

# LEAD-FREE FAMILIES INITIATIVE

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The 2019 Lancaster County Community Health Needs Assessment identified that safe and affordable housing is one of the basic conditions needed to support health in Lancaster County; the risk of lead poisoning in residential properties is a particular concern. In response to this need, Penn Medicine Lancaster General Health's Board of Trustees committed \$50 million over 10 years to the Lead-Free Families program to reduce childhood lead poisoning by removing lead hazards from Lancaster County homes.

## BACKGROUND

Lancaster County has a lead problem. It is a tainted legacy from much of what we enjoy about this area. Historic buildings in a county incorporated in 1729<sup>1</sup> mean we also have a disproportionate number of structures built prior to 1978, when lead paint was banned by the U.S. Consumer Product Safety Commission.

Lancaster now has the fourth highest rate of lead poisoning among Pennsylvania counties.<sup>2</sup> The fact that we also have the highest percentage of children under age 7 per capita in the state<sup>3</sup> and the second lowest percentage of children in the state screened for lead poisoning<sup>2</sup> adds to the concern that we are underestimating the problem.

## PHYSIOLOGIC AND SOCIOECONOMIC EFFECTS OF LEAD POISONING

As has been well known for millennia, lead causes a variety of hematologic and neuropsychiatric effects when it enters the human body. It is only recently, however, that studies have correlated even "sub-clinical" lead exposure in children with future learning problems in school, increased rates of aggressive behavior, ADHD, and lower IQ points.<sup>4</sup> Regarding a loss of IQ points, no detectable threshold level of lead poisoning is considered safe.

Lead poisoning has been implicated in juvenile delinquency, as the result of both prenatal and postnatal

exposures.<sup>5</sup> In adults, low-level exposure to lead can accelerate renal insufficiency in patients who already have chronic renal disease.<sup>6</sup> Lead poisoning has also been associated with increased crime rates, rates of incarceration, and lost years of occupational economic advantage.

The associated costs of lead poisoning – including health care, lifetime earning losses, increased need for special education and behavioral services, and crime-related costs – was estimated to be \$1.2 trillion in 2008 for a birth cohort of all U.S. children ages 0-6 years and projected for 65 years.<sup>7</sup> A Pew Charitable Trusts issue brief in 2010 suggested that costs to abate lead in homes ranged between \$1.2 billion and \$11 billion, but would save \$192 billion to \$270 billion, meaning a return on investment of at least \$17 for every \$1 spent on corrective action.<sup>8</sup>

## LEAD POISONING TREATMENT

As the damaging effects of lead poisoning have become more apparent and overt lead poisoning has decreased, the Centers for Disease Control and Prevention (CDC) has lowered the blood lead reference value (BLRV), representing the top 2.5% of all measured blood lead levels, from 60 mcg/dl in the 1970s to 3.5 mcg/dl in 2021.<sup>9</sup> The reduction in the BLRV does imply some success in the fight against lead poisoning, but significant numbers of children are still being poisoned, even at these lower levels.

Chelation, once a mainstay in treatment for children with elevated blood lead levels, has not been shown to reverse the damage in children with lower lead levels and is now reserved for children who present with levels above 45 mcg/dl. In fact, medical intervention does not reverse the loss of IQ points, nor help deter other neuropsychiatric effects of lead poisoning. The lack of treatment options forces the medical community to focus on primary prevention such as reducing or removing lead hazards before the child is exposed.<sup>10</sup>

**UNIVERSAL LEAD SCREENING**

Screening for lead poisoning has been a mainstay of routine care within the realm of Family Medicine and Pediatrics for many years. This has taken many forms, from questionnaires given to parents, to targeted screening for Medicaid patients. The U.S. Preventative Services Task Force concludes that the current evidence is insufficient to assess the balance of benefits and harms of screening for elevated blood lead levels in asymptomatic children and pregnant women. This screening recommendation reflects the lack of treatment available.

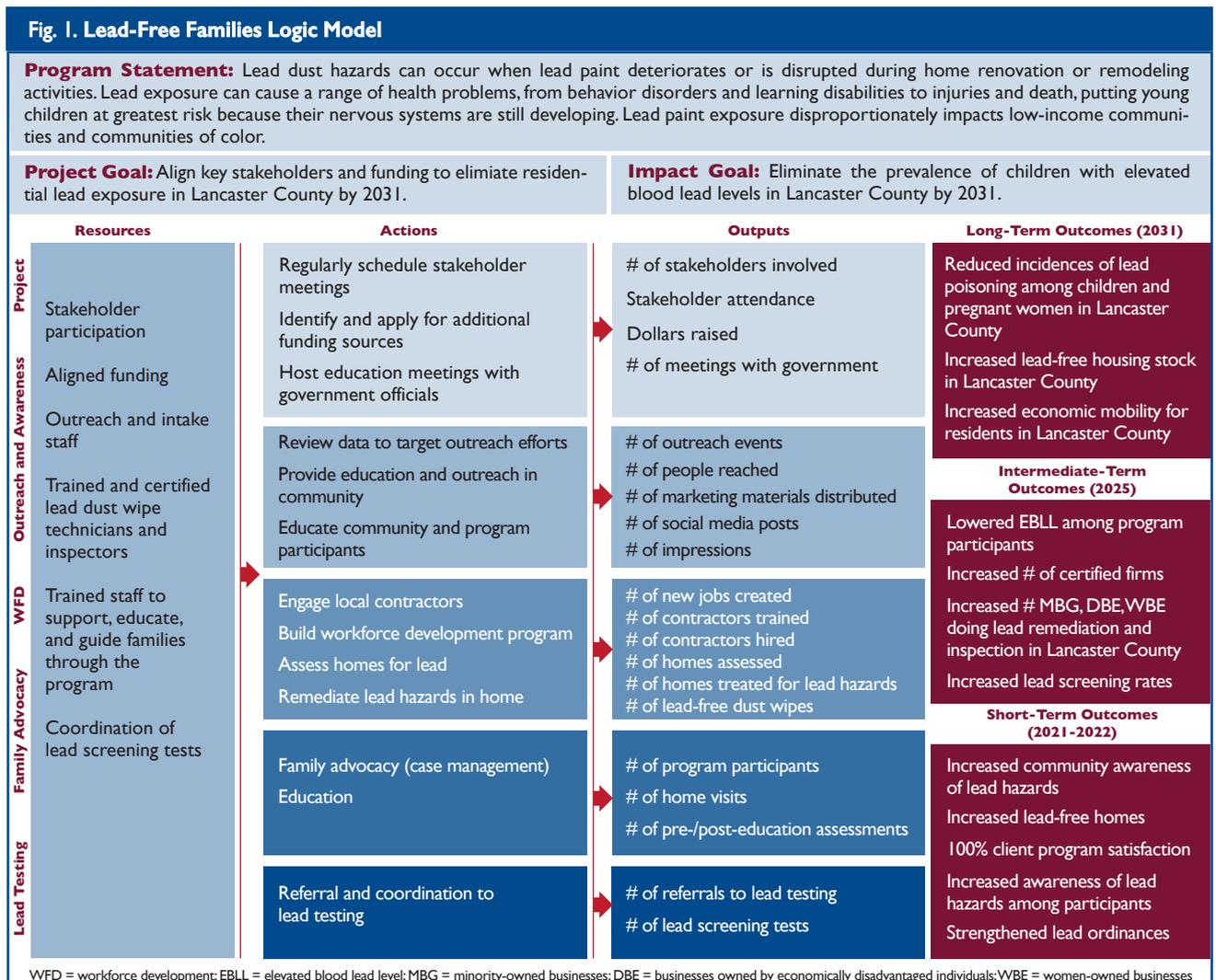
However, other national medical groups and public health organizations, like the American Academy of Pediatrics and the CDC, state that screening should be based on the inherent risks of lead poisoning in the child’s community. Screening may limit the effects of further exposure and help local governmental and health care organizations target areas of high lead burden for abatement. It is for these reasons that we advo-

cate for universal screening (two lead tests by age 3 years, one at 12 months, and another around 24 months of age) for all children who live in Lancaster County.

**LEAD POISONING DISPARITY**

Lead poisoning does not affect all in our community equally. According to Michael Horst, PhD, LG Health epidemiologist, internal modeling of elevated lead tests reported to the Pennsylvania Department of Health for Lancaster County show that communities overburdened by socioeconomic issues – such as higher poverty rates, low rates of high school graduation, and higher unemployment rates, among others – are up to three times more likely to have children who are lead poisoned.

Further, elevated blood lead levels are up to three times more common among Black and brown persons than white persons.<sup>11</sup> Thus, vulnerability to lead poisoning is related to a child’s zip code, census tract, race, and socioeconomic status.



**ABATEMENT AS TREATMENT**

With the knowledge that even low levels of lead in an individual can cause significant health risks, and that the health care community can do very little in the way of treating lead poisoning, abatement (or removal of the lead hazard) in the community is the essential tool in combating this epidemic. As noted above, abatement is cost effective when modeling out the sequelae over decades, and when it comes to lead poisoning, abatement is health care and the primary reason that LG Health has committed significant capital to this effort.

**THE LEAD-FREE FAMILIES PROGRAM**

Lead-Free Families, launched in August 2021, aims to remove lead hazards from at least 2,800 Lancaster County housing units over 10 years. Lead-Free Families is a direct-service lead poisoning prevention program that includes the following: client outreach, education throughout the community, home visits, lead inspection/risk assessment, lead hazard remediation, clearance and follow-up education, lead-certified contractor training, and capacity building. The required resources, activities, outputs, and short- to intermediate-term outcomes for the program are outlined in the Lead-Free Families Logic Model (see Fig. 1).

The program prioritizes households with young children diagnosed with elevated blood lead levels countywide for lead hazard remediation and lead poisoning prevention education services.

Lead-Free Families aims to increase the overall understanding of childhood lead poisoning among all residents of Lancaster County and will provide lead remediation services for families who meet the eligibility criteria (see Table 1).

**LEAD RISK ASSESSMENT**

When a client is enrolled in the program, the team will forward the property to a certified lead inspection company contracted to conduct a lead risk assessment to determine if lead-based paint hazards exist in the property. The lead risk assessor will conduct a lead risk assessment by performing a visual inspection, sampling for lead dust, sampling soil as appropriate, and conducting surface-by-surface inspections to verify the presence of any lead-based paint and lead hazards.

Testing methods will follow all federal, state, and local regulations, and will use the current standards of 1.0 mg/cm<sup>2</sup> or 0.5% by weight as the criteria for lead-based paint. The lead risk assessor will follow

Table 1. Program Eligibility Criteria
Property located in Lancaster County
Property constructed prior to 1978
A pregnant woman or child under the age of 6 resides in the property or a child under age 6 spends a significant amount of time visiting
Homeowner or tenant occupant meets the program's income eligibility requirements (household income is less than 400% Federal Poverty Level, i.e., family of four making \$111,000 or less)
Property contains at least one bedroom
Property contains lead-based paint hazards as verified by the lead risk assessment

state regulations and the federal Guidelines for the Evaluation and Control of Lead-Based Paint Hazards in Housing. The assessor will create a risk assessment report based on testing data and the site visit visual inspection, and forward the report to the program.

If the risk assessment reveals that lead-based paint and lead hazards are present, a scope of work will be developed describing the lead hazard reduction work necessary to meet state and program clearance standards.

**TEMPORARY RELOCATION**

Abatement can take up to 10 days. Before remediation begins, the team will conduct a home visit and will make arrangements to temporarily relocate the property's occupants. The occupants might stay temporarily with family or friends, or the Lead-Free Families program will utilize hotels in target communities as temporary relocation sites for families displaced by the lead hazard reduction activities. At all times, children and pregnant women will be out of the property during the intervention.

**LEAD HAZARD REMEDIATION INTERVENTION (LEAD SAFE PLUS STANDARD)**

Lead hazard remediation will be managed by the Green and Health Homes Initiative (GHHI), an organization that addresses the social determinants of health and advances racial and health equity through the creation of healthy, safe, and energy-efficient homes. GHHI's lead hazard control strategy for identified leaded surfaces includes:

- Window replacement with lead-free energy-efficient windows

- Door and baseboard replacement
- Paint stabilization of deteriorated leaded surfaces
- Treatment or abatement of other friction and impact surfaces
- Repair of minor structural defects that are causing paint to chip, flake, or peel
- Lead-specific cleaning, including HEPA vacuuming and wet cleaning of all interior horizontal surfaces sufficient to achieve lead dust clearance

Where the program is providing lead remediation to a household with a child with an elevated blood lead level, the scope of work will meet or exceed local, state, or federal regulations. With the exception of window, door, and baseboard replacement as warranted, the program will employ paint stabilization intervention measures on painted surfaces rather than full lead abatement strategies.

**QUALITY STANDARDS AND CLEARANCE INSPECTION**

A lead visual inspection and lead dust clearance by a third-party lead inspector will be conducted to confirm that the property is safe for re-occupancy by the clients and to check the quality and completeness of the lead remediation work. All properties receiving lead hazard reduction treatments will pass the lead dust clearance standards.

Services will be subsidized based on property type (rental or owner occupied). Low-income, owner-occupied households will be offered remediation services via Lead-Free Families. Rental property owners with low-income tenants will be offered remediation services via Lead-Free Families with a requirement to pay 10% of the remediation and to maintain rents no higher than fair market for Lancaster County for up to three years.

**EVALUATION**

Evaluation is essential for monitoring the program, supporting continuous quality improvement, and ensuring that the investment of time and resources is achieving the intended outcomes. The overall goal of the initiative is to prevent lead poisoning in Lancaster County. Thus, the program evaluation aims to answer the following broad questions:

1. Has the program effectively eliminated lead hazards in residential properties?

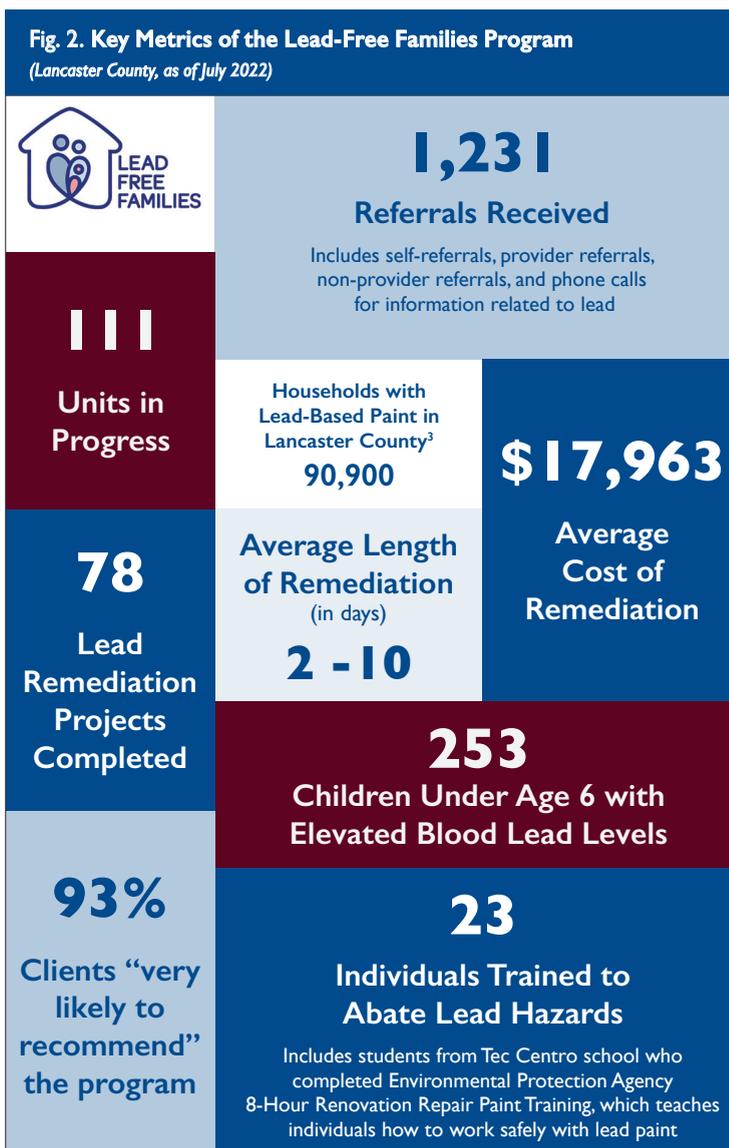
2. Has the initiative improved policies and systems to identify and prevent lead poisoning?
3. Has the initiative reduced lead poisoning among children under 6 years of age?

See Fig. 2 for a status report of key metrics tracked and used to evaluate the program.

**SUSTAINABILITY**

To enhance and sustain efforts, it is essential to increase enforcement of local housing codes, federal lead-related laws (such as Title X and the Environmental Protection Agency Lead Renovation, Repair, and Painting Rule), and lead-safe work practices.

The Lead-Free Families team will advocate for increased inspection and enforcement of housing codes. Enforcing housing codes and citing property owners for chipping and peeling paint violations in pre-1978



properties is a critical component of a lead poisoning prevention strategy. Training existing housing code office personnel and encouraging government agencies to hire additional housing code inspectors will be important priorities for the program staff.

While Lancaster City and Columbia Borough currently have lead ordinances, the Lead-Free Families program is also offering resources to other municipalities to help them create ordinances that work for their communities. This program will thus also aim to increase the number of municipalities in Lancaster County that require lead inspection, hazard remediation, and lead-safe certification of rental units or properties at the point of sale.

Certification of lead-safe rental properties can incentivize property maintenance over time, and revenues from annual certification fees and fines for violations could sustain program operations in the long term.

#### PROGRAM ENHANCEMENT

LG Health was excited to receive a nearly \$2 million grant from the Department of Housing and Urban Development (HUD) in January 2022 to support and enhance the services provided by the Lead-Free Families program. This funding will enable the pro-

gram to address additional health and safety hazards that are found in homes during home remediation. These include mold and radon issues, risks for falls, and risks for fire and burn injuries.

It is through collaboration with many community partners, municipal leaders, and medical providers that Lead-Free Families will make the goal of eliminating lead poisoning in Lancaster County a reality. The initiative will change the trajectory of the lives of thousands of children and their families.

**For information on Lead-Free Families or to refer a patient, providers can type "Amb ref lead" into the Epic order search or call 717-544-LEAD (5323). Individuals may self-refer by calling the same number or emailing [info@leadfreefamilies.org](mailto:info@leadfreefamilies.org).**

#### ACKNOWLEDGEMENT

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#### REFERENCES

1. Collections. LancasterHistory. Accessed July 26, 2022. <https://www.lancasterhistory.org/research/collections/>
2. Pennsylvania Department of Health. 2020 Childhood Lead Surveillance Annual Report. January 2022. Accessed July 26, 2020. <https://www.health.pa.gov/topics/Documents/Environmental%20Health/2020%20Childhood%20Lead%20Surveillance%20Annual%20Report.pdf>
3. U.S. Census Bureau. Quick facts: Pennsylvania. Accessed July 26, 2022. <https://www.census.gov/quickfacts/fact/dashboard/PA/AGE135220>
4. Lanphear BP, Hornung R, Khoury J, et al. Low-level environmental lead exposure and children's intellectual function: an international pooled analysis [published correction appears in Environ Health Perspect. 2019;127(9):99001]. *Environ Health Perspect*. 2005;113(7):894-899.
5. Dietrich KN, Ris MD, Succop PA, Berger OG, Bornschein RL. Early exposure to lead and juvenile delinquency. *Neurotoxicol Teratol*. 2001;23(6):511-518.
6. Lin JL, Lin-Tan DT, Hsu KH, Yu CC. Environmental lead exposure and progression of chronic renal diseases in patients without diabetes. *N Engl J Med*. 2003;348(4):277-286.
7. Muennig P. The social costs of childhood lead exposure in the post-lead regulation era. *Arch Pediatr Adolesc Med*. 2009;163(9):844-849.
8. Partnership for America's Economic Success. Issue brief #14: cutting lead poisoning and public costs. Pew Center on the States. February 2010. Accessed July 26, 2022. [https://www.pewtrusts.org/~media/assets/2010/02/22/063\\_10\\_paes-costs-of-lead-poisoning-brief\\_web.pdf](https://www.pewtrusts.org/~media/assets/2010/02/22/063_10_paes-costs-of-lead-poisoning-brief_web.pdf)
9. Centers for Disease Control and Prevention. Childhood lead poisoning prevention. Updated October 27, 2021. Accessed July 26, 2022. <https://www.cdc.gov/nceh/lead/data/blood-lead-reference-value.htm>
10. Advisory Committee on Childhood Lead Poisoning Prevention. *Low Level Lead Exposure Harms Children: A Renewed Call for Primary Prevention*. Centers for Disease Control and Prevention. January 4, 2012. Accessed March 25, 2021. [https://www.cdc.gov/nceh/lead/docs/final\\_document\\_030712.pdf](https://www.cdc.gov/nceh/lead/docs/final_document_030712.pdf)
11. Landrigan PJ, Rauh VA, Galvez MP. Environmental justice and the health of children. *Mt Sinai J Med*. 2010;77(2):178-187.

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