

ALLEGHENY COUNTY  
HEALTH DEPARTMENT

2022  
LEAD  
REPORT





# ALLEGHENY COUNTY 2022 LEAD REPORT

A publication of the  
**Allegheny County Health Department**

Report prepared by:  
**Bureau of Data, Reporting, and Disease Control**  
542 Fourth Avenue, Pittsburgh, PA 15219

**Ryan Fischer, MS, CSTE Fellow**  
**Margaret Kuzemchak, MS, Environmental Epidemiologist**  
**Alyssa Monaghan, MPH, Epidemiology Research Associate**  
**LuAnn Brink, PhD, Chief Epidemiologist**

**Special thanks to**  
**Brian Kelly, Tim Murphy and Otis Pitts,**  
**Bureau of Food, Housing and Policy**

**December 2023**



# TABLE OF CONTENTS

Introduction .....	1
Lead as a neurotoxin.....	1
Sources of Lead in Allegheny County .....	1
Paint .....	1
Water.....	1
Soil .....	2
Airborne.....	2
Other Sources.....	2
Definitions.....	3
Historical Perspective .....	4
Removal of Lead from gasoline and lead paint in the 80’s.....	4
Allegheny County Testing .....	6
Number of children less than six years of age tested over time.....	6
Number of children between 9 and 14 months of age tested over time.....	6
Blood lead levels over time .....	7
Changes in unconfirmed capillary tests .....	11
Validity of capillary tests .....	13
Number of households contacted and number of home inspections completed.....	13
Predictive Modeling.....	17
Lead in Water.....	18
ACHD Lead Activities.....	19
Surveillance .....	19
Prevention and Education.....	19
Intervention .....	19
Resources for Remediation.....	20

# INTRODUCTION

This report covers information on the number of children tested, their lead levels, and interventions underway to continue to improve outcomes in Allegheny County, Pennsylvania.

## LEAD AS A NEUROTOXIN

Lead is a known neurotoxin and a serious threat to public health, particularly to young children and pregnant women. The health effects of lead are well known. Lead impairs brain development and children under the age of six are particularly vulnerable to its effects. At extremely high levels of lead exposure, which are infrequent within the United States and Allegheny County, lead can cause seizures, coma, and even death.

There is no safe lead level in children, as even minor elevations in blood lead concentrations have demonstrated adverse effects on a child's IQ, ability to pay attention, academic achievement, and other behavioral issues. The overall load of lead exposure in children is cumulatively influenced by various sources. Blood lead levels, as an indicator of children's exposure, have exhibited a consistent decline on a national and local scale, coinciding with the enactment of significant legislative measures aimed at mitigating sources of lead exposure. Notably, these measures have entailed the elimination of lead from gasoline, paint, and plumbing fixtures. Nevertheless, the historical use of lead endures as an enduring hazard, as it persists in certain existent sources.

The primary contributor to lead exposure in children arises from the presence of lead-based paint in older residential structures, wherein it can deteriorate, flake, peel, and give rise to lead dust. Additionally, lead is also detectable in water pipelines, solder, as well as in select consumer products such as toys, jewelry, cosmetics, imported foods, and other imported consumer goods.

## SOURCES OF LEAD IN ALLEGHENY COUNTY

### Paint

Lead had been used in paint for many years. Adding lead created a highly durable and washable paint, which was desirable for use as both an interior and exterior paint. It was banned from use in residential paint by the Consumer Product Safety Commission in 1978. More than 80% of the Allegheny County homes were built before 1978 and 40% of homes were built before 1950. In Pittsburgh, more than 60% of homes were built prior to 1950, and over 85% were built before 1978. Peeling or flaking lead paint and household dust that contains lead accounts for up to 80% of elevated lead levels in US children. Houses built before 1950 usually contain the most lead paint.

### Water

Lead can be present in water when it is transported from water treatment facilities to homes through pipes that contain lead, or when it travels within the home through plumbing fixtures that contain lead. Historically, lead was commonly used in plumbing pipes and fixtures. The federal government included language to the Safe Drinking Water Act in 1986 to reduce the amount of lead used in residential and commercial plumbing. Lead is no longer used in new plumbing installation, but lead pipes and fixtures can still be found in older homes and many water systems still have lead water pipes.

## Soil

Lead is a naturally occurring element. However, it may be present in soil at higher concentrations due to known sources of contamination. Although the phase out of leaded gasoline began in 1975, it was not totally banned in the United States until 1996. Emissions from vehicles powered by leaded gasoline would often settle in soil around garages, alleys, and busy intersections. Runoff from these areas has transported lead to the edges of properties. Lead was also found in emissions from some industrial sources.

Lead paint can also enter the soil through demolition debris which could be buried or left in abandoned properties. This usually results in higher concentrations of lead-contaminated soil in the center of properties. Lead can also enter soil around the edges of the house due to paint chips falling to the ground and years of unsafe scraping and sanding exterior house paint when preparing to apply new coats of paint. The so-called “drip line” usually extends 2-3 feet out from the foundation wall of the house.

## Airborne

Federal standards control air emissions of lead from industrial facilities. In the past they were less stringent than today, resulting in areas with higher concentrations of lead in soil surrounding specific facilities. Due to the unique topography of Allegheny County, both industrial emissions and gasoline emissions tended to settle near the points of emission, rather than blowing further away. Industrial sources in valleys, for example, could be expected to have higher concentrations of lead in the soil than sources in higher elevations and more open areas. Today, the Federal Clean Air Standards include lead as one of the six criteria pollutants that is monitored by the ACHD Air Quality Program.

## Other Sources

Some occupations and hobbies may increase a person’s risk to lead exposure. Lead dust can linger on clothing, hair, and hands, so it is important for parents to use caution so that lead is not accidentally brought into the home. Home contractors, painters, and people working on home remodeling projects are at an increased risk to encounter lead, as are people repairing vehicles, performing metal work, and welding. Working on electronics repair and jewelry repair may also expose a person to lead. Alternative sources such as candy, jewelry, ceramics, some herbs and medicinal remedies, cosmetics, and other consumer products from foreign countries where lead content is not regulated can make their way to the United States. These alternative sources are important to identify and report to the Consumer Product Safety Commission.

# DEFINITIONS

## Venous Blood Test

Venous blood tests draw blood from the child's vein to test for the presence of lead. The results for venous lead tests are considered the most accurate method for confirming a child's blood lead levels.

## Capillary Blood Test

Capillary, or "finger prick", tests are preliminary tests that can accurately identify if a child does not have an elevated blood lead level. However, since capillary tests can include trace amounts of lead from the exterior surface of the child's finger in the results, this test may overestimate the amount of lead absorbed by the child. If a capillary test returns an elevated level, the child must also have a follow-up venous blood test to confirm the result within 1 to 84 days of the capillary test.

## Confirmed Blood Lead Level

The Allegheny County Health Department considers blood lead level results from all venous blood tests as confirmed and considers blood lead level results less than 3.5 µg/dL from capillary blood tests as confirmed. Capillary blood tests can register lead levels higher than, but not lower than, actual blood lead levels; therefore, capillary blood tests can be used to confirm a low blood lead level.

## Elevated Blood Lead Levels

The Allegheny County Health Department currently treats confirmed blood lead level tests with 3.5 µg/dL or more of lead as elevated. This measurement is based on the Centers for Disease Control and Prevention's reference level for public health action, which was last updated in 2021.

## Blood Lead Reference Value

The current Blood Lead Reference Value is set at 3.5 µg/dL. This value is defined by the CDC and was determined from the 97.5<sup>th</sup> percentile of reported blood lead values among children included in the National Health and Nutrition Examination Survey (NHANES).

## Population of Interest

Children under six years of age are both at the highest risk for absorbing lead from their environment and most susceptible to the long-term harm caused by lead absorption.

## Hand to mouth behavior

Young children explore their environments in ways that make them more susceptible to lead absorption. By putting objects in their mouths, touching surfaces, and then placing their fingers in the mouths, etc., young children in environments with lead present are at risk for ingesting lead.

## Brain development

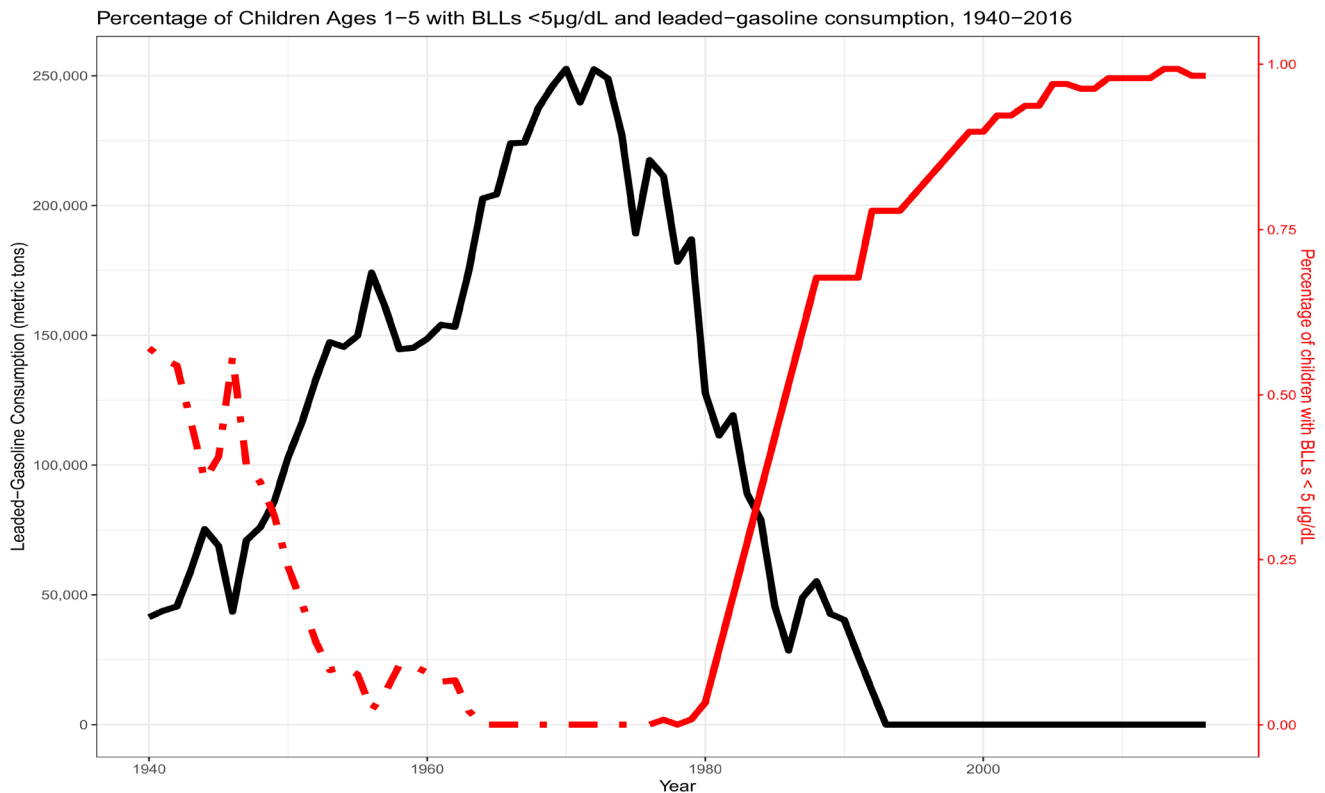
A person's brain rapidly develops during childhood, with their brain reaching approximately 90% of adult size by six years of age. Lead absorption effects cognitive development, putting children less than six years of age at risk for permanent changes in their brain's growth.

# HISTORICAL PERSPECTIVE

## Removal of Lead from gasoline and lead paint in the 80's

In the late 1970s and throughout the 1980s, the removal of lead from gasoline and paint emerged as a pivotal milestone in environmental and public health policy. This endeavor was primarily driven by mounting scientific evidence of the detrimental effects of lead exposure on human health, particularly on the neurological development of children. The decision to phase out leaded gasoline was supported by extensive research demonstrating that combustion of leaded gasoline in internal combustion engines released fine lead particles into the atmosphere, contributing to atmospheric lead pollution. This pollution, in turn, posed a significant risk to human health, as airborne lead particles were inhaled and subsequently absorbed by individuals. Moreover, the ban on lead-based paint stemmed from scientific investigations revealing the risks associated with lead-based paint deteriorating into dust or chips, especially in older housing. These findings underscored the urgency of eliminating lead from these widely used consumer products, ultimately leading to the implementation of regulatory measures and the introduction of unleaded gasoline and lead-free paints as safer alternatives.

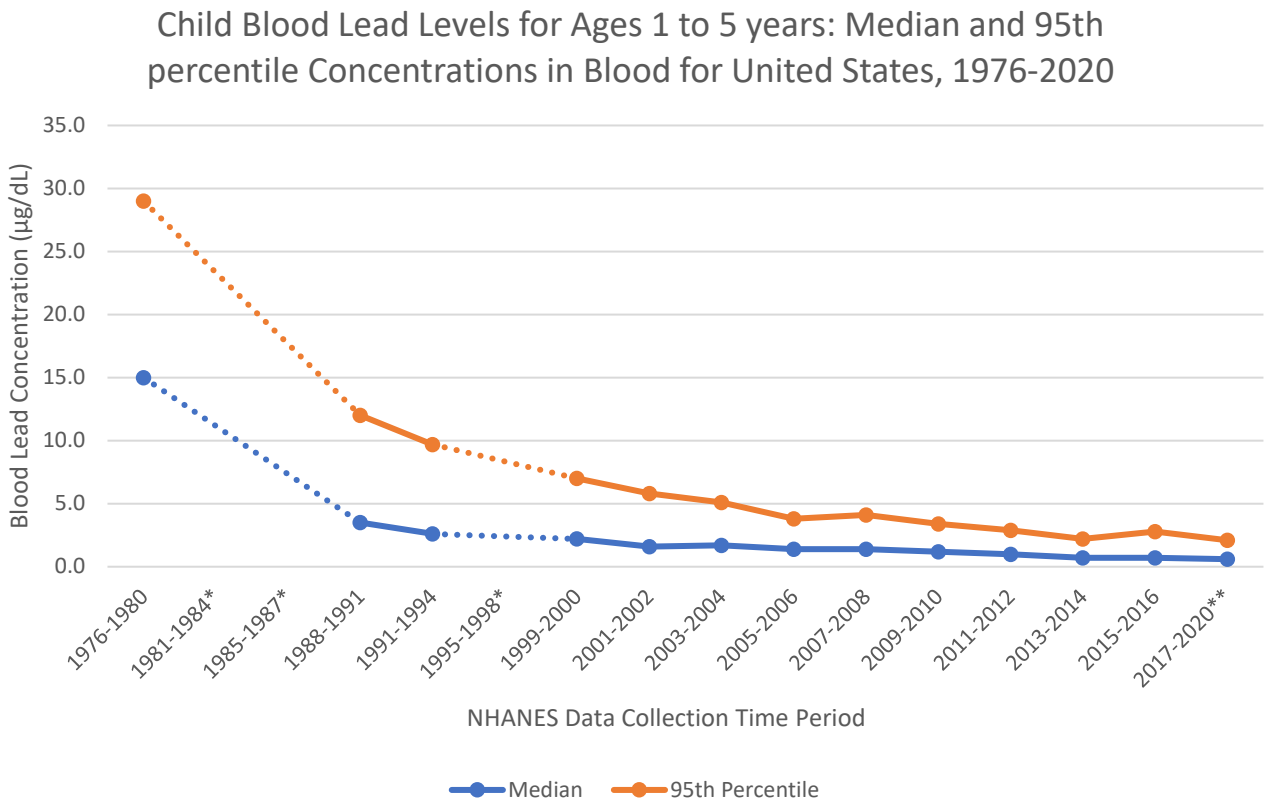
**Figure 1: Percentage of Children with Blood Lead Levels below 5 µg/dL and leaded-gasoline consumption**



This figure was reproduced with permission. From “Half of US population exposed to adverse lead levels in early childhood” by M. McFarland, M. Hauer, and A. Reuben, 2022, Proceedings of the National Academy of Sciences, 119(11), 1-7. Copyright 2022 by National Academy of Sciences.

Figure 1 shows a major decrease in average blood lead levels in children across the United States which occurred with the removal of lead from gasoline in the late 1970s. Data for leaded gasoline consumption comes from the Bureau of Mines Minerals Yearbook. The percentage of children aged 1 to 5 with BLLs come from 1976 to 2016 of the NHANES waves 2 to 4 (solid red line), while the dotted line is an estimation generated by regressing childhood BLLs on leaded gasoline consumption for those years.

**Figure 2: Median and 95<sup>th</sup> Percentile Blood Lead Levels for Children Living in the United States**



Data are sourced from the National Health and Nutrition Examination Survey (NHANES) which is collected by the National Center for Health Statistics and National Center for Environmental Health, Centers for Disease Control and Prevention.

\*Data were not available for these time periods.

\*\*Data collection was not completed for the 2017-2020 cycle because NHANES suspended data collection due to COVID.

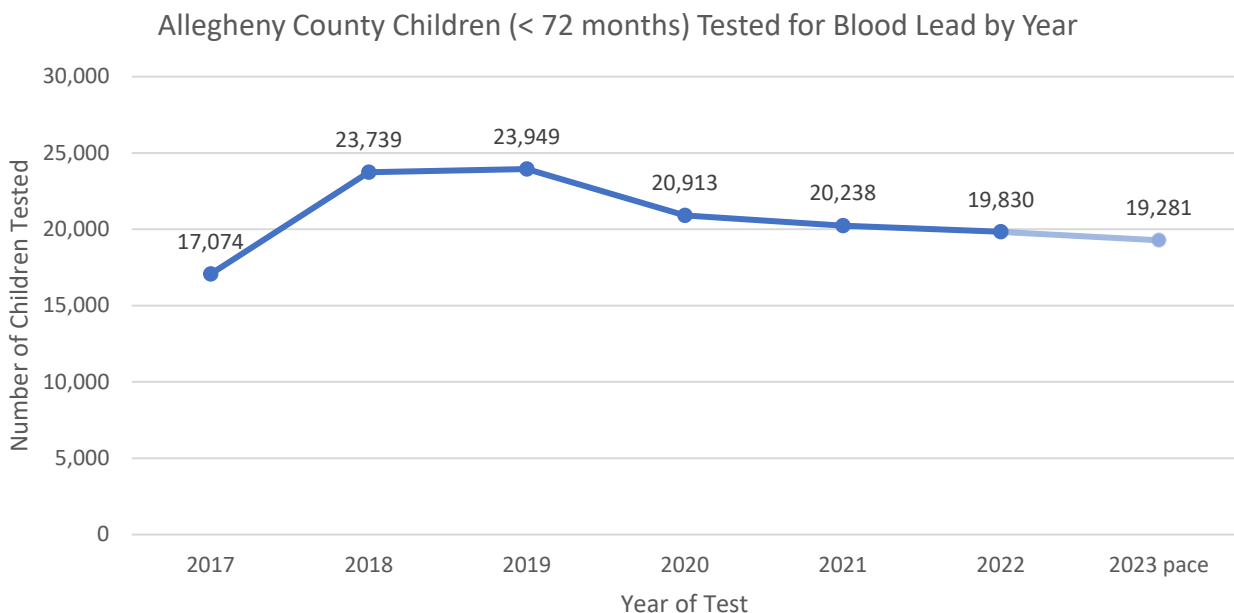


# ALLEGHENY COUNTY TESTING

## Number of children less than six years of age tested over time

The Allegheny County Council approved a regulation in July 2017 to require county-wide universal childhood blood lead testing for children under six years of age. The regulation was publicly discussed in the summer and fall before going into effect on January 1, 2018. Following this, the number of children being tested for lead rose sharply, peaking prior to the 2020 COVID pandemic. Following the pandemic, testing is still at a diminished proportion, but is still being performed to a higher degree than before the implementation of the childhood blood lead testing mandate.

**Figure 3: The number of unique Allegheny County children under six years of age tested for blood lead levels by year**



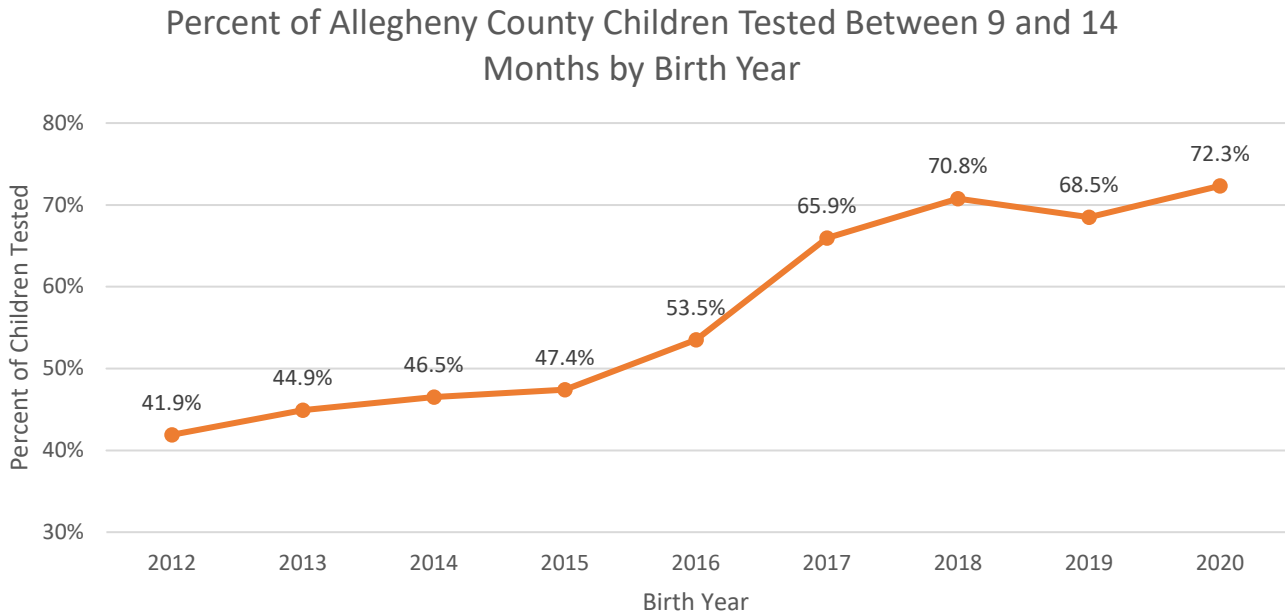
Testing numbers increased by about 6,700 with the introduction of the universal childhood blood lead testing mandate. The 2020 pandemic and healthcare provider shortage were associated with a decrease in testing which continues to decline.

## Number of children between 9 and 14 months of age tested over time

The universal childhood blood lead testing regulation requires all county children to have their first blood lead test between nine months of age and their first birthday (measured specifically between 270 days and 412 days of age consistent with Early Periodic Screening Diagnosis and Treatment measurement standards). The proportion of children born in Allegheny County that were tested in this age range has increased steadily

in recent years, with a pronounced increase after 2017 when the universal childhood blood lead testing mandate was passed. Allegheny County Health Department’s goal is to have as many children as possible tested by their first birthday, and then tested again near the date of their second birthday.

**Figure 4: The percent of Allegheny County children tested for blood lead between the ages of 270 days and 412 days (corresponding to 9 months and 14 months of age) by birth year**

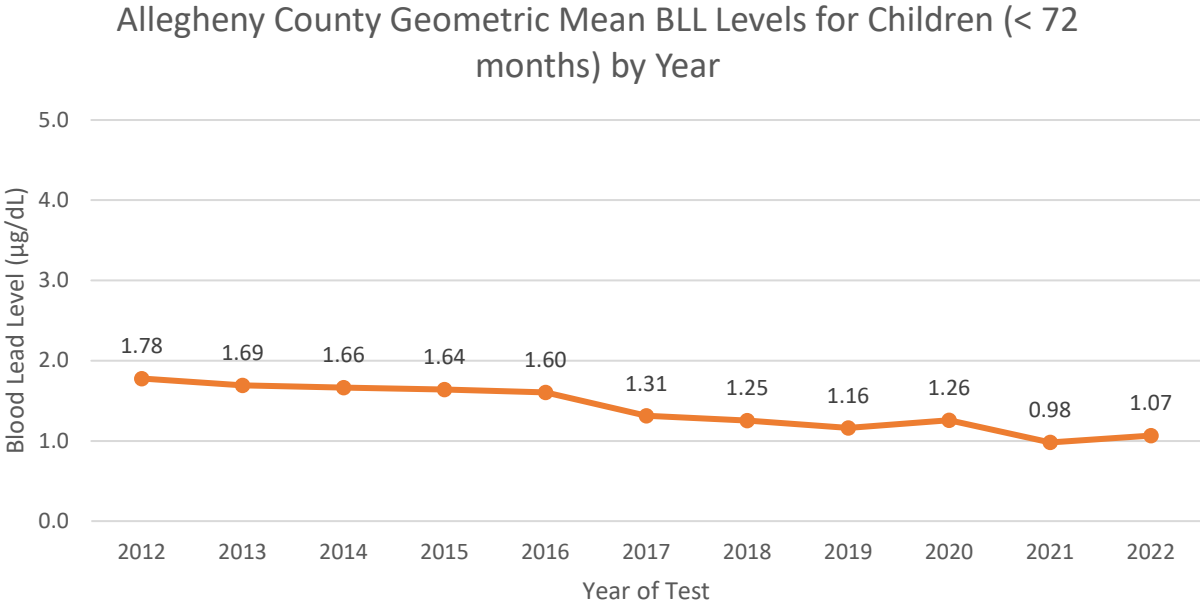


This period in a child’s life is the first blood lead testing requirement established in the County’s universal testing regulation.

### Blood lead levels over time

Geometric mean is used as a measure of central tendency for skewed data, such as blood lead levels in a population. There are very many test results that are low values, and only a few test results with high values. The geometric mean blood lead level—which represents the average concentration of lead in blood, for children less than 6 years of age in Allegheny County decreased from 2016 to 2017 by more than 1 µg/dL and has remained below 1.5 µg/dL since 2017. This has coincided with increased testing of children from 2017 onward. Blood test results below detection limits were treated as having a result equal to one-half of the specified detection limit. Most test reports for Allegheny County children with undetectable blood lead had a detection limit of 3 or 3.3 µg/dL

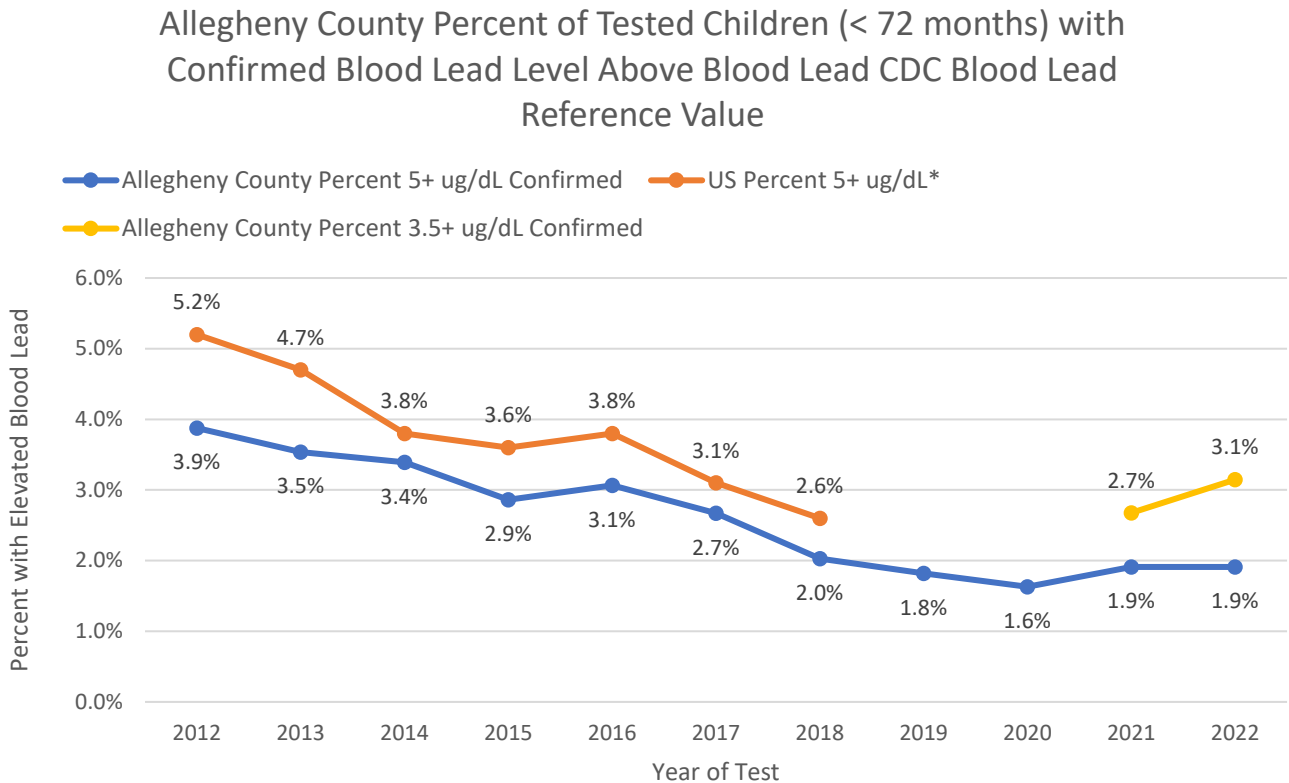
**Figure 5: The geometric mean blood lead level for each year uses the maximum blood lead test for children less than 7 years of age who were tested for lead**



Maximum blood lead levels recorded as zero were converted to 0.1, and null or blank test results were eliminated before calculation.

The confirmed proportion of children with an elevated blood lead level in Allegheny County has decreased steadily over time. The proportion of children in Allegheny County with elevated blood lead has been lower than the proportion for the entire United States as reported by CDC for every year for which there are data. Confirmed tests are venous blood draws, capillary blood tests below the elevated level, or a second capillary blood test (elevated or not) within 84 days of an elevated capillary blood test but not on the same day as the first test.

**Figure 6: The proportion of children (less than six years of age) tested for blood lead with elevated blood lead results**



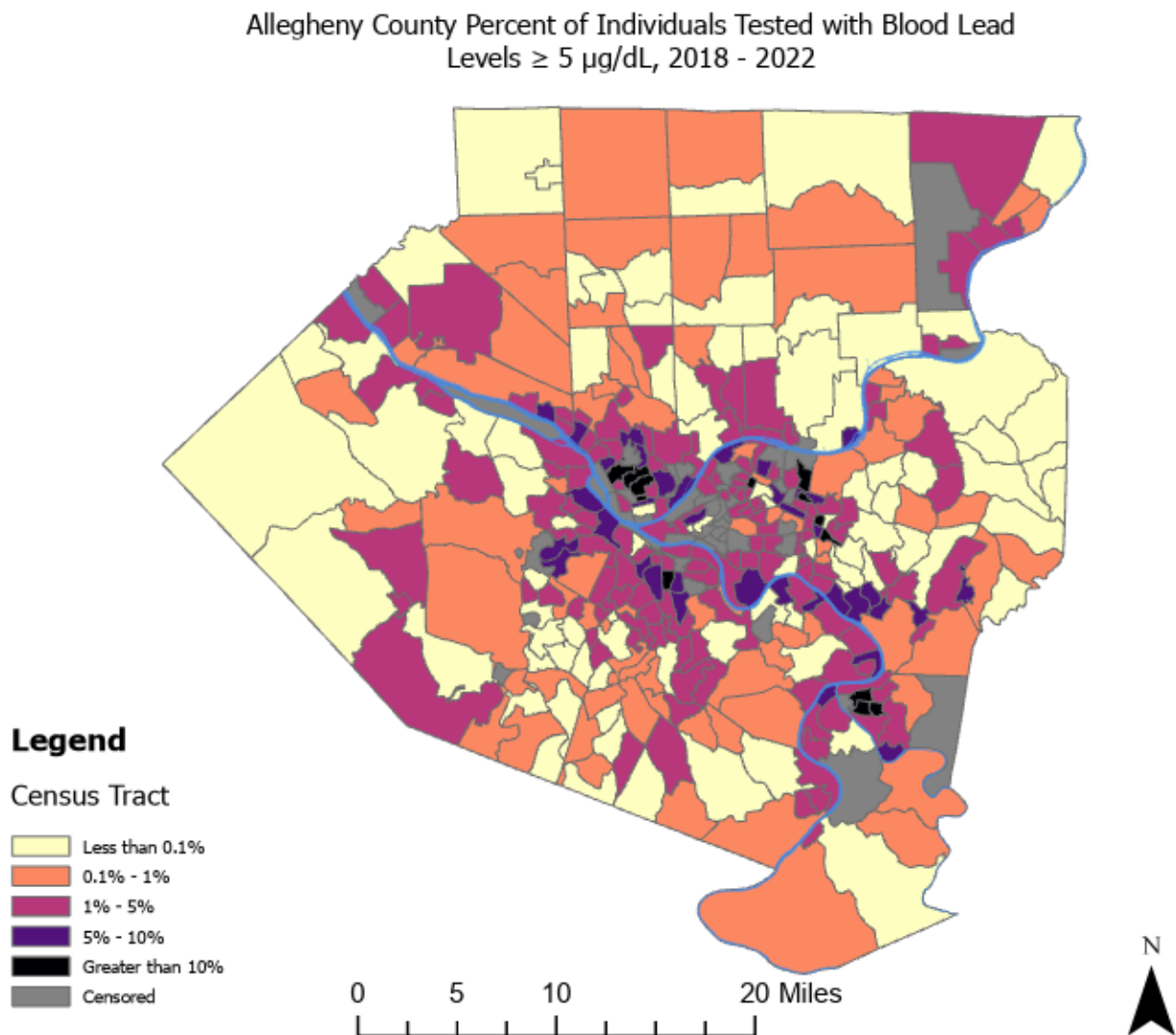
The CDC blood lead reference value for blood lead was defined as 5 µg/dL in 2012 and this changed to 3.5 µg/dL in 2021.

\*Rates for entire United States, provided by the CDC, added for reference in available years (2012-2018).

The Allegheny County regions with the highest rates of children tested with elevated blood lead levels between 2018 and 2022 were in the Northeast corner of the county, the Mon Valley, the Southern tip of the county, and neighborhoods directly North, South, and West of downtown Pittsburgh.



**Figure 7: Percent of tested children (less than six years of age) in 2018-2022 with blood lead levels  $\geq 5 \mu\text{g/dL}$  by Allegheny County census tract**

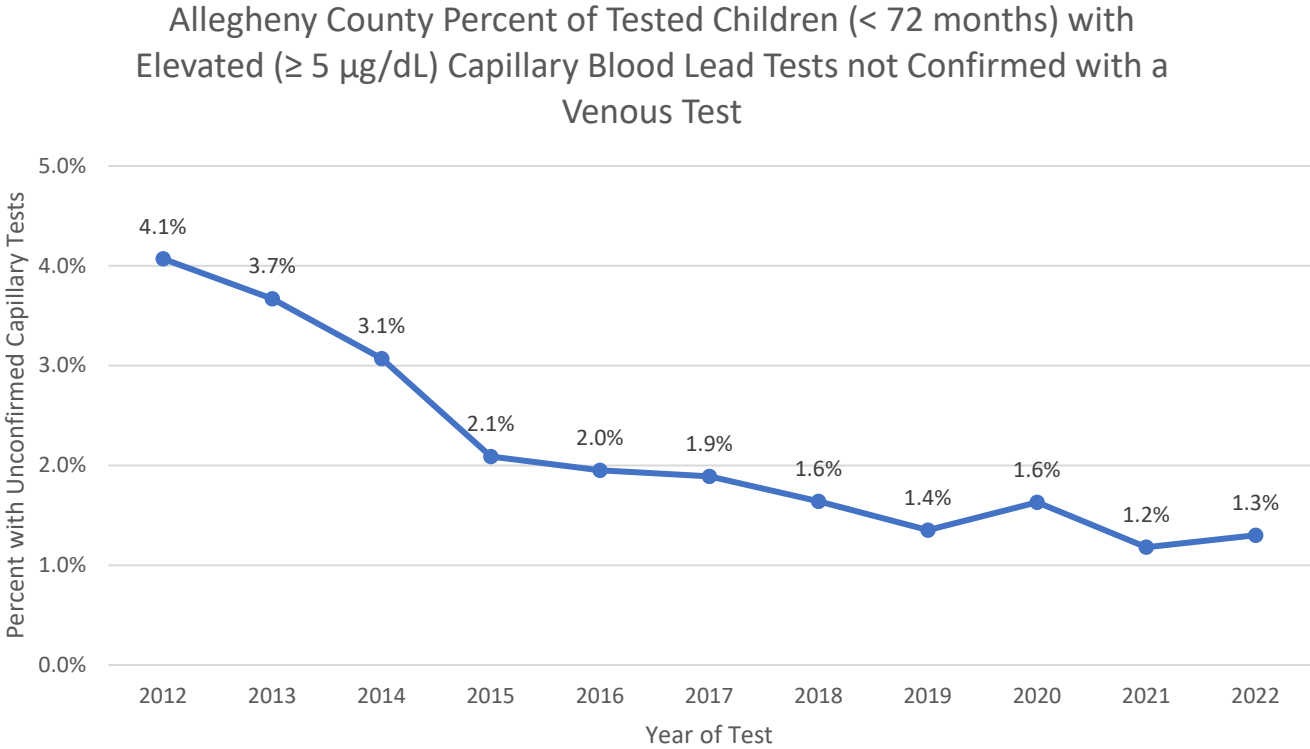


Census tracts with less than 50 tested children over that period are censored.

### Changes in unconfirmed capillary tests

A child with a capillary lead test  $\geq 5 \mu\text{g/dL}$  must have their blood lead level confirmed with a venous blood test within 84 days but not on the same day as the elevated capillary test. The blood lead reference value was  $5 \mu\text{g/dL}$  from 2012 until 2021 when the CDC changed it to  $3.5 \mu\text{g/dL}$ . The percent of Allegheny County children with capillary tests  $\geq 5 \mu\text{g/dL}$  that did not have a venous confirmation test in the specified time frame decreased from 4.1% in 2012 to 1.3% in 2022.

**Figure 8: Percent of Allegheny County children tested for blood lead that had a capillary blood lead test with a result  $\geq 5 \mu\text{g/dL}$  that was not confirmed with a venous blood lead test**

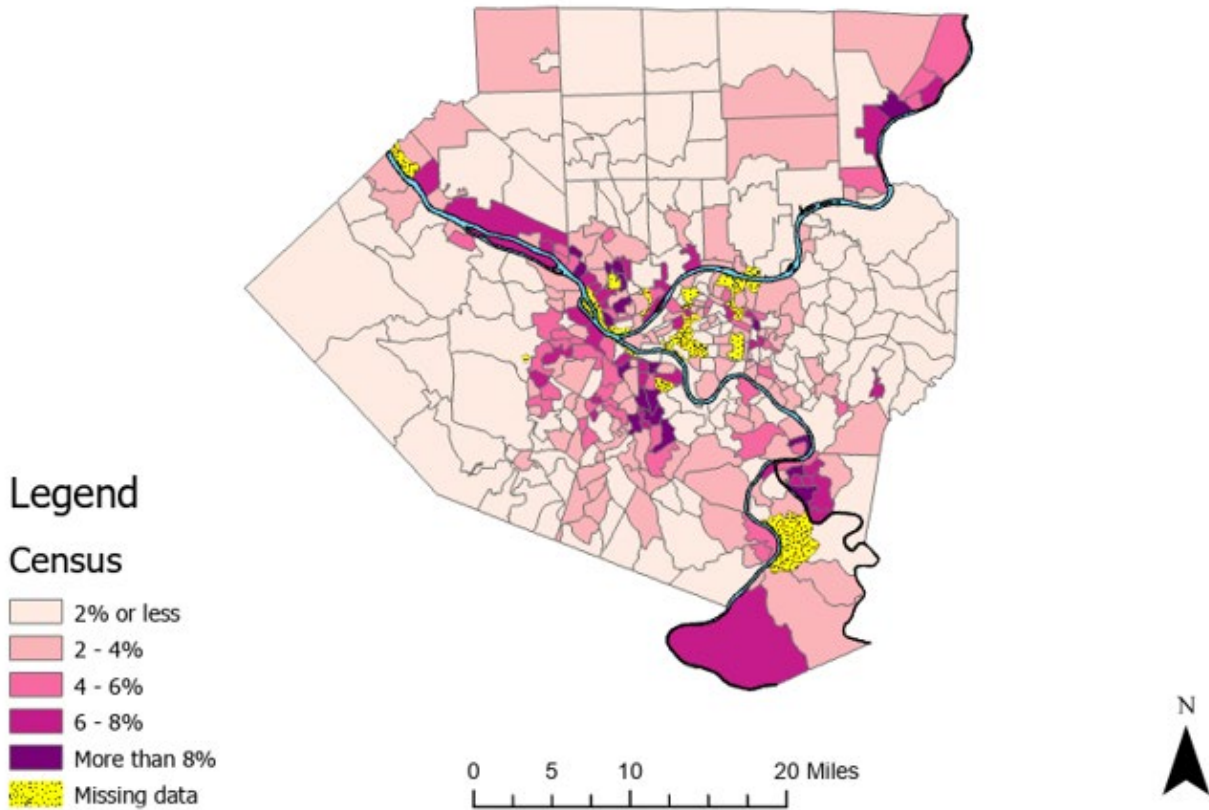


The venous test must occur within 84 days of the elevated capillary test but not on the same day as the capillary test to be considered a confirmation test.

The regions with highest rates of unconfirmed elevated blood lead capillary tests were in the neighborhoods directly North and South of Downtown Pittsburgh, parts of the Ohio River Valley, the Mon Valley, and several isolated pockets throughout the county.

**Figure 9: Percent of tested children (less than six years of age) in 2018-2022 with capillary blood lead test results  $\geq 5 \mu\text{g}/\text{dL}$  that were not confirmed by a second blood lead test within 1 to 84 days by Allegheny County census tract**

Percent of Capillary Tests not Confirmed with Venous Test by Census Tract (2018 - 2022)



Census tracts with less than 50 tested children over that period are censored.

Prior to the Allegheny County regulation requiring childhood lead testing at ages 9-12 months and 24 months, elevated capillary tests were considered confirmed with a venous test or a second capillary test in between 1-84 days after the first test which follows the definition put in place by the Council for State and Territorial Epidemiologist (CSTE). The percentage of children not receiving a follow-up confirmatory test has decreased over the course of the past ten years from 4.1% in 2012 to 1.3% in 2022.

## Validity of capillary tests

Capillary lead tests are a screening test for elevated blood lead. If the reported concentration is less than 3.5 ug/dL, the child does not have an elevated level of lead in their blood. However, if the capillary test result is 3.5 or over, it may indicate elevated lead. There is a good chance that it is falsely high, sometimes called a “false positive.” Locally the Allegheny County Health Department compared the percentage of elevated capillary blood lead tests with the percentage of elevated venous blood lead tests that were used as a confirmation. These venous tests occurred between 1 and 84 days after the elevated capillary test and are required to confirm that a child’s actual blood lead level is elevated. Venous confirmation tests only revealed an elevated blood lead level about 40% of the time; demonstrating a 60% falsely elevated blood lead level with a capillary test. This rate is consistent with literature on the subject.

**Table 1: Capillary versus venous testing**

Year	Initial Capillary Tests ≥ 5 µg/dL	Initial Capillary Tests ≥ 3.5 µg/dL	Venous Confirmation	Venous Confirmation ≥ 5 µg/dL	Venous Confirmation ≥ 3.5 µg/dL	Venous Confirmation Proportion	Venous Confirmed Elevated Proportion ≥ 5 µg/dL	Venous Confirmed Elevated Proportion ≥ 3.5 µg/dL
2012	1527		937	539		61.4%	57.5%	
2013	1376		851	491		61.8%	57.7%	
2014	1262		825	465		65.4%	56.4%	
2015	1041		739	392		71.0%	53.0%	
2016	1082		782	437		72.3%	55.9%	
2017	1189		855	455		71.9%	53.2%	
2018	1373		963	481		70.1%	49.9%	
2019	1192		824	435		69.1%	52.8%	
2020	1091		729	341		66.8%	46.8%	
2021	960	1343	701	387	543	73.0%	55.2%	40.4%
2022	1145	1672	866	378	624	75.6%	43.6%	37.3%

## Number of households contacted and number of home inspections completed

For children identified with a confirmed elevated blood lead level and documented in the Pennsylvania National Electronic Disease Surveillance System (PA-NEDSS) the ACHD Housing and Community Environment Program performs outreach including a home investigation to find and help mitigate sources of lead. These investigations include the use of X-ray fluorescence technology, dust and soil analysis, and water tests to determine sources of lead in the environment during the inspection. The childhood lead reference level that triggers a home inspection has decreased over time, in part due to



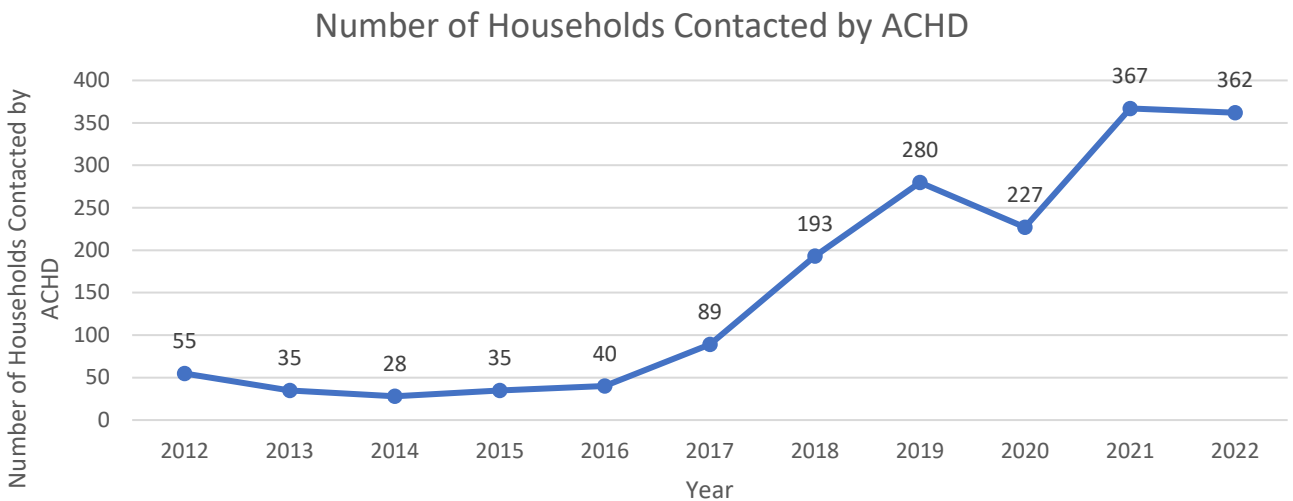
resources and with efforts to conform to CDC reference levels. Owner occupants are educated to mitigate and eliminate the identified lead hazards. For tenant occupied properties, landlords are required to eliminate hazards. A notice of violation with a specified compliance time to correct violations is sent to the landlord. The number of home inspections conducted since 2012, and the threshold for inspection follows in Table 2.

**Table 2: Threshold for Inspection**

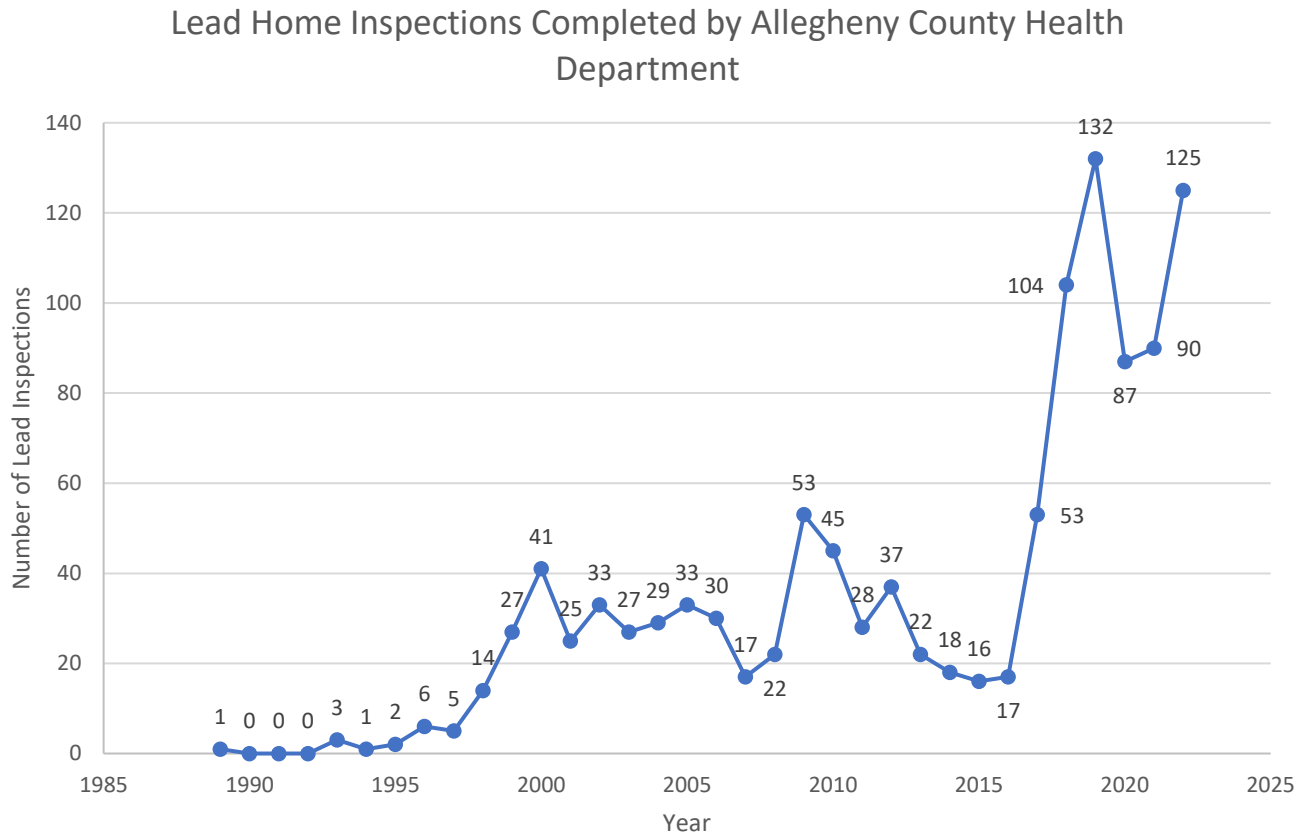
Year	Number of Households Contacted by ACHD	ACHD Home Inspections	Lead Level for Inspection
2012	55	37	≥15 µg/dL
2013	35	22	≥15 µg/dL
2014	28	18	≥15 µg/dL
2015	35	16	≥15 µg/dL
2016	40	17	≥10 µg/dL Starting November 1, 2016
2017	89	53	≥10 µg/dL
2018	193	104	≥ 5 µg/dL Starting June 18, 2018
2019	280	132	≥ 5 µg/dL
2020	227	87	≥ 5 µg/dL
2021	367	90	≥ 5 µg/dL
2022	362	125	≥ 5 µg/dL
2023	309	144	≥ 5 µg/dL

716 home lead inspections were performed by ACHD inspectors from 2012-2022. Between 2017 – 2022, 272 tenant occupied homes were identified with lead-based paint hazards and 178 (65.4%) were confirmed to be remediated after the initial inspection.

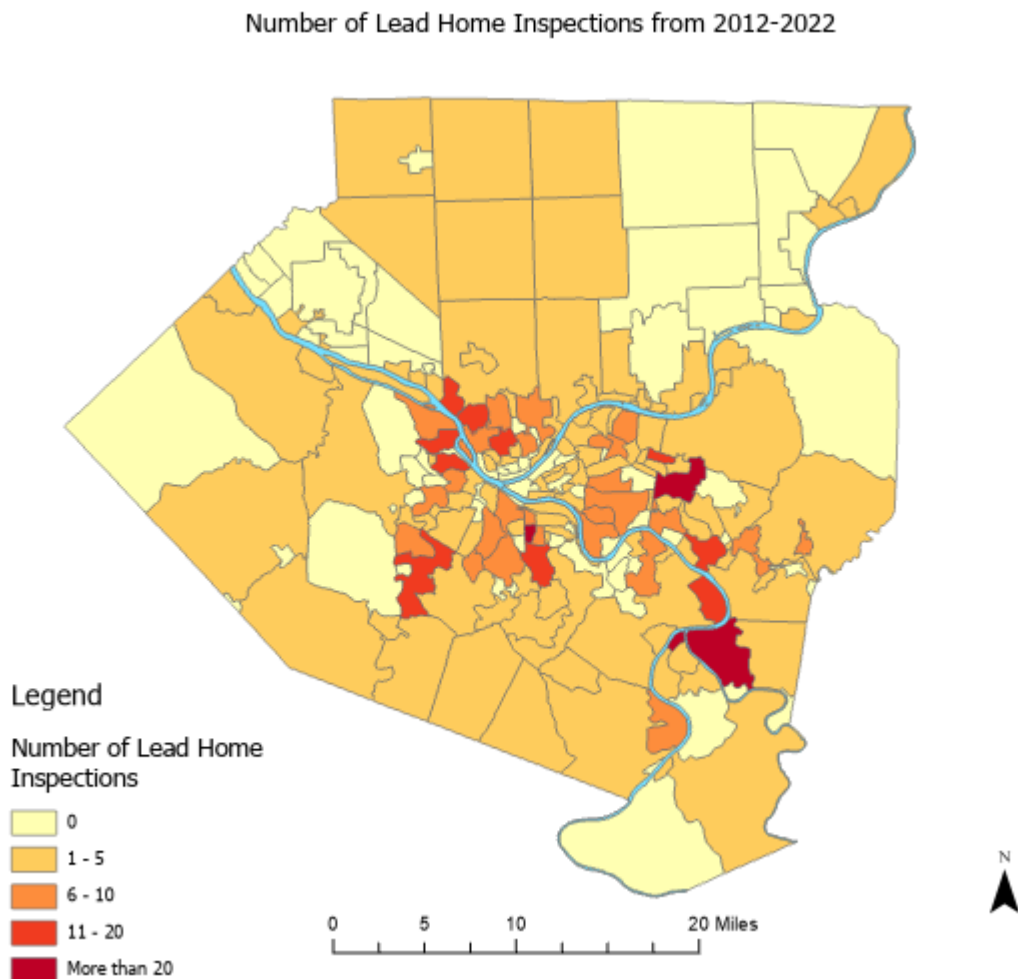
**Figure 10: Number of households that were contacted by the Housing and Community Environment bureau of the ACHD for a lead home inspection.**



**Figure 11: Number of lead home inspections completed per year by the Housing and Community Environment bureau. Many homes that are contacted refuse inspection.**



**Figure 12: Map of lead home inspections by municipality and neighborhood.**



**Table 3: Sources of Lead**

Discovered Sources of Lead from Home Inspections 2012-2022 (n=701)				
Paint	Dust	Soil	Water	Consumer Goods
617 (88.0%)	375 (53.5%)	309 (44.1%)	9 (1.3%)	48 (6.8%)

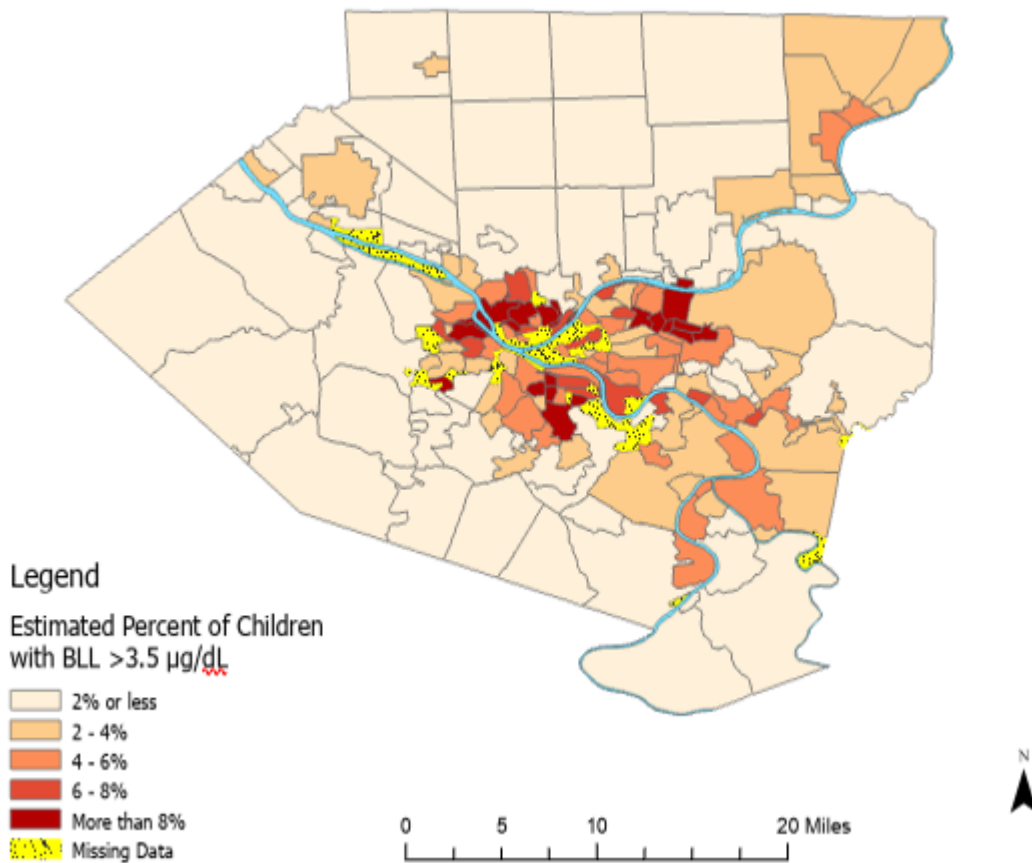
Lead Inspections may uncover multiple sources of lead. Percentages will add up to more than 100.

# PREDICTIVE MODELING

Mathematical modeling for positive lead cases was used to predict how many children that never received a lead test would be expected to have elevated blood lead. Predictive modeling accounted for factors known to be associated with elevated blood lead and using statistical methods and applying these methods to the untested cohort. Variables that were used in the modeling included sociodemographic variables (age of the mother, race, family income, educational attainment, and insurance status) and variables related to housing quality (housing condition and housing age).

**Figure 13: Map of predictive model by municipality and neighborhood**

Predicted Percent of Children with Elevated Blood Lead that were not Tested for Lead

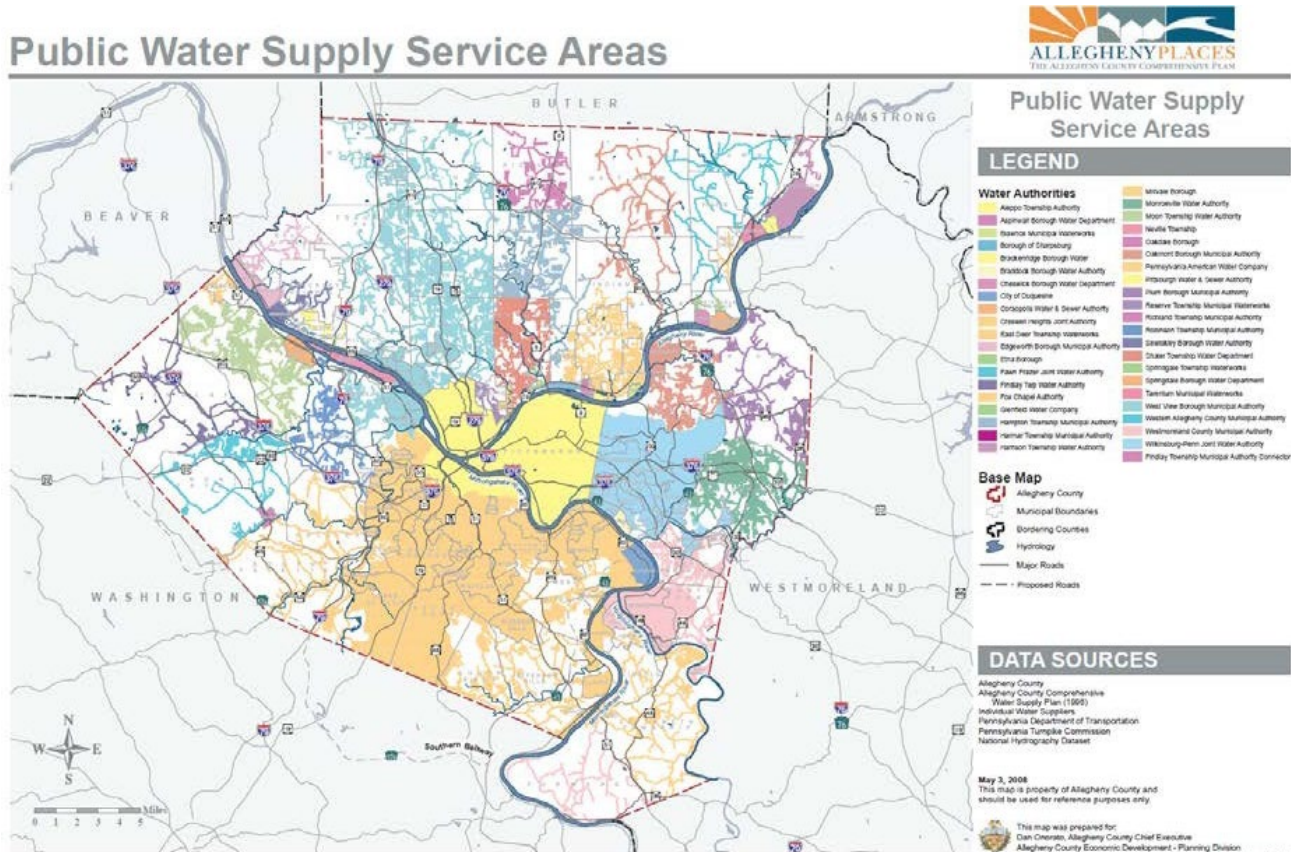




# LEAD IN WATER

The Pennsylvania Department of Environmental Protection (DEP) is the regulatory authority for the federal lead and copper rule (LCR), and only DEP has the authority to require corrective action or to issue penalties due to exceedance or violations of the rule. The federal LCR rule requires the public water system itself to test water for lead every three years by requesting that homeowners and tenants voluntarily obtain samples in their homes. If its results exceed the federally-established action level, the system must then implement measures to decrease those levels. These actions include revisiting its corrosion control methodology, providing public education, increasing the lead testing intervals, and replacing a percentage of lead services lines. Currently, that LCR action level is at 15 ppb. Some systems have also voluntarily taken additional actions such as providing filters, ceasing partial line replacements, and replacing the private side of the line (owned by the homeowner).

**Figure 14: Map of Public Water Supply Service Areas**



# ACHD LEAD ACTIVITIES

Today, ACHD’s comprehensive lead strategy has three main parts: tracking information on childhood blood lead levels (surveillance), education and primary prevention, and intervention. This is a brief review of actions taken to date. ACHD is committed to expanding efforts for prevention and intervention as resources become available. Current lead activities include:

## Surveillance

ACHD monitors children’s elevated blood lead levels (EBLLs) in real time by extracting data from the PA NEDSS system directly. By linking data from birth certificates to data from the PA NEDSS system ACHD can examine exposure over time and identify community patterns using ArcGIS mapping. It also allows ACHD to determine the percent of children who received lead testing on time, what type they received, the number of unconfirmed capillary tests, and trends in all these measures.

## Prevention and Education

ACHD launched its “Get Ahead of Lead Campaign” in 2017 with information available to families in multiple languages. Information such as the “lead prevention brochure” is also available for pediatric providers, parents, day care providers, school nurses and others who interface with children and families.

## Intervention

For children under 6 years of age with a confirmed blood lead level of 5 µg/dl and above, ACHD offers a free home inspection. The goal of this inspection, along with XRF readings, sampling of dust, soil, and water, is to help identify any sources of lead exposure in the home. The inspection includes identifying possible alternative sources of lead exposure from jewelry, toys, cosmetics, parent occupations and/or hobbies. Inspectors also educate the family about how good nutrition can mitigate absorption of lead and immediate steps the family can take to reduce lead exposure in the home. In a tenant-occupied property, the Health Department Housing and Community Environment may issue orders to the landlord to mitigate lead exposure in the property.

# RESOURCES FOR REMEDIATION

For homes built before 1978 and undergoing renovation work that will disturb painted surfaces, it is important that the work be performed by an EPA-certified renovator to reduce the risk of exposing the occupants to lead dust.

The Allegheny County Department of Economic Development [Lead Safe Homes Program](#) currently provides free home repairs to keep families safe from lead paint. This program will test for lead-based paint in the home and will aid with repairs and prevention education to Allegheny County homeowners or renters who meet income requirements and whose home is built before 1978. Repairs are made by Pennsylvania certified lead abatement contractors. Eligible residents must either have a child under 6 years or a pregnant woman in the household.

---