every lake: A hedonic analysis of lake water quality in the Adirondacks. *Resource and Energy Economics, 39*, 1-15.

US Department of Health and Human Services. (2006). The health consequences of involuntary exposure to tobacco smoke: a report of the Surgeon General. US Department of Health and Human Services, Centers for Disease Control and Prevention. *Coordinating Center for Health Promotion, National Center for Chronic Disease Prevention and Health Promotion, Office on Smoking and Health*.

Krieger, J., & Higgins, D. L. (2002). Housing and health: time again for public health action. *American journal of public health, 92*(5), 758-768.