

Evaluating the Cost of Lead Hazard Control and Abatement in Baltimore City

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Executive Summary

This report establishes benchmarks on the data points necessary to approach the goal of citywide lead hazard reduction and eradication by addressing two central questions. First, how many homes in Baltimore City contain dangerous lead hazards that present a risk of childhood lead exposure? Second, what is the cost estimate to reduce or eradicate these lead hazards in Baltimore City's housing stock? We hope these inquiries will add data to the debate on how to carry out lead hazard reduction at a citywide scale.

To first assess the scope, this report estimates the total number of homes across the entire city that contain dangerous lead hazards, applying metrics used in the 2011 American Healthy Homes Survey to Baltimore City's housing stock. This report also assesses the extent of known residential lead hazards in Baltimore City based on lead violations data from the Baltimore City Department of Housing and Community Development.

To assess the at-scale cost, this report establishes per-unit cost ranges for two types of lead hazard interventions: lead hazard control, which is more limited in scope, and

lead abatement, which is a more extensive intervention. We then apply these cost ranges to the recorded and estimated number of homes containing lead hazards in Baltimore City. Lastly, we discuss a range of funding solutions that have been implemented or proposed for large-scale lead hazard reduction projects, both in Baltimore City and across the United States.

This report estimates that across the city, there are 85,087 occupied housing units containing dangerous lead hazards that pose a risk of lead exposure. The estimated base cost to perform lead hazard control work on these units is between \$851 million and \$1.4 billion, and between \$2.5 billion and \$4.2 billion for lead abatement work.

As for known violations across the city, there are currently 2,104 housing units with reported lead violations, 1,138 of which are either vacant or slated for demolition. For the remaining 966 housing units, the base cost of lead hazard reduction is between \$9.7 and \$16.4 million, and for lead abatement, the cost is between \$29 million and \$48.3 million.

Timeline of Maryland Lead Regulations

- 1951** Baltimore City passes legislation banning the use of lead paint in residential housing. It is the first city in the United States to enact a lead ban of this kind.
- 1991** CDC defines the lead exposure “level of concern” at a blood lead level of $\geq 10 \mu\text{g/dL}$.¹
- 1994** The Maryland Reduction of Lead Risk in Housing Law is enacted (Md. Code, Env’t. §6 801)(HB760). The law establishes annual registration and lead “risk-reduction” standards that require landlords to perform lead-risk reduction prior to renting properties built before 1950. Note that owner-occupied properties and housing units are not regulated under this law.
- 2000** Maryland amends state statute to require all children living in “at risk” areas (whose definition captured the entire city of Baltimore) to be tested at ages 1 and 2 years, and provide test evidence to enter public pre-K, kindergarten, or first grade, effective 2003 (Md. Health General Article §18-106 (2000)).
- 2005** Maryland amends state statute to reduce “elevated blood lead level” definition from $15 \mu\text{g/dL}$ to $10 \mu\text{g/dL}$, effective 2006 (e.g. Md. Code, Env’t § 6-846).
- 2012** The Maryland Reduction of Lead Risk in Housing Law is expanded to require all pre-1978 rental properties to comply with risk-reduction standards, effective 2015.
- 2012** CDC replaces the “level of concern” with a national blood lead level “reference value” of $5 \mu\text{g/dL}$ —in practice, this level is synonymous with the federal standard of “elevated” lead exposure.²
- 2016** Governor Hogan implements universal lead testing for all 1- and 2-year-olds in Maryland born after January 1, 2015.
- 2019** The Maryland Healthy Children Act (HB1233) is signed into law. The definition of elevated blood lead levels in Maryland is set to mirror the CDC’s reference value, and is therefore reduced to $5 \mu\text{g/dL}$, effective October 2019 (Md. Code, Env’t § 6-304).
- 2021** The CDC lowers the national blood lead level reference value to $3.5 \mu\text{g/dL}$.³

BACKGROUND ON LEAD HAZARD REDUCTION IN BALTIMORE CITY

The damages associated with lead exposure, especially during childhood, have been well documented, and the public health benefits of reducing lead exposure are clear. Broad consensus within epidemiology and public health has established that lead exposure, even the lowest levels, causes measurable neurological damage on cognitive development, especially when it occurs in early childhood.^{4,5}

Existing research on the sources of lead exposure has pointed toward deteriorating residential lead-based paint as the most common cause of childhood lead exposure today.⁶ The Maryland Department of the Environment (MDE) estimated that lead-based paint hazards accounted for 78% of all potential sources of lead exposure in Baltimore City in 2021.⁷ Myriad recent studies have concluded that strict enforcement and treatment of residential lead hazards contribute to lowering population blood lead levels.^{8,9}

Taken altogether, efforts undertaken by the local city and state government to limit exposure of children to residential lead hazards in Baltimore City have largely fallen under three types of strategies: (1) enacting legislation to protect tenants and establish recourse around lead exposure; (2) creating and expanding citywide lead testing and public education programs; and (3) containing or eradicating physical lead hazards.

Under the first strategy, the 1994 Maryland Reduction of Lead Risk in Housing Law (Md. Code, Env't. §6 801; also called the Maryland "Lead Law") has been one of the most impactful pieces of legislation shaping lead governance in Baltimore City and throughout Maryland. This law, revised in 2012, requires

landlords of rental properties built before 1978 to perform lead hazard reduction work before renting the property, and to register each property's lead reduction certificate with the Maryland Department of the Environment. This has had the impact of increasing the volume of homes that are under direct oversight for lead hazard maintenance. The noteworthy exception to this law is owner-occupied housing units; this exception results in a sizeable gap in the number of housing units covered under this law.

Regarding the second strategy, childhood lead testing and public outreach have been significant in identifying cases of lead exposure in order to facilitate interventions and prevent further exposure. Since 2003, healthcare providers in Baltimore City are required to perform lead tests on patients ages 1 and 2 years, and the Baltimore City and Maryland State health departments have substantially expanded public education and community outreach to increase testing for this age group.¹⁰ Another example of public outreach is the door-knocking campaign of the Baltimore City Department of Housing and Community Development (DHCD), ongoing since 2020, which has involved hiring local residents to canvass in high-risk neighborhoods to instruct residents on how to identify lead hazards.

The third strategy, the large-scale containment or eradication of lead hazards in homes, has been demonstrated in large part through lead hazard control grants administered by DHCD's Lead Hazard Reduction Program. Baltimore City has received ongoing grant funding for lead hazard control from HUD's Office of Lead Hazard Control and Healthy Homes since the early 1990s,¹¹ and from the state of Maryland since the late 1990s and early 2000s.¹² However, the resources to perform widespread lead hazard containment and eradication at a truly citywide level have not been made available to date.

The dramatic reduction of citywide incidences of lead poisoning indicates that these approaches have achieved a level of success. From 1998¹³ to 2019,¹⁴ there was a 97% decrease in children with reported lead poisoning at 10 µg/dL or above; from 2012¹⁵ to 2019, there was a 64% decrease in the number of children with lead exposure at 5 to 9 µg/dL. However, harmful lead exposure continues and there are still gaps to be filled. In 2019, there were 772 cases of children ages 0-6 years with elevated lead exposure of 5 µg/dL or above in Baltimore City.¹⁶ In addition, between 2017 and 2019, only 50%-54% of 1-year-olds and 46%-52% of 2-year-olds in Baltimore City were lead tested each year.¹⁷ Given that, in 2021, the CDC lowered the blood lead reference level to 3.5 µg/dL, future lead testing data will inevitably show an increase in the number of children with “defined” lead exposure.

The public health benefits of eradicating lead hazards from Baltimore City’s housing stock are clear. In order to fully prevent future cases of lead exposure, it will be necessary to assess and remove the source of lead exposure—the residential lead hazards themselves. In the sections to follow, this report investigates the scale of dangerous lead hazards and the costs to reduce and remove them from Baltimore City’s housing stock.

I. ESTIMATED NUMBER OF BALTIMORE CITY HOMES WITH LEAD HAZARDS

Below, we estimate the full universe of occupied housing units in Baltimore City containing dangerous lead hazards (see Appendix A for full data and methods description). This section employs findings

from the 2011 American Healthy Homes Survey (AHHS) to estimate the number of occupied housing units in Baltimore City with lead hazards, and their distribution across the city.

In order to calculate the universe of occupied housing units in Baltimore City containing dangerous lead hazards, we apply the AHHS’s findings on the proportion of homes in the Northeastⁱ containing “significant lead-based paint hazards,”ⁱⁱ broken down by the building’s construction year, to the total number of housing units in Baltimore City.¹⁸ The AHHS additionally publishes data on the number of units per region containing lead-based paint “somewhere in the building,” which is to say all homes that contain lead based paint, even if it is maintained and not posing an immediate health threat. We choose the measure of “significant lead-based paint hazards” to best represent homes that have lead hazards and present a risk of lead exposure.

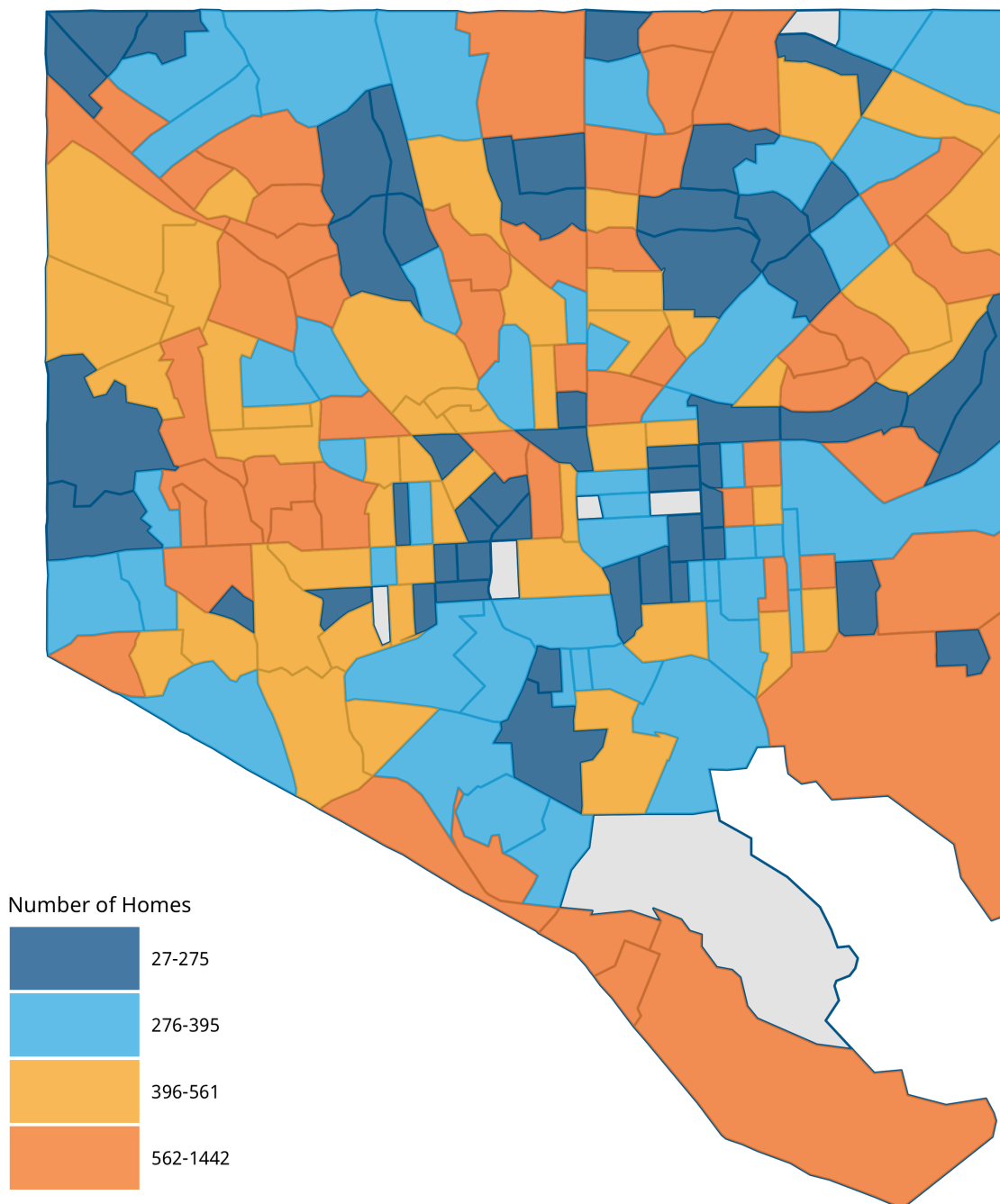
To calculate the total number of affected housing units per census tract, we additionally incorporate the median home value per census tract, where census tracts with lower median home values carry a heavier weight. This decision to incorporate home value, alongside the year of construction, is in response to repeated findings showing that median home value¹⁹ and median income²⁰ are significant indicators of lead exposure risk.

Using these metrics, we estimate that out of the total 199,338 occupied housing units that were built before 1978 in Baltimore City, there are **85,087 occupied housing units citywide containing significant lead hazards**. We map the results in Figures 1 and 2. The numbers of affected housing units per tract are displayed in Figure 1, and the relative

i Note the AHHS does not present data at geographic units smaller than U.S. regions. Baltimore City falls within the AHHS definition of the “Northeast” region.

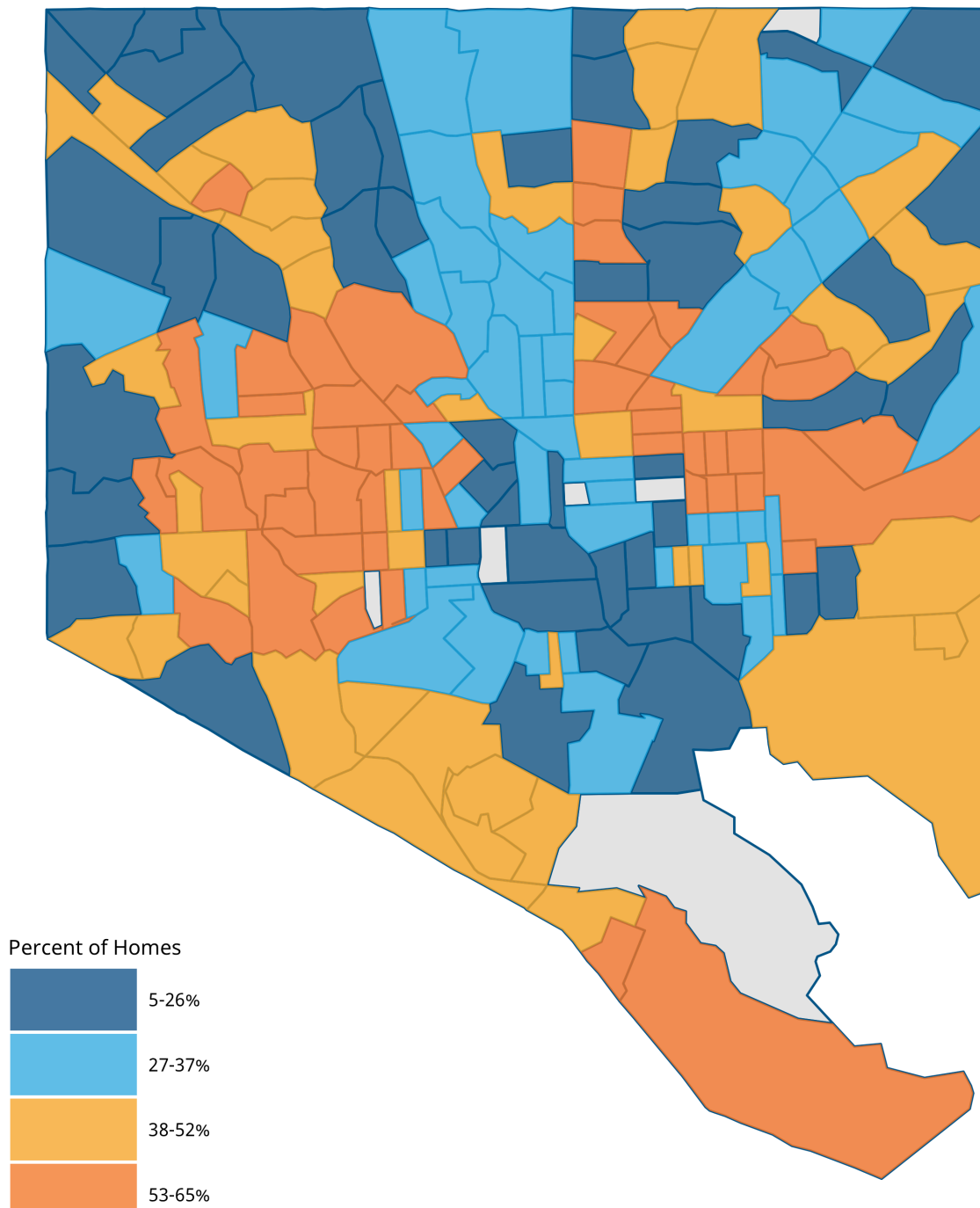
ii Threshold for a significant lead-based paint hazard: deterioration of more than 20 square feet (exterior) or 2 square feet (interior) of lead-based paint on large surface area components (walls, doors), or damage to more than 10% of the total surface area of interior small surface components (windowsills, baseboards, trim). See Section 31.1350(d) of the Lead Safe Housing Rule (24 CFR Part 35). (AHHS 2011, p. ES-1).

Figure 1: Concentrations of Lead-Based Paint Hazards: Number of Occupied Homes with Substantial Lead-Based Paint Hazards in Baltimore City



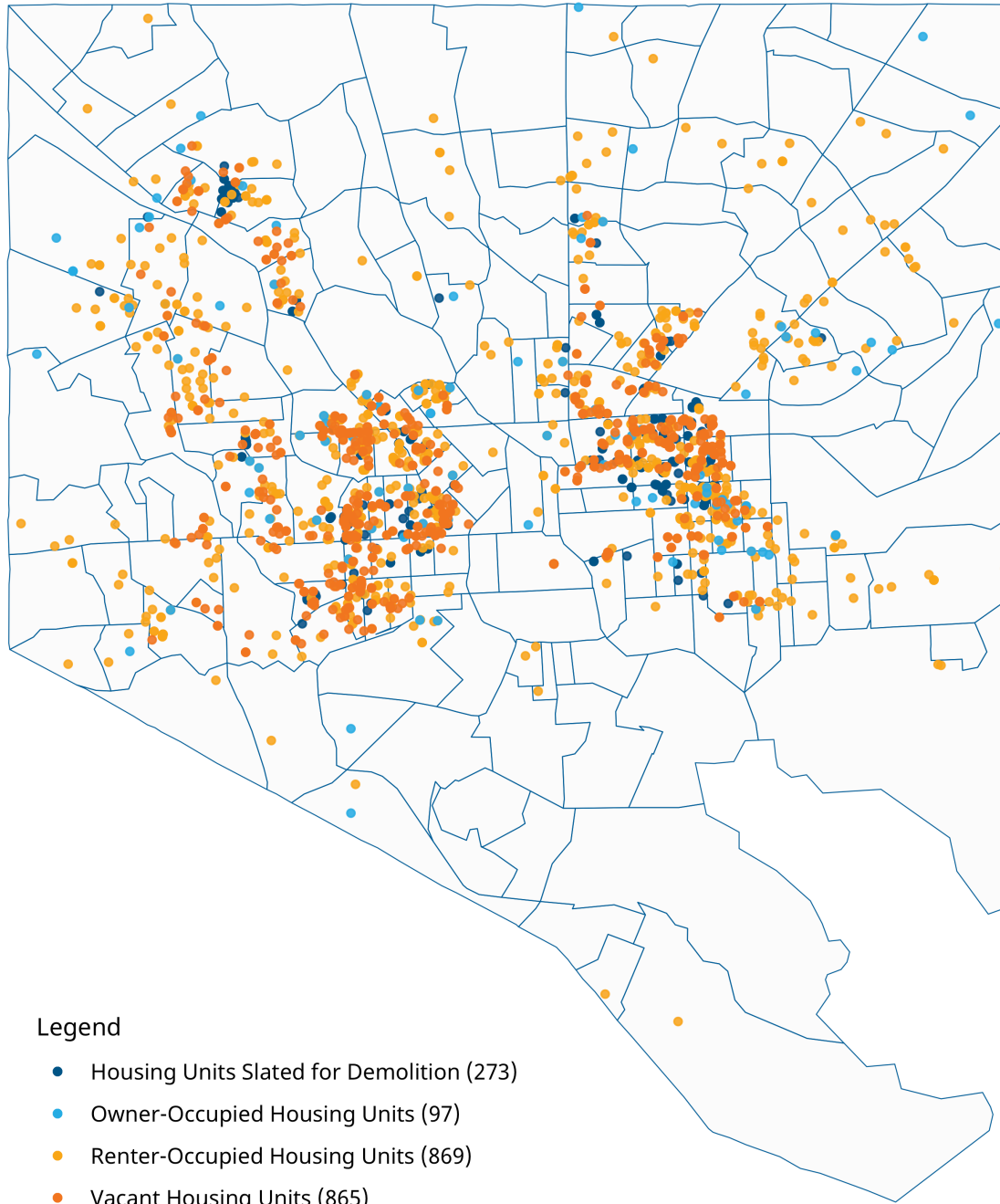
Data Sources: 2011 American Healthy Homes Survey; 2019 U.S. Census Bureau American Community Survey

Figure 2: Concentrations of Lead-Based Paint Hazards: Proportion of Occupied Homes with Substantial Lead-Based Paint Hazards in Baltimore City



Data Sources: 2011 American Healthy Homes Survey; 2019 U.S. Census Bureau American Community Survey

Figure 3: Baltimore City Housing Units with Lead Violations:
2,104 Active Violations as of October 2019



Data Source: Baltimore City Department of Housing and Community Development

proportions of affected housing units are displayed in Figure 2 (page 6).

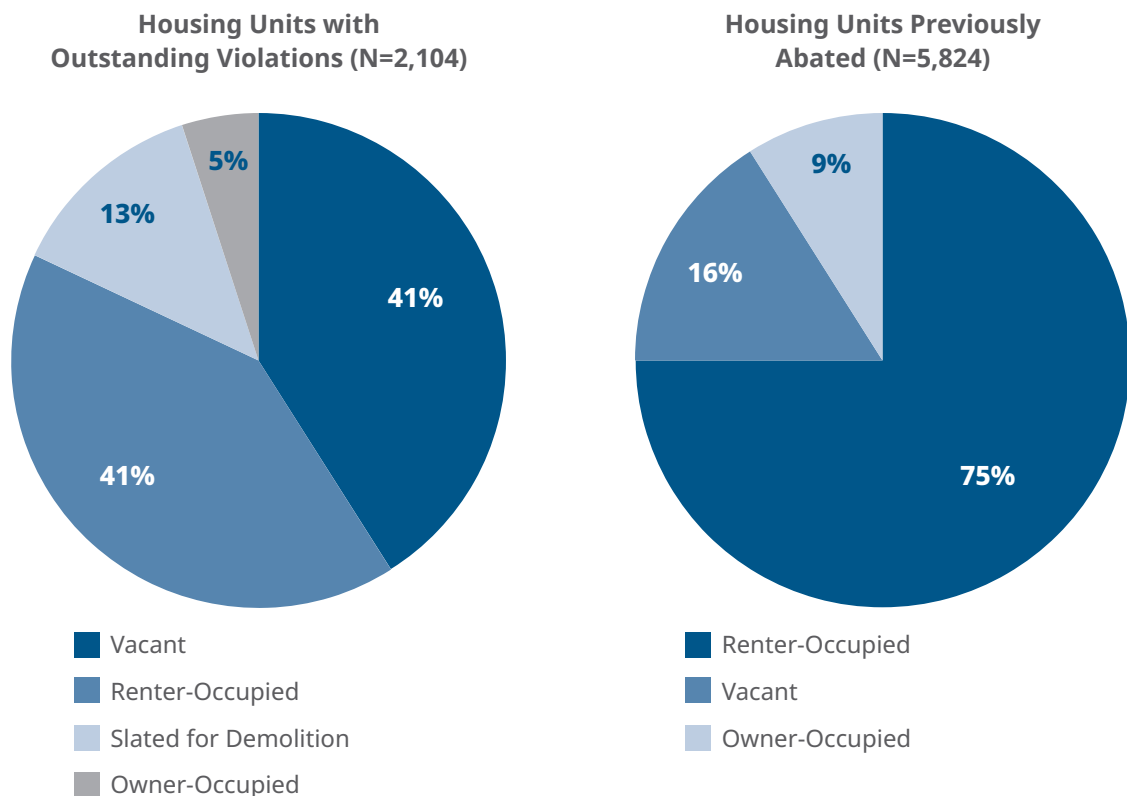
II. RECORDED NUMBER OF BALTIMORE CITY HOMES WITH LEAD HAZARDS

In this section we analyze the group of housing units that are known to have lead hazard violations as recorded by DHCD (see Appendix A for data descriptions and definitions). The advantage of focusing on recorded housing units with lead hazards is that it employs very precise, Baltimore-specific data. Since it is based on specific addresses, it does not over-count the number of homes that may have lead hazards. However, the disadvantage of this metric is that it may be leaving out homes

with dangerous lead hazards that have simply not been reported. The number of homes reported per year may be more a factor of the city's capacity to perform environmental investigations rather than a factor of the total number of hazardous homes.

According to the most recent data (as of October 2019), there are 2,104 housing units in Baltimore City with reported, unabated lead violations. Of this group, 865 (41%) are vacant units, 869 (41%) are renter-occupied units, 97 (5%) are owner-occupied units, and 273 (13%) are units of all types that are slated for demolition. The map in Figure 3 (page 7) shows the geographic distribution of these 2,104 housing units across the city, split up by housing type.

Figure 4: Previously Abated and Outstanding Lead Violations by Housing Type



Of the 2,104 housing units with active lead violations, there are 966 housing units that are neither vacant nor slated for demolition. Of this group, the majority (90%, or 871 units) have violations that were issued prior to 2017, while 10% (95 units) have violations issued between 2017 and 2019.ⁱⁱⁱ

There were a total of 7,928 housing units that received a lead violation at some point between 1988 and 2019. Of that total, 5,824 have been abated since 1988. This translates to an abatement rate of 74%. The group of units that were abated is made up of 16% (932) vacant units, 75% (4,377) renter-occupied units, and 9% (515) owner-occupied units. Figure 4 (page 8) shows a visual comparison of the housing type breakdowns between housing units that have been abated and housing units that have not. This comparison demonstrates that there is a higher proportion of vacant units among those that have not yet been abated (41%) compared to those that have already been abated (16%).

Between 2015 and 2019, there was an average of 132 violations issued per year.^{iv} Figure 5 (page 10) provides the total number of lead violations issued per year (dark blue line), alongside the number of those violations that have received lead abatement treatment (light blue line), between 1988 and 2019.^v For the units that received abatement, the median time between violation issue date and abatement date was 1.2 years. This means a typical home that received a lead abatement treatment had the process completed 1.2 years after receiving the violation.

III. COST ANALYSIS OF LEAD HAZARD CONTROL AND ABATEMENT IN BALTIMORE CITY

There are two primary categories of intervention to address lead paint hazards in a home: lead hazard control (also called “lead risk-reduction practices” and “interim controls”) and lead abatement. A comparison of these two types of interventions is presented in Table 1 (page 11).

The primary difference between these two types of interventions is how long-lasting they are intended to be. Lead hazard control measures can be effective indefinitely as long as they are carefully monitored and professionally maintained; however, without annual inspections to ensure upkeep, they may only be a temporary solution.²¹ Lead abatement measures, in contrast, are considered a permanent or decades-long intervention.

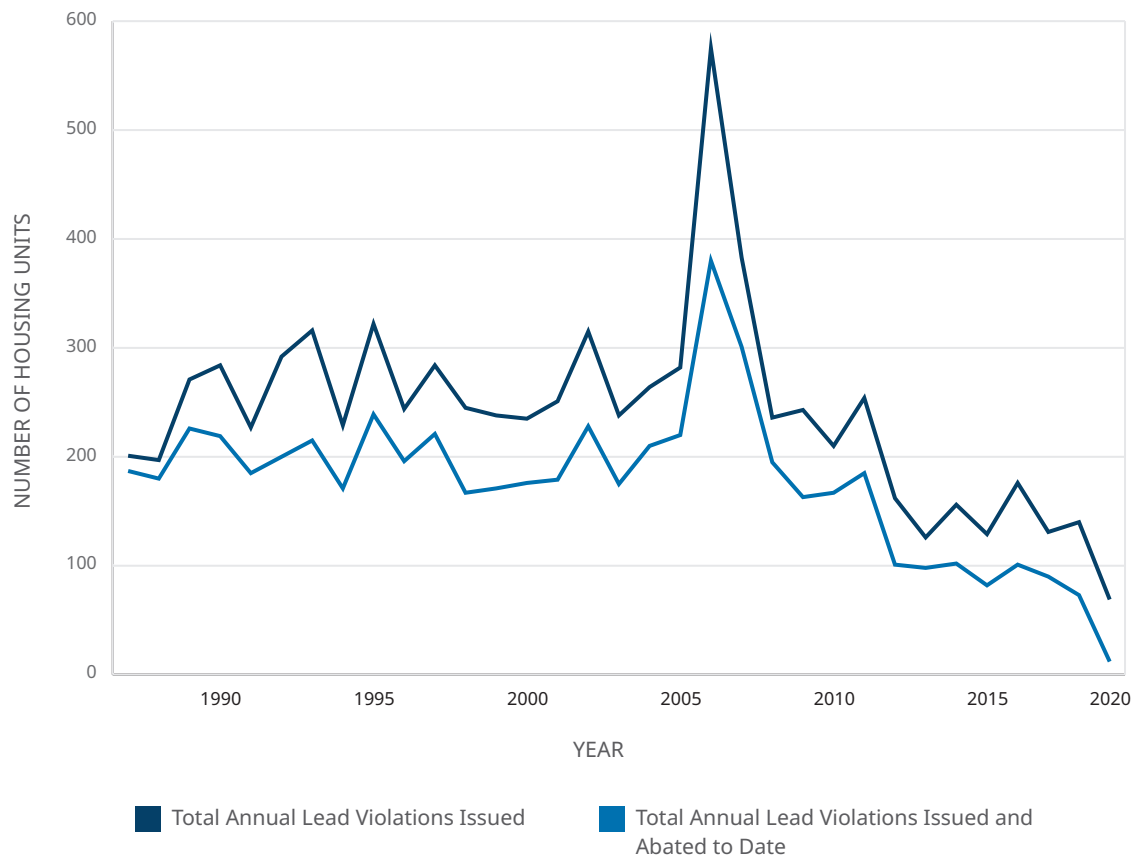
The two categories of interventions described above (lead hazard control and lead abatement) each carry a range of per-unit costs. The cost analysis in Table 2 (page 12) presents two tiers of per-unit estimates, one for lead hazard control and one for lead abatement. Taken with the recorded and estimated numbers of housing units in the city with lead hazards described above in sections I and II, this table proposes a scaled cost for citywide lead hazard interventions.

iii We do not have data on the specific circumstances of each individual lead violation. However, for the violations that have not been cleared for many years, there are possible explanations related to the property not meeting the specific eligibility requirements of the grantor (for example, HUD) that would allow the lead hazard control funds to be used on the home. For example, if the grantor required owner-occupied homes to have a “clean” title, that requirement would not be met if the occupants were not the legal owners, or if there were a lien on the property. In addition, if the grantor required properties to have home insurance, that requirement could be difficult to meet if, for example, the home is surrounded by vacant properties.

iv This average is calculated by constructing a full-year total for 2019 out of the existing data, which ends in October 2019. Assuming a constant rate for the rest of 2019, the total would have been 83 (above the reported total of 69).

v It is important to note that lead violations are issued based on the presence of an “elevated” lead test at a residential property. Since the threshold for “elevated” blood lead levels has lowered over time, there are homes that would fall under the present-day definition of requiring a lead violation that would not have received a violation in earlier periods (see regulations timeline above).

Figure 5: Annual Lead Violations in Baltimore City (All Housing Units):
Total Violations Issued By Year and Total Abated to Date



Data Source: Baltimore City Department of Housing and Community Development
These totals are current as of October 2019.

Table 2 presents the lower- and upper-bound costs for lead hazard control and lead abatement work in a typical two-story home in Baltimore City. **The per-unit cost for lead hazard control work is between \$10,000 and \$17,000, while the per-unit cost for lead abatement is between \$30,000 and \$50,000.** These ranges were determined by triangulating cost information from the Baltimore City Department of Housing and Community Development and from five local contractors accredited to perform lead hazard services in Baltimore City by the Maryland Department of the Environment.^{vi}

As described in section I, there are an estimated 85,087 occupied housing units citywide that contain dangerous lead hazards. This sum translates into a range of approximately **\$851 million to \$1.4 billion for lead hazard control work**, and between **\$2.5 billion and \$4.2 billion for lead abatement work** on all occupied housing units in Baltimore City.

vi HUD has set a national average of \$12,000 per housing unit as the standard per-unit cost. In lieu of using HUD's national average as a per-unit cost, we opted to consult Baltimore-based experts to create a more tailored and localized estimate. HUD. (2020). Office of Lead Hazard Control and Healthy Homes Summary of Resources. <https://www.hud.gov/sites/dfiles/CFO/documents/2020CJ-Lead.pdf>

Table 1: Comparison of Lead Paint Hazard Interventions

	Lead Hazard Control ²²	Lead Abatement ²³
Synonyms & Alternative Language	<ul style="list-style-type: none"> • Lead Risk-Reduction Practices • Interim Controls • Lead Remediation • “Lead-Safe” Practices 	<ul style="list-style-type: none"> • Lead Remediation • “Lead-Free” Practices
Definition & Goals	<ul style="list-style-type: none"> • Control or minimize exposure to existing lead paint hazards. • Can provide indefinite security if regularly maintained and inspected for upkeep. 	<ul style="list-style-type: none"> • Eliminate existing lead paint hazards from the structure. • Considered permanent control or lasting for at least 20 years, depending on the intervention.
Summary of Interventions	<ul style="list-style-type: none"> • Repair and repaint areas with exposed lead hazards. 	<ul style="list-style-type: none"> • Removal, replacement, or encapsulation of lead hazards.
Methods of Intervention	<ul style="list-style-type: none"> • Remove deteriorating paint, smooth the surface, and repaint. • Correct conditions that cause dust generation (i.e., friction points on doors, windows, stairs, cabinets, etc.). 	<p>Three types of lead paint abatement:</p> <ul style="list-style-type: none"> • Encapsulate or enclose surfaces containing lead-based paint (commonly with drywall, wood, aluminum, vinyl). Lifespan of at least 20 years. • Replace individual parts of the home that contain lead-based paint (i.e., windows, doors). Permanent intervention. • Remove (i.e., strip or sand) lead paint from surfaces. Permanent intervention.
Benefits	<ul style="list-style-type: none"> • Effective intervention for structurally sound units with small areas of lead paint deterioration. • In the short term, more cost-effective than abatement. 	<ul style="list-style-type: none"> • Gold standard of lead poisoning prevention. Permanent or lasting at least 20 years. • Requires no or less-frequent maintenance or monitoring post-intervention for upkeep.
Limitations	<ul style="list-style-type: none"> • Not permanent. • Requires monitoring after intervention to ensure upkeep. • Ineffective if the housing unit is not structurally sound or prone to future deterioration or flooding. • May result in higher costs in the long term from ongoing maintenance and upkeep. 	<ul style="list-style-type: none"> • More costly than lead hazard control. • Costs per unit vary widely depending on type of abatement needed or elected, presenting a challenge for at-scale cost estimate. • Describing enclosure methods as “lead-free” is misleading because the hazards are still present and encapsulation can eventually deteriorate.

Notes: Both interventions require pre- and post-intervention assessments. After intervention, leaded dust and other hazards must be below whichever is the most stringent of the city, state, and federal minimum thresholds. Also, prior to any lead hazard control work being done, any structural flaws that could result in paint deterioration are required to be repaired (such as water damage, rotting wood, etc.).

s described in section II, there are 966 active lead hazard violations on occupied housing units that are not currently slated for demolition. Applying the per-unit cost ranges to this total yields an estimated range of approximately **\$9.7 million to \$16.4 million to perform lead hazard control work**, and an estimated range of **\$29 million to \$48.3 million to perform lead abatement work** on occupied housing units with outstanding lead hazard violations.

There are several important aspects to note concerning these cost estimates. First, every house is unique (regarding size, age, condition, etc.), and each may hold different amounts of materials containing leaded paint. For example, on one end of the spectrum could be a small home, in nearly pristine condition, containing several windows with chipping leaded paint. On the other end of the spectrum could be a large two-story home that is in substantial disrepair and would be a candidate for full gut renovation, with sheets of paint falling off the walls, ceilings, and floors in multiple rooms.

In addition, DHCD has implemented maximum spending caps for specific elements of the home (e.g., windows, baseboards, doors, etc.), so the maximum allowed amount to be spent per home from lead hazard control grant funds may vary depending on the types of materials that need to be replaced. Given these complicated factors, there is no single blanket amount that it would cost to address lead hazards in any home. In practice, hybrid methods (a combination of lead hazard control and lead abatement) can be pursued in homes with a diversity of lead hazards and building conditions.

In addition, these costs should be considered the base cost of lead hazard work. Homes must be structurally sound prior to lead control work being done, so any other problems in the home that make it structurally unsound or unsafe (from a leaking roof or mold to deteriorating walls and a full renovation) must be addressed first. In other words, the cost to bring the home to a safe, habitable condition may be far higher.

Table 2: Cost Ranges for Lead Hazard Control and Lead Abatement in Baltimore City (Estimated Costs for a Typical Two-Story House)

		Lead Hazard Control	Lead Abatement
Cost Range Per Housing Unit	Lower Bound	\$10,000	\$30,000
	Upper Bound	\$17,000	\$50,000
Cost Range for Recorded Housing Units Containing Lead Hazards (966)	Lower Bound	\$9,660,000	\$28,980,000
	Upper Bound	\$16,422,000	\$48,300,000
Cost Range for Estimated Housing Units Containing Lead Hazards (85,087)	Lower Bound	\$850,870,000	\$2,552,610,000
	Upper Bound	\$1,446,479,000	\$4,254,350,000

Other potential additions to the base per-unit cost could include: (1) overhead and human resources to manage a large-scale program; (2) human resources to identify other existing but unknown lead hazards; (3) family relocation costs and living stipends; and (4) any other specific actions required by individual funding entities.²⁴

IV. EXISTING AND FUTURE FUNDING MECHANISMS FOR LEAD HAZARD REDUCTION AND ABATEMENT

Below is a description of the various methods and funding solutions that have been implemented or proposed for large-scale or citywide lead hazard interventions. After a heavy emphasis on widespread lead reduction and elimination programs in the 1990s and 2000s, there has been a resurgence in addressing lead hazards in Baltimore and in other cities across the country. These efforts have likely come about from the increased public awareness of the ongoing nature of lead poisoning in the aftermath of the 2014 Flint, Michigan lead crisis.

The Green and Healthy Homes Initiative (GHHI) has produced extensive information about current and future funding opportunities to address lead hazards.^{25,26} An extensive summary of funding available for lead hazard reduction work in Maryland can be found in its *2020 Maryland Lead Poisoning Prevention Asset and Gap Analysis Report* (p. 53-57).

Baltimore City's largest source of funding for lead interventions comes from the federal level, from HUD's Office of Lead Hazard Control.²⁷ From HUD's Lead Hazard Reduction Grant Program and Healthy Homes supplemental funding,^{vii} Baltimore City received \$9.7 million in 2019,²⁸ \$4.1 million in

2018,²⁹ and \$3.7 million in 2015.³⁰ The clear benefit of this funding source is that it offers a regular and substantial pool of funding for lead hazard reduction projects, and the channels to dispense and receive these funds are well established. In addition to the Office of Lead Hazard Control, HUD's Community Development Block Grants (CDBG) can be allocated, in part, toward lead hazard control. For example, in 2019, 3.66% (or \$677,878) of Baltimore City's CDBG was allocated to lead hazard testing and abatement.³¹

However substantial the HUD funding streams are, they come with several limitations. First, these grants have many specific requirements about the types of housing units and households that are eligible to receive funding, which limits the pool of eligible homes and can create operational hurdles for the agencies administering the grants. In addition, the current lead remediation approach used by HUD's Lead Hazard Reduction Grant Program focuses on lead hazard reduction controls as opposed to lead abatement. For properties to remain safe, however, the homeowner or rental property owner must vigilantly maintain intact lead-based paint and conduct regular lead dust cleaning in the property. Lastly, in the model set by HUD, the primary mechanism for locating residential lead hazards comes from tracing the address of an already lead-exposed child with an elevated lead test result. Without the infrastructure and resources to systematically evaluate homes for lead hazards, this practice—relying on test results as the primary barometer to identify lead hazards—will ultimately be reactive, not preventive.

An additional substantial source of federal funding is from Medicaid and Medicare, such as through the Children's Health Insurance Program (CHIP). For example, through a 2019 Special Plan Amendment in Maryland,

vii The "Healthy Homes" supplemental funds can be used to repair any non-lead hazards that exist in the home prior to lead hazard interventions.

Medicaid funding can be used to partially reimburse environmental inspections for lead hazards in homes where Medicaid recipients who have ≥ 5 $\mu\text{g}/\text{dL}$ BLL reside.³² Through the Healthy Homes for Healthy Kids Programs, the Maryland Department of Health and the Maryland Department of Housing and Community Development are providing CHIP-funded lead risk assessments, lead hazard control, and lead abatement for properties where Medicaid/CHIP-eligible children reside with ≥ 5 $\mu\text{g}/\text{dL}$.³³ Lastly, the 2021 federal “Build Back Better” Act proposes to allocate \$5 billion of the \$150 billion to addressing lead hazards and healthy homes; however, given that this Act is currently stalled it is unclear whether these federal funding streams will be expanded in the near future.³⁴

Outside of public funding structures, another model to support large-scale lead hazard repair can come from hospitals and medical centers. Under the Affordable Care Act, nonprofit hospitals have community benefit spending requirements in order to maintain their tax-exempt status.³⁵ For example, the Lead-Free Lancaster program, designed by GHHI and launched by Penn Medicine Lancaster General Health in 2021, is a \$50 million fund that will be distributed over 10 years to address lead hazards in Lancaster County, Pennsylvania, homes.³⁶ With this model in place, there is a clear opportunity for medical centers in Baltimore City to design a similar program. Another way for hospitals to provide community resources is demonstrated through medical-legal partnerships, such as Chicago’s Erie Family Health Center’s collaboration with Loyola University Chicago School of Law and Legal Assistance Foundation of Metropolitan Chicago to advocate on behalf of patients with lead poisoning.³⁷

For private residential lead hazard work, state and federal tax credits offer an additional avenue. For example, the Home Lead Safety Tax Credit Act, reintroduced in the Senate in April 2021 (after being introduced but not

receiving a vote in 2016), would provide a tax credit for private homeowners to remove lead-based hazards from their homes.³⁸ Another funding approach, outside of government programs or tax incentives, is through financing mechanisms that offer low-interest loan structures for private lead hazard repair work. Examples of this kind of funding structure have been implemented in New York State (Neighborhood Housing Services of New York City), Massachusetts (Lead Education Trust Fund), Maine (Lead Poisoning Prevention Fund), and New Jersey (Project ReHEET).³⁹ An additional source for affordable loans for lead hazard repair can come through Lead Poisoning Prevention Funds.⁴⁰ For example, Cleveland’s Lead Safe Home Fund, a partnership between public, nonprofit, and private (corporate and philanthropic) sectors, has raised over \$110 million so far.⁴¹

CONCLUSION

As this paper has documented, an attempt to totally eliminate lead hazards from all homes in Baltimore estimated to have lead hazards would require vast resources from federal, state, and local funders, as well as coordination across different levels of government and the private sector. Even with increasing funding allocations from the federal government, the city is only scratching the surface of the widespread lead paint hazards, and city officials have to make difficult decisions about how to allocate those funds. It is clear the city will need new resources to tackle the urgent problem of lead paint poisoning. As discussed above, there are a number of potential paths to finance lead hazard remediation on a citywide scale. It is up to city, state, and federal officials, working together with private organizations and the health care sector, to determine how best to leverage these funding opportunities to address Baltimore’s lead paint hazards.

Endnotes

- 1 CDC (Centers for Disease Control and Prevention). (1991). *Preventing lead poisoning in young children*. <https://wonder.cdc.gov/wonder/prevguid/p0000029/p0000029.asp>
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- 7 MDE (Maryland Department of the Environment). (2021). *Lead poisoning prevention findings: Supplemental grant (2018 Data) for the Centers for Disease Control and Prevention* [PowerPoint slides].
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Luke Scrivener, Ph.D. is a data scientist from Baltimore, MD, with a background working in policy think-tanks and academic research centers. Luke earned his Ph.D. in sociology from University of Wisconsin-Madison, where his doctoral research focused on statistical and geographic analyses of health inequalities related to lead exposure in Baltimore.

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APPENDIX A: DATA DESCRIPTIONS

Estimated Number of Homes with Lead Hazards

The 2011 AHHS identified a sample of 1,131 occupied housing units across the United States, measuring the presence of certain environmental hazards measured (including lead-based paint) and demographic and housing characteristics of the units. The sample was stratified based on geography, age of housing, income, and race/ethnicity to create a representative sample of United States housing units where children can live. The researchers thus extrapolated the findings from their sample to represent the housing stock of the entire United States. A limitation of using the AHHS findings is that as a regional measure, it does not consider the specific housing makeup of Baltimore City. Moreover, the sample of 1,131 housing units is a relatively small sample size.

To incorporate information on neighborhood-level median income, we use the tract's median home value for owner-occupied homes and the tract's number of occupied housing units by year constructed, using census tract data from the 2019 American Community Survey (5-Year Estimates).ⁱ For each tract, we assign the AHHS proportions of housing units with significant lead hazards to Baltimore City's total numbers of housing units by housing age.ⁱⁱ For each census tract whose median home value is below the citywide median, we use the proportions at the upper tail of the AHHS distribution; for each tract whose median home value is above the citywide median, we use the proportions at the lower tail of the AHHS distribution. Thus, tracts with higher home values are counted as having a lower proportion of homes with significant lead hazards, while tracts with lower home values are counted as having higher proportions of homes with significant lead hazards. The relevant excerpt of AHHS Table C-1 is copied below.

One limitation of this methodology, given that the AHHS is a national-level sample, is the differing timelines across the United States regarding lead paint bans. Baltimore City was the earliest adopter of a residential leaded paint ban in 1951, and several other cities and states passed similar legislation in advance of the federal ban of 1978. Given that AHHS sampled from jurisdictions that may not have banned residential lead paint before 1978, applying the AHHS findings to Baltimore City's housing stock may cause slight incongruence. However, given that approximately 15% of Baltimore City's housing stock was built between 1951 and 1978, this is likely to have a small impact on the results.

Recorded Number of Homes with Lead Hazards

The lead violations dataset is provided by the Baltimore City Department of Housing and Community Development and contains information on every reported lead violation in a Baltimore City housing unit between January 1988 and October 2019. Each individual home contains information on the address, date of violation, whether the property received abatement, date of abatement, whether the home was owned or rented, and the vacancy status. In this dataset, "abatement" means "the elimination of exposure to lead hazards by the appropriate reduction of, removal of, or encapsulation of lead containing substances" (in accordance with Baltimore City Health Department Lead Hazard Abatement Regulations).ⁱⁱⁱ In other words, this dataset does not

ⁱ U.S. Census Bureau American Community Survey 5-Year Estimates. (2019). *Table DP04: Selected housing characteristics*.

ⁱⁱ U.S. Census Bureau American Community Survey 5-Year Estimates. (2019). *Table S2504: Physical housing characteristics for occupied housing units*.

ⁱⁱⁱ BCHD (Baltimore City Health Department). (2009). *Lead hazard abatement regulations*. [https://health.baltimorecity.gov/sites/default/files/Lead%20Abatement%20Regs%202009%20\(executed%20copy\).pdf](https://health.baltimorecity.gov/sites/default/files/Lead%20Abatement%20Regs%202009%20(executed%20copy).pdf)

specify the type of lead hazard treatment that the property received. As such, if these properties were treated with interim lead control methods, then there is a chance that they may have active hazards again but have not been given a new violation. Lastly, this dataset does not include the findings of each address's lead inspection, preventing a more tailored estimate of the cost per each housing unit.

Vacant housing data^{iv} and demolition permits data^v were downloaded from Baltimore City Open Data. We matched the addresses of the demolition permits and the vacant buildings list to the list of lead violations, in order to update the status of any homes that had received lead violations but had been since vacant/boarded or slated for demolition.

2011 American Healthy Homes Survey (Table C-1 Excerpt):
Proportion of Significantly Deteriorated Lead Based Paint
for Northeast Homes by Construction Year

Construction Year	Lower 5% of Distribution	Upper 5% of Distribution	Mean Estimate
1978-Present	0.0%	0.0%	0.0%
1960-1977	6.6%	30.3%	14.9%
1940-1959	15.9%	53.7%	31.9%
Pre-1940	44.5%	71.0%	58.3%

^{iv} Open Baltimore. (Accessed November 29, 2021). *Vacant building notices open*. <https://data.baltimorecity.gov/datasets/vacant-building-notices-open/explore>

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APPENDIX B: LEAD HAZARD ENFORCEMENT IN BALTIMORE CITY

Lead hazard enforcement in Baltimore City is subject to rules and regulations from the federal,^{vi} state,^{vii} and city^{viii} levels, which together create an array of specific guidelines on processes related to lead testing and lead hazard enforcement. Below we chart the process of lead hazard and lead poisoning enforcement and the agencies involved in the enforcement process.

The Baltimore City Health Department (BCHD) oversees lead hazard environmental investigation programs in Baltimore City. In all other Maryland counties (outside of Baltimore City and Prince George's County), the Lead Poisoning Prevention Program of the Maryland Department of the Environment (MDE) is the authority that oversees environmental investigations (GHHI 2020:29).^{ix}

Every child in Baltimore City is required to be tested at 12- and 24-months-old, and laboratories analyzing the blood samples are required to send every lead test result to BCHD.^x When test results show an “elevated” blood lead level (BLL), BCHD coordinates with the provider to retrieve demographic and contract information about the child, retrieves information on the residential address from the state housing database, and coordinates home visits and inspections of the property by a community health educator and an environmental inspector. During the home visits, the medical professional interviews the occupants to target potential sources of the lead exposure, and the environmental inspector inspects the property and sends samples of physical hazards to an independent lab. After receiving test results showing a lead hazard above the minimum threshold, the owner, landlord, or property manager is required to have lead hazard reduction or lead abatement work done by an MDE-accredited contractor within 30 days. After the work has been completed, BCHD re-inspects the property.

vi Applicable federal laws: EPA Renovation, Repair and Painting Rule. CDC Toxic Substances Control Act.

vii Applicable Maryland state laws: Maryland Environment Article, § 6 & 7; Maryland Health General Article §18-106; COMAR Title 26, Subtitles 02 & 16.

viii Applicable Baltimore City laws: Baltimore City Code, Article 13 (Housing and Urban Renewal); Baltimore City Code, Health Code; Baltimore City Health Department Lead Hazard Abatement Regulations.

ix GHHI. (2020). Maryland lead poisoning prevention asset and gap analysis report. <https://www.greenandhealthyhomes.org/wp-content/uploads/Clean-MD-Asset-Gap-Report-5.5.2020.pdf>.

x Md. Health General Article §18-106.

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**Evaluating the Cost of Lead Hazard Control
and Abatement in Baltimore City**

by Luke Scrivener, Ph.D.

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