2016 Data Report on Childhood Lead Testing and Elevated Levels: Michigan

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Errata Page

Revisions as of 11/26/2018:

- Table 7 (Blood lead levels for children ages one and two in targeted communities, 2016), page 45, has been revised.
  - Corrections made to counts of venous samples ≥ 5 µg/dL.
  - Text describing the contents of Table 7 on page 12 were updated with the corrected counts.

Revisions as of 9/21/2018:

- Table 7 (Blood lead levels for children ages one and two in targeted communities, 2016), page 45, has been revised.
  - Corrections made to counts of all blood samples tested, blood samples ≥ 5 µg/dL, capillary samples ≥ 5 µg/dL, and venous samples ≥ 5 µg/dL.
  - Text describing the contents of Table 7 on page 12 were updated with the corrected counts.
- References to appendices in the body of the text have been replaced with links to the web addresses with appropriate legislation on pages 1 and 3.
- Navigation features have been added to areas of the document where previously missing.
- The report version number has been added to the footer.
- Margins were made smaller; as a result, the report text takes up fewer pages and the page numbers have changed.

Revisions as of 5/31/2018:

- Table 3 (Blood lead levels for children under age six enrolled in Medicaid by county), page 35, was revised: The proportion of all blood lead tests that were venous tests with results of 5-14 µg/dL has been corrected to be 2.0%.

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Executive Summary

This is the 13th annual statistical summary of clinical laboratory reports of children tested for lead in Michigan. This report provides a summary of the 2016 blood lead data for the public, public health professionals, and researchers to use to understand the scope of blood lead testing and elevated blood lead levels throughout Michigan. Data tables in this report are available in Excel upon request. The State of Michigan uses the reference value recommended by the CDC's Advisory Committee on Childhood Lead Poisoning Prevention (ACCLPP),[1] five micrograms per deciliter of blood (µg/dL), to define a child as having an elevated blood lead level (EBLL).

Data for this report cover tests conducted in the calendar year 2016, and comparison data are provided for the previous 19 years. Note: This report does not present an analysis of blood lead data on children in Flint beyond that which is presented for the state as a whole, counties, and by zip code. For more information, see the State of Michigan's Flint water response website (www.michigan.gov/flintwater).

Key Findings

- In 2016, 157,892 children younger than six years of age had a blood lead test, approximately 23% of the population in this age group.
  - Among those aged one and two, 95,143 were tested for lead, approximately 41.3% of the population in this age group.
- Of 157,892 children under age six who were tested for lead, 5,724 (3.6%) had an EBLL of ≥ 5 micrograms of lead per deciliter of blood (µg/dL).
  - Of all 5,724 children with an EBLL, 2,932 (51.2%) had a venous blood test ≥ 5 µg/dL, while the remainder had capillary or unknown sample type blood tests.
- Jackson, Saint Joseph, and Calhoun County ranked as the three counties with the highest percentage of children under age six with an EBLL, with 7.6%, 6.4%, and 6.4%, respectively.
- More children under age six were tested and had an EBLL in Detroit than any county in Michigan, with 23,678 tested and 2,073 with EBLLs (8.8%). Detroit also had the highest percent tested (40.4%) of the estimated population of children under age six.
- In 2016, 106,176 children under age six, including 60,433 children one and two years of age, who were enrolled in Medicaid were tested for lead.
  - Approximately 33% of children under age six enrolled in Medicaid or other public health coverage were tested in 2016.
  - Elevated blood lead levels were detected in 4,550 (4.3%) of Medicaid children under age six.
  - Among children one and two years of age, 2,746 (4.5%) had an EBLL.

Key recommendations and next steps for the MDHHS Childhood Lead Poisoning Prevention Program

- Improving the completeness, accuracy, and timeliness of the surveillance system by implementing a modernized data management system and automating the process of receiving and compiling reports from laboratories.
- Partnering with other agencies to increase screening rates and to increase the proportion of children with EBLLs based on capillary tests receiving a confirmatory venous test.
- Collaborating with the MDHHS Lead Safe Home Program (LSHP) as the LSHP implements a major expansion of their programs to offer environmental inspection services and financial support for home lead abatement.

Report Abbreviations

ABLES: Adult Blood Lead Epidemiology and Surveillance

ACCLPP: CDC Advisory Committee on Childhood Lead Poisoning Prevention

ACS: U.S. Census American Community Survey

BLL: Blood Lead Level

CDC: Centers for Disease Control and Prevention

CLPPP: Childhood Lead Poisoning Prevention Program

EBLL: Elevated Blood Lead Level ($\geq$ 5 µg/dL of blood)

HHLPSS: Healthy Homes and Lead Poisoning Surveillance System

HHS: Healthy Homes Section

LHD: Local Health Department

LoR: Limit of Reporting

LSHP: Lead Safe Home Program

MCIR: Michigan Care Improvement Registry

MDHHS: Michigan Department of Health and Human Services

MHSDA: Michigan State Housing Development Authority

MiCLPS: Michigan Childhood Lead Poisoning Surveillance data management System

MPI: Master Person Index

NCM: Nursing Case Management

NHANES: National Health and Nutrition Examination Survey

NVSS: National Vital Statistics System

WIC: Women, Infants and Children Food and Nutrition Program

The 2016 Annual Report: Introduction

MDHHS Childhood Lead Poisoning Prevention Program

The Michigan Department of Health and Human Services (MDHHS) Childhood Lead Poisoning Prevention Program (CLPPP) began in 1992 through a grant from the federal Centers for Disease Control and Prevention (CDC). The program was formalized into state law in 1998, under Michigan's Public Health Code MCL 333.5474 with the goal of preventing lead poisoning through targeted primary and secondary prevention aimed at high-risk children and their families.

The CLPPP, located in the Division of Environmental Health, focuses its activities on children younger than six years of age and their families, health care providers, and child health advocates in Michigan communities.

The Lead Safe Home Program (LSHP) within the Healthy Homes Section (HHS), located in the Division of Environmental Health, is responsible for the abatement of lead hazards in eligible homes built before 1978; certification of lead inspectors, risk assessors, abatement workers, supervisors, clearance technicians, abatement contractors and the accreditation of training providers; and enforcement of certification, accreditation and work practice standards established by the Lead Abatement Act of 1998 and associated Administrative Rules. The CLPPP and LSHP work closely together on a comprehensive response to the complex issue of lead hazards in homes that can impact the health of young children and their families.

Health Hazards of Lead

For over 40 years, government, environmental advocates, parents, and the public have worked tirelessly to reduce and eliminate childhood lead poisoning hazards. These efforts have led to considerable gains, such as: the elimination of lead in paint and gasoline in the 1970s and additional consumer products since then; increased awareness of lead as an environmental hazard; and improvements in guidance for blood lead testing and treatment of lead poisoned children.[2,3]

Sadly, lead poisoning is far from being eliminated. Significant factors correlated to lead poisoning include living in homes built before the ban on the use of lead in paint (1978) and poverty. Lead poisoning is also more common in the children of some ethnic and racial groups.[2-5] The detrimental and long-lasting effects of lead are magnified in Michigan's urban areas, where aging housing stock and substandard living conditions increase the risk of exposure.

Young children, wherever they live, are particularly vulnerable to lead poisoning because children absorb a greater proportion of the lead that they consume than adults,[3] and their tendency to put contaminated hands and items, such as toys, into their mouths.[4,6] As the central nervous system is undergoing a period of rapid and critical growth in early childhood, the effects on a child's nervous system, hearing, vision, cognitive development and behavior can be devastating.[3,4,8,9] Long-term effects of lead poisoning can also reduce a child's potential due to the negative effects on behavior, which affects the child's ability to do well in school and work, achievement of good personal health, and ability to maintain healthy relationships.[3,8,9]

Health Hazards of Lead

No safe blood lead level has been identified. In children, exposure to low levels of lead can cause:

- Learning and behavioral issues, including hyperactivity
- Lower IQ
- Slowed growth and development
- Hearing and speech difficulties
- Anemia

Sources of Lead Exposure

The primary source of lead exposure for Michigan children is lead-based paint in pre-1978 housing.[3,7,10-12] Deteriorating lead-based paint—dust from multiple coats of paint on impact or water-damaged surfaces, or flaking, chipping, peeling lead-based paint—creates a hazard on windowsills, floors, porches, and in the soil around the outside of a home. The repair and renovation of homes built before 1978 can increase the risk for lead exposure if workers fail to follow lead-safe work practices during renovation.[3,10,12] In several cases, the work on the home, which resulted in children's exposure to lead, was being performed by the parent(s); in some cases, the parent was a building/construction professional doing his/her own work.[12]

There are other invisible sources of lead exposure in and around the home.[4-7,10-12] Soil in driveways and yards adjacent to streets and highways may be a source of lead as it was contaminated from tailpipe exhaust falling to the side of roadways during the more than 70 years when leaded gasoline was in use, and former industrial or commercial properties that may be contaminated by heavy metals or industrial chemicals (brownfields) can have elevated levels of lead and other heavy metals in soils.[6,7,10-11] Cases of lead poisoning have been linked to the use of pottery with glazes containing lead; lead buckshot or fishing weights, stained glass supplies (lead cane); imported cosmetics (e.g., kohl, kajal); some imported sauces, spices and candy; toys or jewelry with lead paint or parts; and even supplements, folk remedies, and ayurvedic medicines.[1,3-6]

Recently, concern of drinking water as a source of lead exposure for children has increased. In Washington D.C., a change in water treatment chemicals in 2000 resulted in lead leaching into drinking water from water mains, solder joints, and plumbing fixtures.[13-14] This problem was not addressed until 2004, when the Army Corps of Engineers began chemical treatments to prevent lead from further leaching out and the subsequent replacement of lead pipes in 2005. More recently, switching the source of Flint drinking water from the Detroit municipal water system to the Flint River in 2014 resulted in lead release from pipes and fixtures into drinking water due to the high corrosivity of the water.[15-17]

The Flint Water Crisis

On April 25, 2014, the City of Flint changed its water supply from Lake Huron (supplied by the Detroit Water and Sewerage Department) to the Flint River. This was done under the direction of state-appointed emergency management in an effort to save the city money. Water from the Flint River was corrosive, and corrosion inhibitors were not added when the water supply was switched. This allowed corrosive water to run through aging pipes and fixtures, resulting in lead release into the city's water supply.

Increased water lead levels and EBLLs in young children were observed in Flint[15] and confirmed by the State of Michigan in September 2015. In October 2015, Flint's water supply was returned to water from the Detroit Water Authority. This event brought local, state, and federal resources together to coordinate a public health response that is expected to be ongoing, with the common goal of protecting Michigan residents from lead exposure.

This report does not present an analysis of blood lead data on children in Flint beyond that which is presented for the state as a whole, counties, and zip codes. The reader is referred to information and summary data that are available on the State of Michigan's Flint water response website (www.michigan.gov/flintwater).

Blood Lead Testing and Surveillance

The MDHHS CLPPP blood lead surveillance program has compiled blood lead test results from clinical laboratory reports for Michigan residents since 1997. Under the Public Health Code, clinical laboratories and users of portable blood lead analyzers are required to submit all blood lead laboratory test results to the MDHHS CLPPP (see Michigan's Public Health Code MCL 333.20531) within five working days after test completion. The database is the foundation of the statewide surveillance system.

Human exposure to lead is measured by blood tests. The laboratory test for blood lead level (BLL) is performed on a venous blood sample or a capillary blood sample (usually from a finger stick) drawn by a nurse or phlebotomist. Capillary tests, often used because they are easier to do, can produce false positive results, thus elevated levels from capillary blood tests should be confirmed with a venous blood test.

The State of Michigan uses the reference value recommended by the CDC's Advisory Committee on Childhood Lead Poisoning Prevention (ACCLPP), currently 5 micrograms per deciliter of blood (µg/dL), to define a child as having an elevated blood lead level (EBLL).[1-4] The reference value is the level at which interventions to identify and remove sources of lead are initiated. These interventions include additional testing to confirm an EBLL, nursing case management, family education, and assessment of the home for lead hazards.

Elevated Blood Lead Level (EBLL): What does it mean?

- In Michigan, an EBLL is a blood lead test result equal to or higher than the currently-recommended CDC reference value.
- The reference value is used to identify children whose blood lead levels are ***higher than the national average***.[1] This value is based on the 97.5th percentile of BLLs in children 1–5 years old in the United States. This means that only 2.5% of these children had blood lead levels greater than or equal to 5 µg/dL, based on data generated by the National Health and Nutrition Examination Survey (NHANES) from 2007 to 2010.
- The reference value is *not* the level at which children require medical treatment. Children do not require medical treatment for acute lead poisoning unless the child:
  - Exhibits symptoms of lead poisoning (coma, seizures, bizarre behavior, apathy, incoordination, vomiting, alteration in the state of consciousness, subtle loss of recently acquired skills), or
  - has a blood lead level equal to or above 45 µg/dL.

Surveillance Targets

The State of Michigan does not recommend the practice of universal testing of children for blood lead, but conducts surveillance focused on testing children at the greatest risk for lead poisoning. While childhood lead poisoning is a significant health problem throughout the state, due to the industrial past and general age of homes (more than a million built before 1950), the magnitude of the exposure problem is greatest in Michigan's urban areas. As the percentage of Michigan children with elevated blood lead levels has decreased over time, efforts have been concentrated on the geographic areas and populations where the exposure problem is greatest. While Michigan has mandatory reporting for all blood lead test results (see Michigan's Public Health Code MCL 333.20531), it is important to recognize that blood lead testing is not universal, and that testing data are not representative of all Michigan children. However, it is possible to use the testing data to identify trends in testing practices from year to year, compare the total number of EBLLs reported to MDHHS over time, and characterize the population currently being tested.

All Medicaid-enrolled children are considered to be at increased risk for lead exposure and poisoning. Michigan Medicaid policy requires that all enrolled children be tested for lead exposure at 12 and 24 months of age, or once between 36 and 72 months of age if not previously tested.[18] A test at 12 months of age identifies exposure to lead due to early crawling or possible prenatal exposure. The second test, at 24 months of age, reflects exposure occurring during the time period when hand-to-mouth behavior is common. Both tests are necessary to discern a child's exposure to lead.

The CLPPP Blood Lead Surveillance Database

The CLPPP maintains a public health surveillance database of all laboratory test results (Table A). The surveillance database is updated continuously as laboratories submit blood lead tests to CLPPP. This includes reports of new blood lead test results, test results that were not submitted within five working days after test completion, and changes or corrections to previously submitted test results. This allows the CLPPP to maintain the most complete and correct database of blood lead test results.

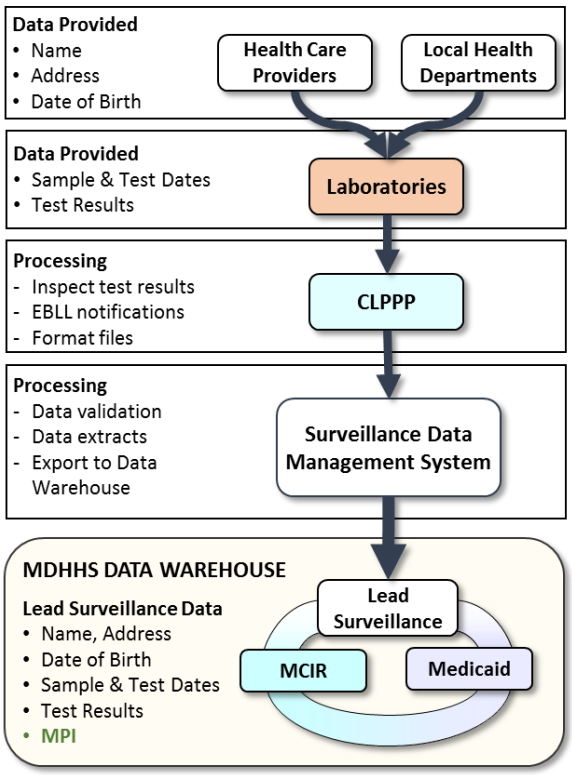
Table A. Contents of the Michigan CLPPP Surveillance Database

Type of Data	Description
Patient Information	Name, Address, Date of Birth, Gender, Race, Ethnicity
	Parent/Guardian, Contact information
	Social Security Number, Medicaid ID Number (if applicable)
Testing Information	Physician Contact information, Laboratory Contact information
	Blood lead specimen number, Date of sample collection
	Date of testing, Type of blood sample, Test result

The CLPPP compiles all blood lead test reports weekly. Inaccuracies are identified and corrected. This does **not** include changing blood lead test results, but includes inconsistencies in dates (e.g., testing date is before the child's date of birth), incomplete addresses (e.g., missing the city), or follow-up to check on test information (e.g., the type of blood sample reported was incorrect – instead of a C for capillary or V for venous, the sample type reported was an F). After this process, the data are then uploaded into the data management system. Each week, an extract of the data is uploaded to a database in the MDHHS data warehouse where a computer algorithm generates a Master Person Index (MPI), which is a unique identifier used to link multiple tests of the same child.

The MPI is also used to link the results to the Medicaid data files and the state's immunization registry (MCIR: Michigan Care Improvement Registry) (Figure A). Because the blood lead surveillance database is linked to MCIR, health care providers can see their patient's lead level when the child's immunization record is opened in MCIR.

Figure A. Blood Lead Data Flow



The CLPPP assures that the local public health agency for the child's jurisdiction of residency is notified of all blood lead test results. If there is an EBLL in the report, this initiates management of the child's lead exposure, which includes public health nurse home visits for health assessment and family education, and/or environmental investigations, a critical component for identifying all sources of exposure in a child's environment and assuring clearance of lead hazards.

Uses of Surveillance Data

The CLPPP surveillance data are used for a variety of purposes including improving compliance with requirements and recommendations for testing of children, initiating individual case management for children with EBLLs, and identifying homes in need of inspections for lead hazards. Surveillance data are also used to identify areas of concern when unusual or unexpected increases in the numbers of cases of EBLL are seen, and to identify high-risk groups for targeting a variety of interventions.

Using the data to improve screening and testing

To improve compliance with the lead testing requirements of Medicaid and recommendations for testing of high-risk children, and to promote the importance of obtaining a confirmatory venous test for EBLLs from capillary tests:

- The lead testing status of children is provided to all Medicaid Managed Care Plans. This is done by matching Medicaid enrollment files with CLPPP lead surveillance data files. Managed Care Plans use the data to contact their providers who are not compliant with Medicaid testing requirements.
- The CLPPP provides local health departments (LHDs) with a monthly list of children who are enrolled in Medicaid and their lead testing status so that LHDs can conduct follow-up with providers of children who are not in compliance with Medicaid testing requirements.
- CLPPP provides LHDs with a weekly list of all new blood lead tests, including whether they are venous or capillary, so that the LHDs can follow up with the families of children with capillary EBLLs to encourage them to see their provider to get a confirmatory venous test.

Using the data for case management

To promote individual case management interventions for children with EBLLs, the CLPPP notifies LHDs weekly of all new and updated lead test results for children in their jurisdiction. The CLPPP provides assistance to LHDs in providing case management services to children with EBLLs and their families. Nursing Case Management (NCM) includes one or more home visits to make a visual assessment of suspected lead hazards, an assessment

of the child's growth and development, education of the caregivers on nutrition and cleaning, and referrals to other agencies for interventions. A nurse consultant at MDHHS supports case management activities at the LHDs through training and technical consultations. LHDs use a web-based application called the Healthy Homes Lead Poisoning Surveillance System (HHLPSS) to track case management activities. In January 2017, an NCM program was implemented, which provides reimbursement per visit to LHD public health nurses that make home visits to families with EBLL children.

Using the data to target the abatement of lead hazards in homes

To ensure that families of children in lead contaminated homes have resources to remove lead hazards from the home, CLPPP provides information on all children with EBLLs to the MDHHS LSHP. This program provides assistance to low-to-moderate income families whose children have EBLLs and to families that live in potentially hazardous homes. The program provides resources to identify lead hazards and hire contractors that safely remove these hazards. CLPPP also provides data to the Michigan State Housing Development Authority (MSHDA) to identify any MSHDA homes that may require environmental testing and hazard abatement.

Using the data for education and outreach

Providing professional education and training, current health education materials, and education for the general public are regular CLPPP activities. Part of these activities include generating reports and fulfilling data requests from the surveillance database. Responses to both internal and external requests for data to direct local plans and activities represents a significant demand for the time and skills of the staff, depending on the scope and complexity of the request.

The CLPPP also provides funding to local public health agencies in nine target communities with a history of high percentages of children with EBLLs: Adrian, Detroit, Flint, Grand Rapids, Hamtramck, Highland Park, Jackson, Lansing, and Muskegon. This funding is used to encourage and promote primary prevention of childhood lead poisoning, with emphasis on reaching families in pre-1978 housing where young children or pregnant women reside. In addition to funding for target communities, all ten Prosperity Regions in the state receive funding for education and outreach activities to increase BLL testing rates for all Michigan children.

Partners in education and outreach efforts include local public health departments and other agencies throughout the state with shared interests, including the MDHHS LSHP, Department of Labor and Economic Growth, Michigan State Housing Development Authority, Special Supplemental Nutrition Program for Women, Infants and Children (WIC), Early On, Head Start, and Early Head Start.

Legislation enacted in October 2006 (Public Act 286) requires that all children who receive WIC nutrition services be lead-tested. Families receiving benefits are required to attend WIC clinics every three months for nutrition counseling and other services, including blood lead tests. Without testing at WIC clinics, families would have to schedule blood lead testing through other providers, which can be a problem for low-income families where time and transportation are challenges to seeking health care. Even though WIC is not required to provide the test, 34 WIC clinics throughout the state currently have the ability to conduct blood lead testing for their clients.

The 2016 Annual Report: Methods

Blood lead surveillance data

Blood lead test results were extracted from the surveillance database that resides in the MDHHS data warehouse for tests for children under age six conducted in 2016. Extracted data elements included: blood lead level; blood sample type (venous, capillary, or unknown); age at the time of the test; and city, county, and zip code of residence at the time of the test. In addition, the number of children tested and number with EBLLs were obtained for previous years going back to 1998.

Each child was counted only once in a calendar year. If a child had multiple tests within a calendar year, the highest BLL obtained from a venous test was retained. If no venous test was performed, the highest BLL obtained from a capillary blood draw was retained. If the only test result was one for which the test type was unspecified, then that result was used. If the highest level was ≥ 5 µg/dL, the child was counted as having an EBLL.

All test outcomes were categorized by sample type and BLL:

- Capillary or venous BLL < 5 µg/dL
- All capillary or unknown sample type tests ≥ 5 µg/dL
- Venous tests ≥ 5 to < 15 µg/dL
- Venous tests ≥ 15 µg/dL

Analytical approach

Counts

The numbers of children tested and EBLL status of children were aggregated by age group, Medicaid enrollment status, county, target community, and zip code. Data were analyzed for all children under age six, and for children between one and two years of age. This group was examined because they are targeted by Medicaid for testing and represent the age group with the highest risk for EBLLs.

Risk Factors

The risk factor and population data used in this report were collected from the U.S. Census American Community Survey (ACS) 5-year estimates for 2016, using the U.S. Census American Factfinder data access tool (https://factfinder.census.gov/).

For county-level test results, two indicators of older housing were included: percent of housing constructed before 1980 (leaded paint was banned in 1978), and percent of pre-1950 housing, when homes had high levels of leaded paint.[1,4,6,11,12] These percentages were based on data from ACS report B25034 (Year Structure was Built), which reports the year homes were built by decade. Since ACS does not provide data on homes built specifically before 1978, this report used data on homes built before 1980, which includes all homes built before 1978 and homes built in 1978 and 1979.

Census data: what is a 5-year estimate?

The U.S. Census ACS produces *period estimates* of socioeconomic and housing characteristics. These estimates describe the average characteristics of an area over a specific period of time. The 2016 5-year estimates are based on data collected from January 2012 to December 2016. For more information, see the ACS General Handbook at https://www.census.gov/content/dam/Census/library/publications/2008/acs/ACSGeneralHandbook.pdf.

Populations

Population figures were necessary to determine the percentage of children tested. The number of children under age six was based on data from the ACS report B09001 (Population Under 18 Years of Age) 5-year estimates for 2016. The number of children under age six that received Medicare or other public health coverage was based on estimates from the ACS report B20773 (Public Health Insurance Status by Sex and Age) 5-year estimates for 2016. For children ages one to two, the National Vital Statistics System (NVSS) provides population estimates by year of age at the county level only. These estimates are provided by the National Center for Health Statistics (https://www.cdc.gov/nchs/nvss/bridged_race/data_documentation.htm).

Data suppression

If there were fewer than six counts in a given tabulation, the value was suppressed to maintain confidentiality. Further, to prevent back-calculation of the suppressed numbers using other numbers in the rows and/or columns of the data tables, some numbers greater than six were also suppressed. Tables without data suppression will be made available to local health departments upon request.

The 2016 Annual Report: Results

The CLPPP surveillance program collected blood lead test results for Michigan residents in all 83 counties in Michigan during calendar year 2016. A total of 157,892 children less than age six, 24,241 children ages six to 17, and 34,501 adults ages 18 and older were tested in 2016.

Surveillance of Michigan Children, 1998 to 2016

The number of children that have received BLL tests has significantly increased over time, while the percentage of Michigan children with elevated blood lead levels has declined over time.

Figure 1. Number of children less than age six tested for lead in Michigan by zip code area, 2016

- This map shows the number of children tested throughout the state of Michigan by zip codes: the darkest shades indicate the zip code areas with the highest numbers of tested children. Children were tested in all 83 counties in the state, with the highest numbers of children tested concentrated in the more densely populated areas of the state.

Figure 2. Number of children less than age six tested for lead, and number of children with elevated blood lead levels in Michigan, 1998 – 2016

- There were a total of 157,892 children less than age six tested in 2016, which was the highest number tested in this timeframe. The number of children tested in 2016 was nearly 20% larger than the number tested in 2015.

Figure 3: Percentage of children under age six with elevated blood lead levels by year, and percentage of children with elevated blood lead levels based on venous blood tests, Michigan, 1998-2016

- The percentage of children less than age six with EBLLs (per venous or capillary blood test) has declined significantly since 1998, from 42.7% in 1998 to 3.6% in 2016.
- The percentage of children with EBLLs based on venous blood tests has similarly declined over time.

Figure 4: Number of children under age six with elevated blood lead levels ($\geq$ 5 µg/dL) in Michigan, by zip code area, 2016

- The zip code areas with the highest numbers of children with EBLL were concentrated in urban areas, including zip codes in Wayne, Oakland and Macomb counties (the metropolitan Detroit area), Genesee County (Flint), and Kent County (Grand Rapids).

Figure 5: Number of children less than age six, tested for lead, 1998 – 2016, by Medicaid enrollment status

- The total number of children less than age six who were tested for blood lead rose from 73,643 in 1998 to 155,847 in 2010, followed by a decline to 140,857 in 2015, and a dramatic increase to 157,892 in 2016. The proportion of children who were enrolled in Medicaid and tested for blood lead increased from 56.8% in 1998 to a peak of 76.5% in 2010, followed by a decrease to 67.2% in 2016.

Figure 6: Number of children ages one and two tested for lead, 1998 – 2016, by Medicaid enrollment status

- In 2016, 60.3% (95,143) of the 157,892 children less than age six tested for blood lead were ages one and two, and 63.5% of these children were enrolled in Medicaid. The total number of children tested more than

doubled from 34,034 in 1998 to 95,143 in 2016. The percentage tested for blood lead who were enrolled in Medicaid rose from 50.3% in 1998 to a peak of 75.3% in 2010, and has steadily declined to 63.5% in 2016.

Blood Lead Levels in Michigan Children by County: 2016

The following tables present the number and percent of EBLLs, categorized by venous and capillary results, presented with county-level population and housing data, for different age groups and Medicaid enrollment status. These tables present data for Wayne County divided into results for children in Detroit, and results for Wayne County children that did not live in Detroit. The BLL testing rates in Detroit are much higher than the remainder of Wayne County, and reporting Detroit test results separately provides a better description of BLL test results from the rest of Wayne County.

Table 1: Blood lead levels for children under age six by county, 2016

- Overall, 22.9% (157,892) of all Michigan children under age six were tested. The percent of children tested ranged from 40.4% (Detroit) to 8.8% (Livingston County). Detroit had the largest number of tested children (N= 23,662) and the highest percentage of older housing (58.0% built before 1950 and 91.9% built before 1980).
- A total of 5,724 (3.6% of the total children tested) had EBLLs, of which 48.8% (2,932 out of 5,724) were based on venous blood samples. Detroit had the highest percent of EBLLs based only on venous tests (5.9%), followed by Lenawee County (3.9%) and Calhoun County (3.7%). Of the 5,724 children with EBLLs, 2,073 (36.2%) lived in Detroit. Of the 2,932 children with EBLLs based on a venous test, 1,390 (47.4%) lived in Detroit.
- Of the total number of children tested in Michigan, 318 (10.9%) of the 2,932 venous tests were 15 µg/dL or greater, a level at which a home intervention is recommended to take place as soon as possible to identify and mitigate sources of lead exposure. The majority of these children (138 of 318, or 43.4%) were residents of Detroit. Nine children (data not presented) had a confirmed venous level of 45 µg/dL or greater, a level requiring immediate medical attention and possible chelation therapy.

Table 2: Blood lead levels for children ages one and two by county, 2016

- A total of 95,143 children ages one and two were tested for blood lead in Michigan in 2016 (Table 2). The overall testing rate for this age group (41.3%) was higher than for all children under age six (22.9%). Testing rates ranged from 80.6% in Keweenaw County to 17.6% in Midland County.
- In 2016, 3,508 (3.7%) of children in this age group had EBLLs, which was similar to the percent for all children under age six (3.6%). Of these children, there were five with a confirmed venous level of 45 µg/dL or greater (data not presented).

Table 3: Blood lead levels for children under age six enrolled in Medicaid, by county, 2016

- Approximately 33.3% of Michigan children receiving Medicaid or other public health coverage were tested for blood lead in 2016.
- For the 106,176 tested children under age six enrolled in Medicaid at any time in 2016, 4,550 (4.3%) had an EBLL. The counties with the highest percent EBLL were Jackson (9.2%), Muskegon (7.6%), and Kent (7.4%). Over half (56.3%) of the 4,550 Medicaid children with an EBLL lived in Wayne or Kent County.
- A total of 2,432 of the 106,176 (2.3%) Medicaid children under age six that were tested had an EBLL from a venous test. The highest percentage of children with an EBLL from a venous test were from Calhoun County (7.3%), Wayne County (6.2%) and Lenawee County (4.4%).

- The 2,432 EBLLs from venous tests comprised 53.5% of the 4,550 total EBLLs. The counties with the highest percentages of venous tests out of all EBLL tests included Genesee (71.7% of 187), Wayne (68.4% of 2,065), and Lenawee (62.7% of 51).

Table 4: Blood lead levels for children age one and two enrolled in Medicaid by county, 2016

- Of the 60,433 tested children ages one and two enrolled in Medicaid at any time in 2016, 2,746 (4.5%) had an EBLL. The counties with the highest percent EBLL in children ages one and two were Jackson (9.8%), Saint Joseph (8.4%), and Calhoun (8.3%). Over half (53.5%) of the 2,746 children with an EBLL lived in Wayne (40.5%) or Kent County (13.1%).
- For the 2,746 children with EBLLs, 1,416 had an EBLL from a venous test. This comprised 51.6% of all EBLLs in children ages one and two enrolled in Medicaid. The four counties with the highest numbers of children with venous EBLLs were Wayne (763), Kent (107), Genesee (59), and Calhoun (54). Over half (53.9%) of all children tested with an EBLL from a venous test came from Wayne County.

Blood Lead Levels in Children in Targeted Communities: 2016

The following tables present the number and percent of EBLLs, categorized by venous and capillary results, with population and housing data, for different age groups in the nine targeted communities in Michigan. The targeted communities were selected based on their histories of higher than average elevated blood lead levels in children, and higher levels of housing stock built before the sale of lead-based paint was banned in 1978. All of the nine targeted communities had higher percentages of housing stock built before 1950 (ranging from 33.2% to 69.6%) and before 1980 (ranging from 77.0% to 92.3%) than the state of Michigan (23.1% and 65.8%, respectively).

Table 5: Blood lead levels of children under age six in targeted communities, 2016

- The percentages of children that were tested in the nine targeted communities were much higher than the statewide percentage. The highest testing rates were seen in Flint (84.0%), Jackson (63.0%), and Muskegon (61.2%). This was much higher than the statewide average of 22.9%, and shows that work to improve testing rates in these targeted communities is having a positive impact.
- For the 47,554 children under age six in targeted communities in 2016, 7.7% (3,429) had an EBLL. Seven of the nine communities had higher percentages of EBLLs than the statewide average (3.6%), with Highland Park having the highest percentage of children tested with an EBLL (14.0%) of all nine communities in 2016. The percentages of children with EBLL test results actually dropped below the statewide average in the communities of Flint (2.4%) and Lansing (3.3%) in 2016.
- In seven of the nine targeted communities, the percentages of EBLL test results that were based on venous blood tests were higher than the statewide average (51.2%). The highest percentages of venous EBLL tests were seen in Highland Park (78.7% of all EBLL tests), Flint (73.4%), and Detroit (67.1%). The communities with the lowest percentages of venous EBLL tests were Grand Rapids (35.7%) and Jackson (38.2%).

Table 6: Blood lead levels for children under age six in targeted communities, 2013 to 2016

- In Michigan, the number of children under age six tested began to increase in 2015 and significantly increased, by 77.4%, in 2016.
  - In 2015, there was a 15.4% increase in the number of children tested in Flint (from 2,343 in 2014 to 2,703 in 2015) and 14.4% in Jackson (976 in 2014 to 1,117 in 2015).
  - The number of children tested in 2016 was higher than 2015 in all nine targeted communities. The communities with the greatest percentage increase in the number of children tested included Flint and

Muskegon, where the number more than doubled from 2015 (2,703 in Flint and 799 in Muskegon) to 2016 (7,381 in Flint and 1,807 in Muskegon). The number tested in Jackson nearly doubled (1,117 in 2015 to 2,221 in 2016).

- Between 2013 and 2016, the percentage of EBLL in tested children declined for all but two of the eight communities with data for all four years (Detroit and Hamtramck).
  - In Flint and Muskegon, the percentage of EBLLs peaked in 2014 and declined in 2015 and 2016. It should be noted that the significant increase in the number of children tested in both cities in 2016 may have contributed to these decreases. Please see the section *Increased Blood Lead Testing in 2016* on page 14 of this report.

Table 7: Blood lead levels for children ages one and two in targeted communities, 2016

- For the 24,400 children ages one and two tested in 2016 in targeted communities, 8.2% (2,010) had an EBLL. Eight of the nine communities had higher percentages of EBLLs than the statewide average (3.5%), with Highland Park and Detroit having the highest percentages of children tested with an EBLL (16.6% and 11.0%, respectively) of all nine communities. The percentages of children with EBLL test results dropped below the statewide average in Flint (2.9%).
- Similar to children under six years of age, the percentage of EBLL test results that were based on venous blood tests was higher than the statewide average (51.6%) in six of the nine targeted communities. The highest percentages of venous EBLL tests were in Flint (71.1% of all EBLL tests), Highland Park (68.0%), Detroit (67.1%), and Hamtramck (62.7%). The communities with percentages of venous EBLL tests below the statewide average were Grand Rapids (33.2%), Jackson (38.6%), and Muskegon (44.7%).

Table 8: Blood lead levels for children ages one and two in targeted communities, 2013 to 2016

- The number of children ages one and two tested decreased from 2013 to 2015 for most of the communities. The number tested then increased for each community in 2016.
  - The communities with the greatest percentage increase in number of children tested in 2016 as compared to 2015 were Muskegon (170%), Jackson (104%), and Flint (100.0%).
- There was a decrease in the percentage of children ages one to two with an EBLL in nearly all communities from 2013 to 2016.
  - The percentage of tested children with EBLL was lower in 2016 than 2013 in all targeted communities except Detroit.
  - Highland Park, the targeted community with the highest percentage of EBLL children, had a much lower percentage of EBLL in 2016 as compared to the three previous years.

The 2016 Annual Report: Discussion

Childhood Blood Lead in Michigan

The State of Michigan has made great strides in reducing the number of children with elevated blood lead levels while also increasing the number of children getting tested. The long-term trends demonstrate that the percentage of children with EBLL has declined over time (Figure 3). Despite these successes, childhood lead poisoning remains a public health threat for many Michigan children.

In 2016, there were 5,724 children under the age of six with elevated blood lead levels, comprising 3.6% of all tested children. Detroit continued to bear the greatest burden of EBLLs in children. Detroit and other communities with a high percent of children living in poverty and with older housing continue to have a disproportionate number of children with elevated blood lead levels. Levels of EBLLS are still higher in the Medicaid population (4.3% in children under age six, 4.5% in children ages one and two, Tables 3 and 4) than the overall population of children in Michigan (3.6% in children under age six, 3.7% in children ages one and two, Tables 1 and 2), which may indicate that children enrolled in Medicaid have a higher exposure to lead.

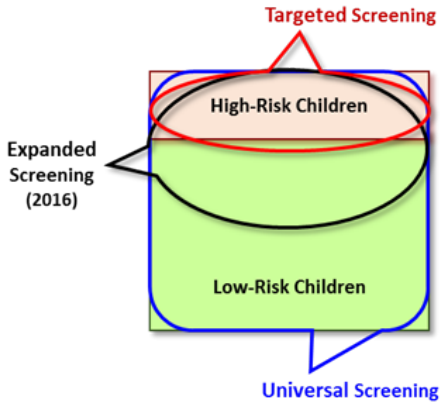
Increased Blood Lead Testing in 2016

Approximately 22.9% of children under age six, and 41.3% of children ages one and two were tested for blood lead in 2016. This is an increase from 2015, where 20.1% of children under age six and 37.9% of children ages one to two were tested.[19] Children enrolled in Medicaid made up over 67% of the 157,892 children under age six, and over 66% of the 95,143 children ages one to two, who were tested in 2016. The percentage of tested children enrolled in Medicaid was down from 2015 for children under age six (71.2%), and children ages one and two (68.7%). This suggests that the increased blood lead testing in 2016 was reaching children throughout Michigan that have not been in the targeted, high-risk category.

Blood lead testing for children across Michigan increased significantly in 2016, particularly in Genesee County and Flint. This increased testing was part of the CLPPP response to the Flint Water Crisis after a state of emergency was declared in January 2016. The Flint Water Crisis raised the public's awareness of childhood lead poisoning, and testing increased across the entire state.

Before 2016, the blood lead surveillance program in Michigan targeted children at the highest risk for lead poisoning (e.g., children living in houses built before 1978, children in families where other family members had EBLL tests, children living in poverty). The result of this testing approach is that the majority of Michigan children tested for lead were those considered to be at high risk for lead poisoning, and were not representative of *all* Michigan children (Figure B). This makes it difficult to draw specific conclusions regarding the actual rates of lead poisoning for all children in Michigan.

Figure B. Low and high-risk children covered in targeted, expanded, and universal screening



The most accurate way to quantify statewide rates of lead poisoning would be to test *all* children in the State of Michigan through a universal screening program (Figure B). As testing expands to include more children with a low-risk of an EBLL, the proportion of children at high risk for lead poisoning who are tested will decrease, and the proportion of tests that are elevated will likely decrease.

The Flint Water Crisis

The MDHHS CLPPP program mounted an active response to the Flint Water Crisis in 2016. After the declaration of a state of emergency by the Governor in January 2016, CLPPP worked with public and private partners in Flint with the goal of blood lead testing all Flint residents. In addition, CLPPP worked to increase and support active case management in Flint and Genesee County, and increase home lead abatement through the MDHHS HHS.

The CLPPP provided data and customized reports to government agencies, the media, the public and other community stakeholders to support their activities in monitoring and responding to community needs and legislative actions. During the height of the Flint Water Crisis, requests for data increased dramatically: the number of Freedom of Information Act (FOIA) requests went from about one every six months to one every week, and the number of subpoenas increased from about 30 per month to approximately 400 per month. CLPPP staffing was increased to meet these needs, from three full-time employees at the beginning of the Flint Water Crisis in 2014, to six in 2016.

In addition to activities by the MDHHS, other agencies within the State of Michigan have acted in response to the Flint Water Crisis with programs to increase water testing, remove lead service lines from homes in the affected area, and other programs to reduce exposure to lead in Flint. Governor Rick Snyder created the Child Lead Poisoning Elimination Board in 2016 to address the need for coordinated efforts to design a long-term strategy for eliminating child lead poisoning in Michigan.[20] The Board's recommendations focused on preventing children's exposure to lead by eliminating sources of lead in the environment. Many of the recommendations are being implemented in CLPPP, and will serve as guidelines for future improvements to child blood lead surveillance in Michigan.

2016 CLPPP Activities

Accomplishments

The Michigan CLPPP was very active during 2016. In addition to blood lead surveillance activities in Flint and throughout the state, CLPPP:

- Submitted and was awarded grant funding from the CDC for statewide childhood lead poisoning related activities
- Collaborated with the Division of Occupational and Environmental Medicine in the Michigan State University College of Human Medicine to continue the Adult Blood Lead Epidemiology and Surveillance (ABLES) program
- Monitored case management services for children in all Michigan counties and target communities
- Worked to encourage and support local efforts to increase blood lead testing rates, with primary focus on the target communities
- Provided and encouraged primary prevention activities in all Michigan counties for daycare facilities and other child caregivers, with special emphasis on the targeted communities

Challenges

CLPPP has faced a number of challenges:

Surveillance

- The number of children with EBLLs is based on those who are tested. These results likely are an underestimate because not all children are tested.
- The Flint Water Crisis illustrated the need for the CLPPP to routinely provide useful, timely, and comprehensive data. The increased demands on the Program have created a need for more resources for staffing, surveillance data management, and ongoing epidemiologic analyses.

Case definition and data quality

- Inclusion of counts of EBLLs based on capillary test results without confirmatory venous tests may lead to an overestimate of the count/percent of children with EBLLs because capillary tests are known to produce false positives. In 2016, slightly under 50% of the 5,724 children under the age of six with EBLLs did not have a confirmatory venous test.
- The CLPPP surveillance database did not have the ability to automatically geocode blood lead test data. The first step in geocoding a blood lead test result is to have an accurate address for the tested child, but the CLPPP data management system and the MDHHS Data Warehouse, where blood lead surveillance data are stored, did not have the capacity for automatic address validation when a blood lead test report was submitted. Consequently, any request to CLPPP for geocoding was conducted on a case-by-case basis, which involved CLPPP staff manually validating addresses, and then linking the validated addresses with geocoding databases. This has limited CLPPP's capacity to present blood lead surveillance data in maps.

What is Geocoding?

Geocoding is the process of assigning a specific location to an address so that it can be placed as a point on a map.

- The computer algorithm used to assign unique identifiers to each child in the MDHHS Data Warehouse is imperfect, due to differences in spelling of names, dates of birth and other information. When a child has more than one blood lead test, these identifiers are used to link each test result to that child. When the identifier linkage fails, some children may be counted more than once.
- The surveillance definition of an EBLL varies from state to state, and even within the CDC. These inconsistencies make it difficult to compare results between agencies. In this report, Michigan CLPPP reports the highest capillary test for a child if there was no venous test in 2016 data, while the CDC CLPPP reports the *lowest* capillary test if there was no venous test. The Michigan approach will identify a larger group of children that may have been exposed to lead than the CDC approach, and provides more inclusive data with which to target interventions.
- Each blood lead analyzer has a limit as to the lowest blood lead level it can detect with a reasonable degree of accuracy. This level is the Limit of Reporting (LoR). When a test result is reported as below the LoR, it does not mean that there is *no* lead in the sample, but that the level of lead is some value *below* the LoR. Laboratories report these test results with special notations (e.g., a test result of < 3 indicates that there were *less than* 3 µg/dL of lead in the sample).
    - The CLPPP surveillance database follows the requirements specified by Administrative Rule R 325.9082, which governs blood lead analysis and reporting in Michigan. The rule states that blood lead test results are to be reported as whole numbers, rounded to the nearest whole number, with no method of identifying test results that are below the LoR. For example, a test result below an LoR of 3 (< 3) is stored

in the surveillance database as a result of 3. An actual test result of 3 from the same laboratory is stored as a 3, and when test results are retrieved from the surveillance database, there is no way of determining if a test result of 3 from this laboratory is an actual test result or is a test result below the LoR.

- One issue that primarily affects scientific researchers is that, as noted above, the surveillance database did not have any method to identify test results that were below the LoR of the analyzers used by different laboratories. It is important to use the most accurate data possible for the statistical analysis of blood lead data. Ignoring the difference between the non-detects (LoR test results) and detections (actual tests results) will generate incorrect summary statistics.[21]
- The CLPPP surveillance database follows the requirements specified by Administrative Rule R 325.9082, which governs blood lead analysis and reporting in Michigan. The rule states that blood lead test results are to be reported as whole numbers, rounded to the nearest whole number, with no method of identifying test results that are below the LoR. For example, a test result below an LoR of 3 (< 3) is stored in the surveillance database as a result of 3. An actual test result of 3 from the same laboratory is stored as a 3, and when test results are retrieved from the surveillance database, there is no way of determining if a test result of 3 from this laboratory is an actual test result or is a test result below the LoR.

Case management and primary prevention

- Nursing case management for EBLL children is complex, and many health departments do not have sufficient resources needed to support their case management staff in providing NCM to all of their EBLL children and the activities that NCM includes.
- Because of the age of Michigan's housing stock, the number of children living in rental homes, and lack of funding for lead remediation, many Michigan children continue to be at risk of adverse health effects from exposure to lead. Primary prevention – eliminating sources of lead in the environment – is the most effective way to address the problem of elevated blood lead levels in children,[1,3,6,10] and the Child Lead Poisoning Elimination Board Report, issued to the public in November 2016, highlighted the critical importance of primary prevention.[20]

Recommendations and Future Steps

Based on the challenges outlined above, the following general recommendations and steps are planned:

Improving the completeness, accuracy, and timeliness of the surveillance system, by implementing a modernized data management system and automating the process of receiving and compiling reports from laboratories

- CLPPP, in partnership with the Michigan Public Health Institute, has completed development of MiCLPS, a web-based surveillance data application with significantly enhanced functionality. In 2018, MiCLPS will replace the current data management system which has been used since 1998. In addition to the tasks performed by the previous data management system, MiCLPS provides several significant features:
  - The search and reporting capacities of MiCLPS are greatly expanded from the previous data management system and will include the ability to generate information to use to assess the quality of data being submitted by laboratories to CLPPP.
  - MiCLPS will be capable of automatic address validation, which will allow CLPPP staff to inform laboratories about address issues that can be resolved in a timely manner. In addition, MiCLPS will geocode validated addresses, which will be a significant improvement in the content of the surveillance database.

- CLPPP is now conducting regular analysis and dissemination of surveillance data, with the goal of identifying high-risk communities for targeted surveillance. These analyses include the identification of other factors (e.g., socioeconomic factors associated with EBLL) that can be used to identify potential EBLL cases and high-risk groups, to initiate investigation and follow-up by CLPPP and other health care partners.
- CLPPP will begin initiatives to improve data quality by utilizing database management tools for data quality validation and assurance. One program that will be implemented in 2018 will be producing 'report cards' for laboratories that submit data to CLPPP. These quarterly report cards will report the number of test results submitted by labs, and will include the number of test results that did not meet state-mandated reporting requirements (e.g., missing date of birth, invalid addresses).

Partnering with other agencies to increase screening rates, and increase the proportion of children with EBLLs based on capillary tests receiving a confirmatory venous test

- CLPPP is working with Medicaid, health care providers, and LHDs to stress the importance of the confirmatory venous blood tests.
- The Flint Water Crisis dramatically increased the number of people (children and adults) tested in 2016. Recommendations by the Child Lead Poisoning Elimination Board include statewide universal blood lead testing at the ages of 9-12 months and 24-36 months to ensure that every child with an EBL receives treatment, case management, and monitoring.[10] CLPPP will be developing strategies to address this recommendation.

Launching a new program to increase reimbursement to LHDs for the provision of in-home nursing case management to Medicaid children with EBLLs, supported by training and technical assistance from MDHHS CLPPP

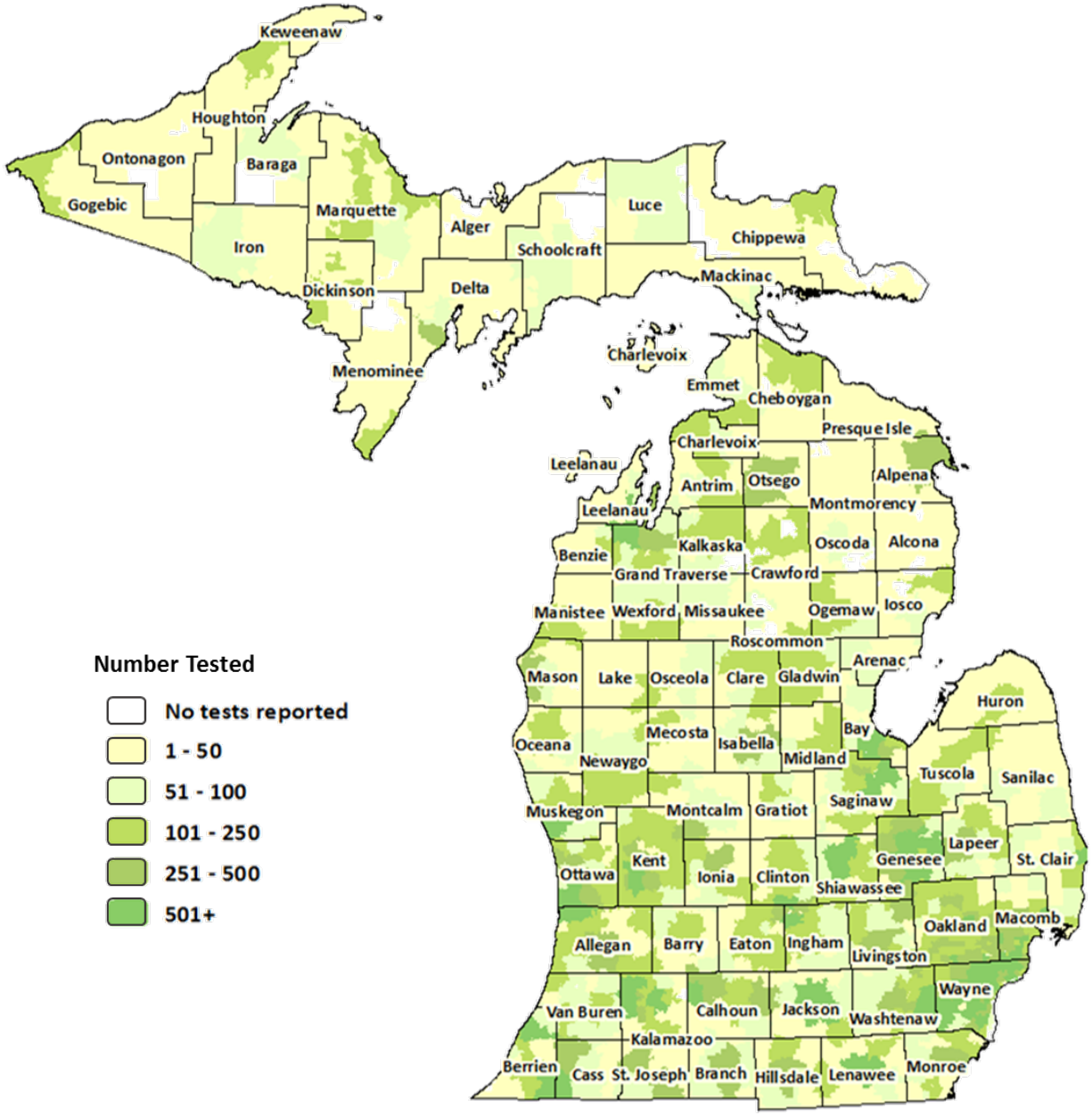
- All local health departments are eligible to be reimbursed for in-home NCM for Medicaid children with venous confirmed EBLLs starting January 1, 2017.

Collaborating with the MDHHS LSHP as LSHP implements a major expansion of their programs to offer environmental inspection services and financial support for home lead abatement

- BLL surveillance data will be critical in identifying a long-term statewide strategy to help prevent some of Michigan's most vulnerable residents from being exposed to lead from all sources, as recommended by the Governor's Child Lead Poisoning Elimination Board .[1]

The 2016 Annual Report: Figures and Tables

Figure 1. Number of children under age six tested for lead in Michigan, by zip code area, 2016



Source: MDHHS Data Warehouse

October 9, 2017

Figure 2. Number of children under age six tested for lead, and number of children with elevated blood lead levels in Michigan, 1998 – 2016

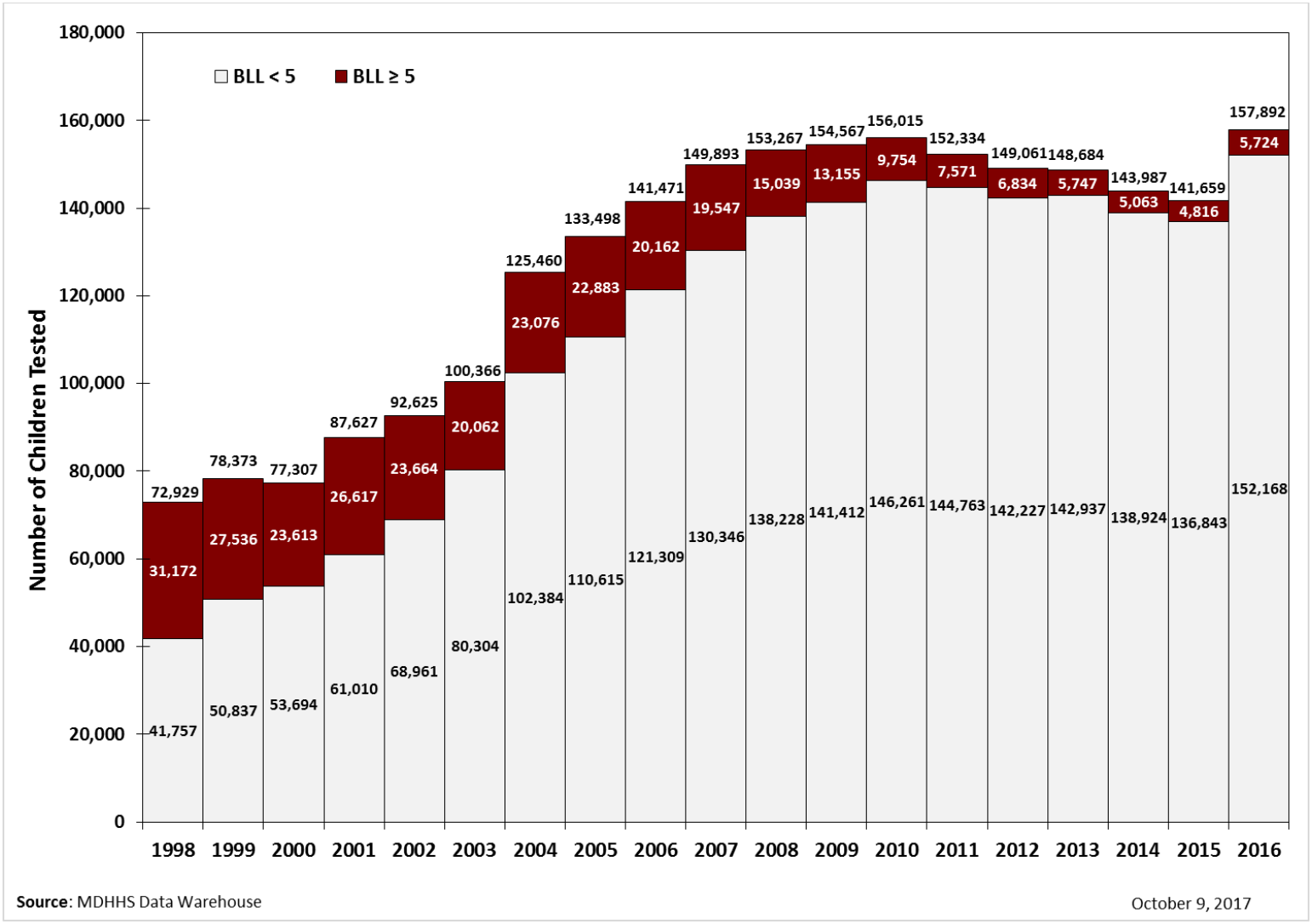


Figure 3. Percentage of children under age six with elevated blood lead levels, and percentage of children with elevated blood lead levels based on venous blood tests, Michigan, 1998 – 2016

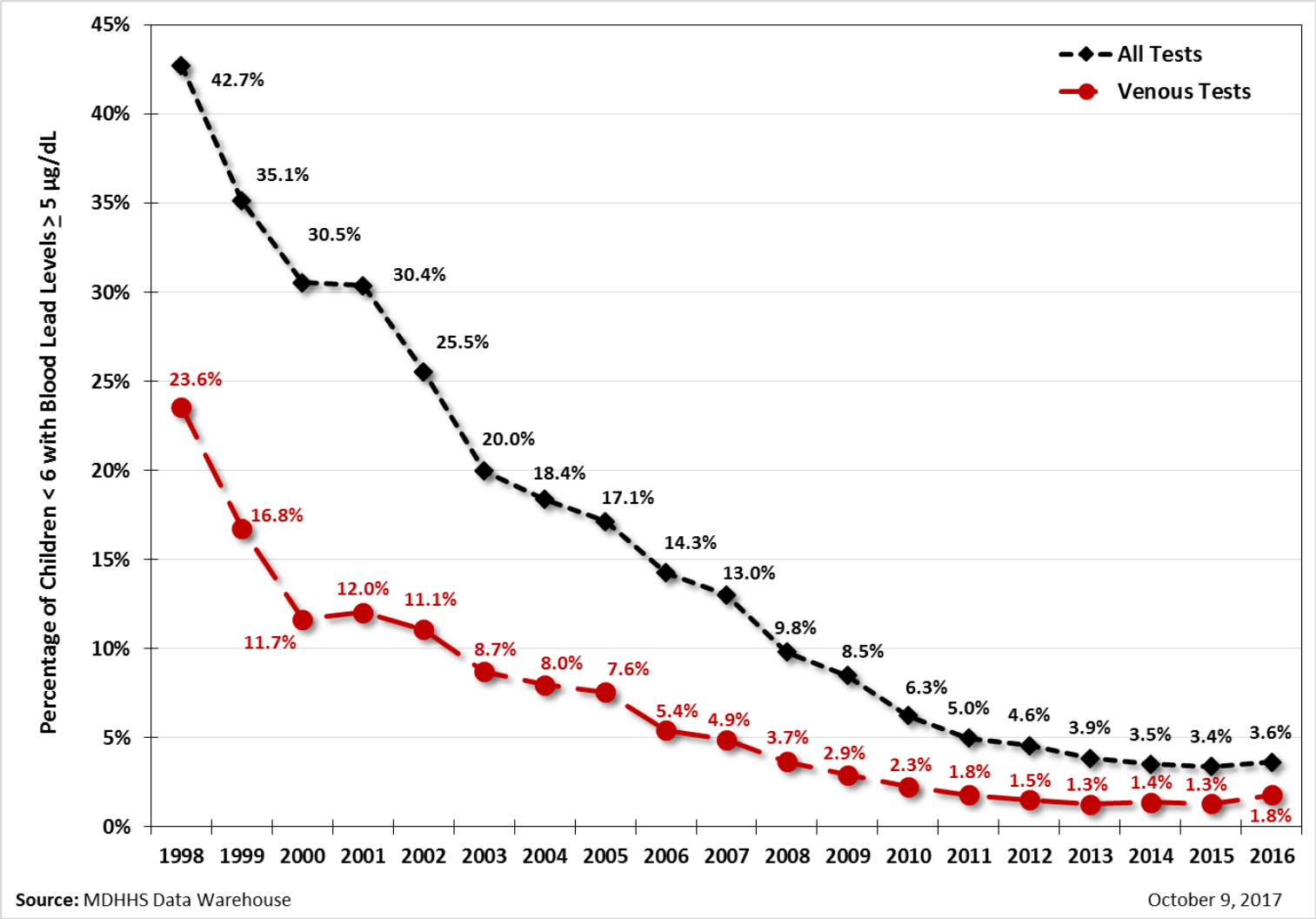
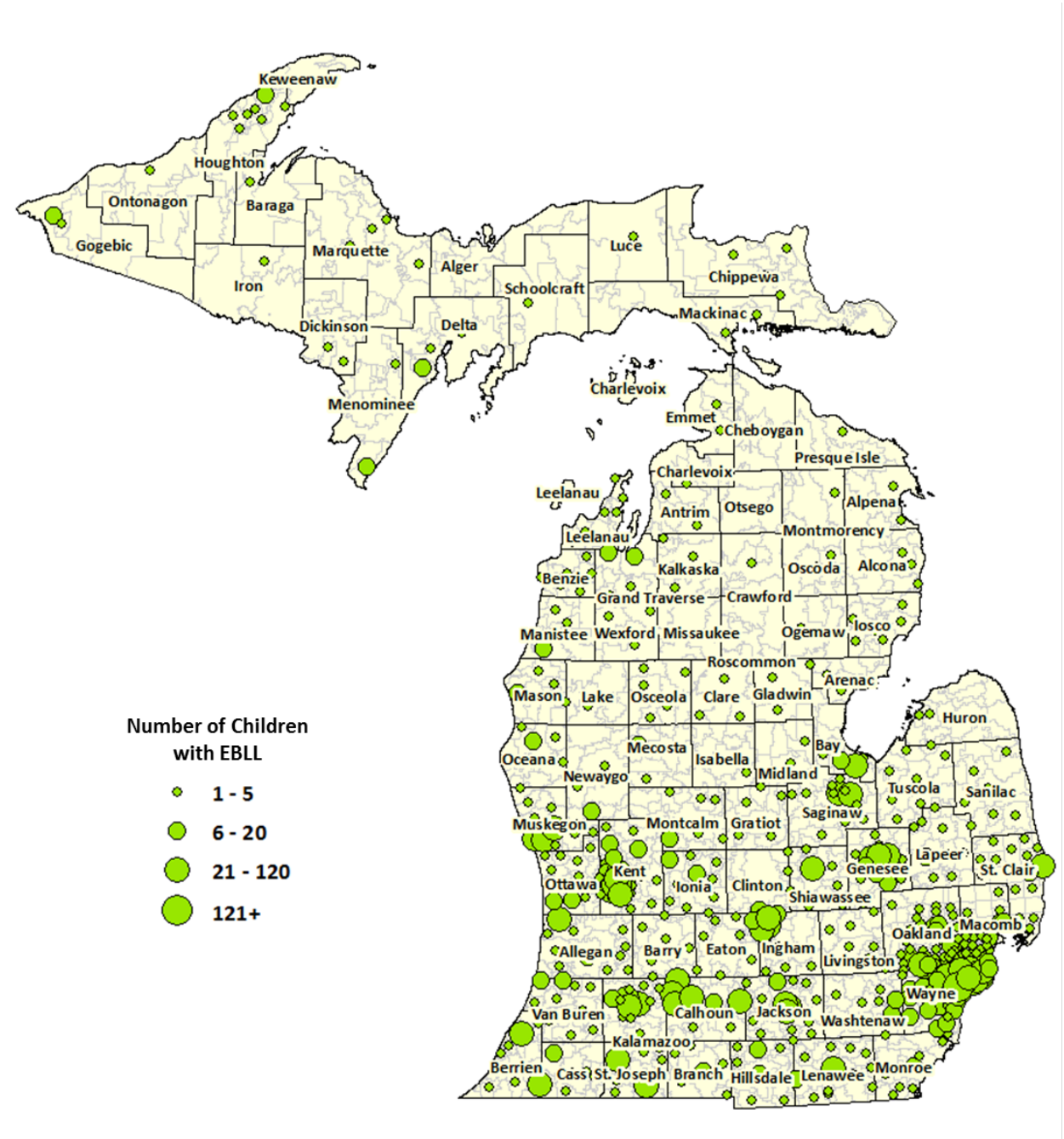


Figure 4: Number of children under age six with elevated blood lead levels (≥ 5 µg/dL) in Michigan, by zip code area, 2016



Source: MDHHS Data Warehouse October 9, 2017

Figure 5: Number of children under age six, tested for lead, 1998 – 2016, by Medicaid enrollment status

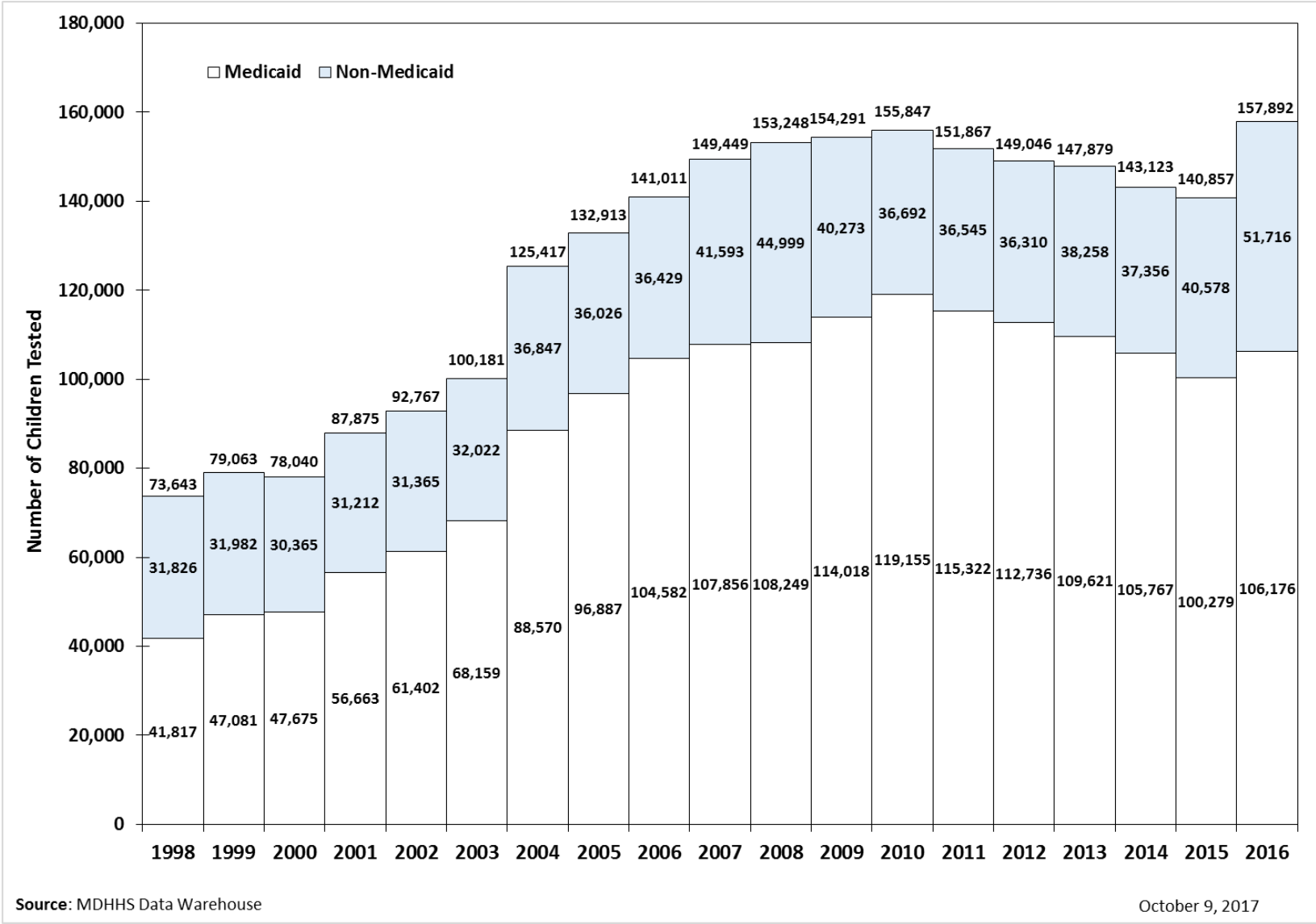


Figure 6: Number of children ages one and two, tested for lead, 1998 – 2016, by Medicaid enrollment status

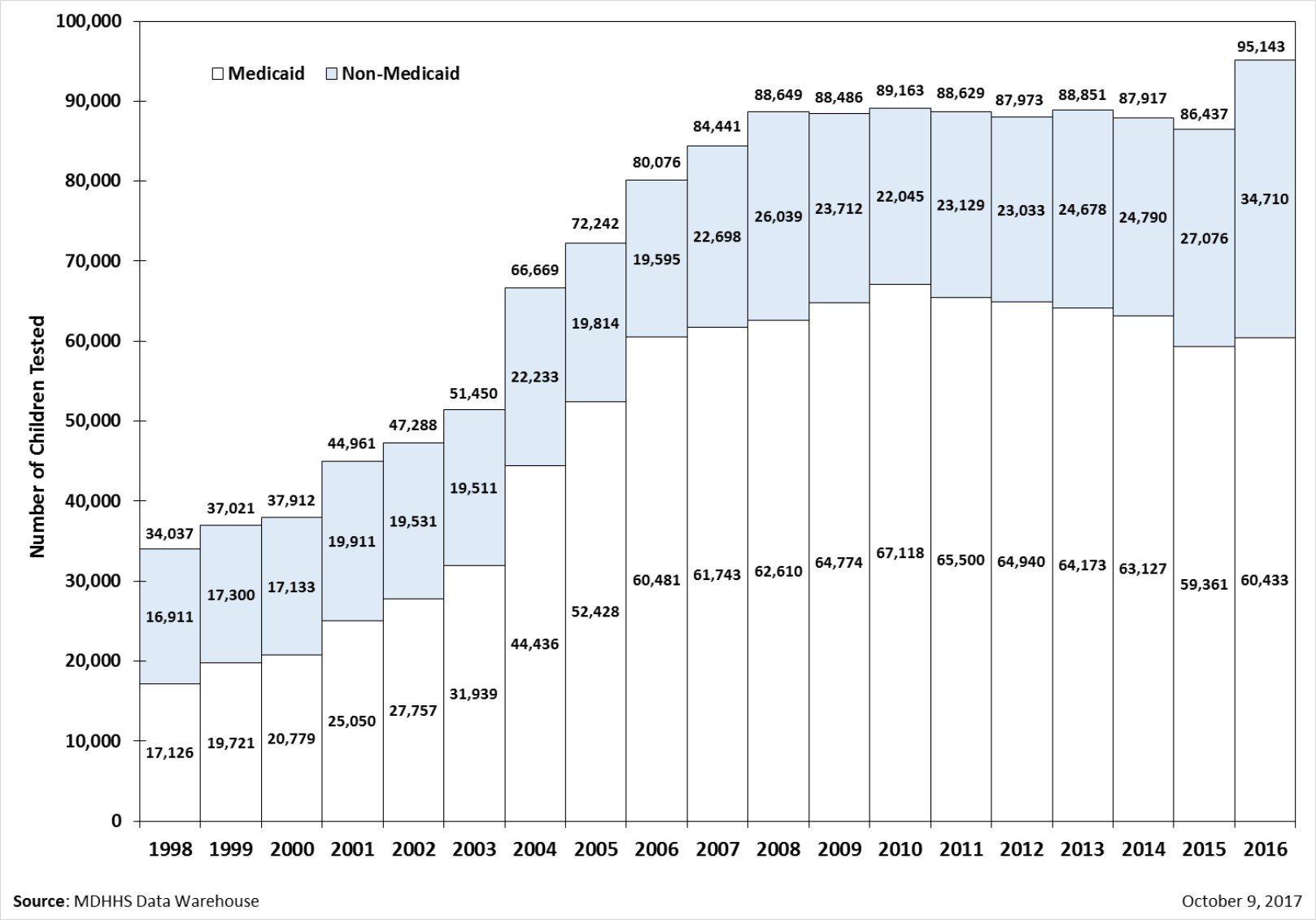


Table 1. Blood lead levels for children under age six by county, 2016, data suppressed*

CHILDREN UNDER 6	Housing[a]		Population[a]	All Blood Samples[†]				Capillary[†]		Venous					
				Tested		≥ 5 µg/dL		≥ 5 µg/dL		≥ 5 µg/dL		5-14 µg/dL		≥ 15 µg/dL	
County	% Pre-1950	% Pre-1980		N	% of Pop	N	% of Tested	N	% of Tested	N	% of Tested	N	% of Tested	N	% of Tested
ALCONA	14.7	67.6	414	93	22.5	*	-	*	-	*	-	*	-	0	0.0
ALGER	21.8	58.9	441	65	14.7	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
ALLEGAN	22.5	52.3	8,431	1,583	18.8	40	2.5	24	1.5	16	1.0	*	-	*	-
ALPENA	23.3	73.8	1,604	348	21.7	6	1.7	*	-	*	-	*	-	*	-
ANTRIM	17.0	52.3	1,179	322	27.3	*	-	*	-	*	-	*	-	0	0.0
ARENAC	15.6	58.9	784	265	33.8	*	-	*	-	*	-	*	-	0	0.0
BARAGA	27.2	67.2	477	147	30.8	*	-	*	-	0	0.0	0	0.0	0	0.0
BARRY	24.9	58.2	3,770	466	12.4	16	3.4	7	1.5	9	1.9	*	-	*	-
BAY	32.6	77.1	6,542	1,492	22.8	50	3.4	34	2.3	16	1.1	16	1.1	0	0.0
BENZIE	18.2	45.9	954	282	29.6	7	2.5	*	-	*	-	*	-	0	0.0
BERRIEN	26.0	70.3	11,248	2,166	19.3	76	3.5	41	1.9	35	1.6	29	1.3	6	0.3
BRANCH	29.6	64.0	3,195	672	21.0	26	3.9	14	2.1	12	1.8	*	-	*	-
CALHOUN	32.6	75.2	9,881	2,735	27.7	174	6.4	74	2.7	100	3.7	90	3.3	10	0.4
CASS	21.4	62.2	3,173	609	19.2	28	4.6	17	2.8	11	1.8	*	-	*	-
CHARLEVOIX	19.6	56.0	1,542	300	19.5	*	-	*	-	0	0.0	0	0.0	0	0.0
CHEBOYGAN	21.7	56.7	1,269	265	20.9	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0

Table 1. Blood lead levels for children under age six by county, 2016, data suppressed*

CHILDREN UNDER 6	Housing[a]		Population[a]	All Blood Samples[†]				Capillary[†]		Venous					
				Tested		≥ 5 µg/dL		≥ 5 µg/dL		≥ 5 µg/dL		5-14 µg/dL		≥ 15 µg/dL	
County	% Pre-1950	% Pre-1980		N	% of Pop	N	% of Tested	N	% of Tested	N	% of Tested	N	% of Tested	N	% of Tested
CHIPPEWA	20.3	58.3	2,259	348	15.4	8	2.3	*	-	*	-	*	-	0	0.0
CLARE	11.7	60.3	1,909	391	20.5	8	2.0	*	-	*	-	*	-	0	0.0
CLINTON	20.1	51.1	4,937	739	15.0	6	0.8	*	-	*	-	*	-	0	0.0
CRAWFORD	10.9	56.6	665	145	21.8	*	-	*	-	0	0.0	0	0.0	0	0.0
DELTA	32.8	69.8	2,259	414	18.3	13	3.1	*	-	*	-	*	-	0	0.0
DICKINSON	37.1	72.1	1,517	242	16.0	*	-	*	-	*	-	*	-	0	0.0
EATON	19.8	58.6	7,608	1,154	15.2	30	2.6	14	1.2	16	1.4	*	-	*	-
EMMET	21.6	48.0	1,811	332	18.3	*	-	*	-	*	-	*	-	0	0.0
GENESEE	19.1	70.3	30,328	11,703	38.6	210	1.8	64	0.5	146	1.2	126	1.1	20	0.2
GLADWIN	10.9	54.5	1,533	302	19.7	*	-	*	-	*	-	*	-	0	0.0
GOGEBIC	45.3	74.2	732	192	26.2	7	3.6	*	-	*	-	*	-	*	-
GRAND TRAVERSE	14.4	44.0	5,839	1,430	24.5	20	1.4	*	-	*	-	*	-	*	-
GRATIOT	34.3	70.3	2,522	513	20.3	11	2.1	*	-	*	-	*	-	0	0.0
HILLSDALE	33.1	64.8	3,108	888	28.6	42	4.7	27	3.0	15	1.7	*	-	*	-
HOUGHTON	47.4	73.8	2,358	562	23.8	21	3.7	*	-	*	-	*	-	0	0.0
HURON	28.1	67.6	1,864	409	21.9	*	-	*	-	*	-	*	-	0	0.0
INGHAM	23.9	69.0	19,215	4,712	24.5	123	2.6	52	1.1	71	1.5	63	1.3	8	0.2
IONIA	31.8	61.4	4,590	980	21.4	27	2.8	8	0.8	19	1.9	*	-	*	-
IOSCO	19.0	69.6	1,290	263	20.4	9	3.4	*	-	*	-	*	-	*	-

Table 1. Blood lead levels for children under age six by county, 2016, data suppressed*

CHILDREN UNDER 6	Housing[a]		Population[a]	All Blood Samples[†]				Capillary[†]		Venous					
				Tested		≥ 5 µg/dL		≥ 5 µg/dL		≥ 5 µg/dL		5-14 µg/dL		≥ 15 µg/dL	
County	% Pre-1950	% Pre-1980		N	% of Pop	N	% of Tested	N	% of Tested	N	% of Tested	N	% of Tested	N	% of Tested
IRON	42.5	71.5	609	107	17.6	*	-	*	-	*	-	*	-	0	0.0
ISABELLA	14.9	48.3	4,025	610	15.2	*	-	*	-	*	-	*	-	0	0.0
JACKSON	28.9	67.8	11,140	2,879	25.8	218	7.6	142	4.9	76	2.6	69	2.4	7	0.2
KALAMAZOO	21.0	61.7	18,683	3,727	19.9	132	3.5	88	2.4	44	1.2	38	1.0	6	0.2
KALKASKA	12.1	50.2	1,126	241	21.4	8	3.3	*	-	*	-	*	-	0	0.0
KENT	22.8	59.8	52,891	9,984	18.9	617	6.2	412	4.1	205	2.1	176	1.8	29	0.3
KEWEENAW	46.0	68.9	129	33	25.6	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
LAKE	10.9	50.8	590	102	17.3	*	-	*	-	0	0.0	0	0.0	0	0.0
LAPEER	17.9	55.0	5,536	1,014	18.3	32	3.2	26	2.6	6	0.6	*	-	*	-
LEELANAU	15.8	46.2	1,030	279	27.1	13	4.7	*	-	*	-	*	-	0	0.0
LENAWEE	31.5	66.7	6,430	1,164	18.1	71	6.1	26	2.2	45	3.9	38	3.3	7	0.6
LIVINGSTON	10.6	42.2	11,652	1,030	8.8	11	1.1	*	-	*	-	*	-	*	-
LUCE	20.9	60.5	334	76	22.8	*	-	*	-	0	0.0	0	0.0	0	0.0
MACKINAC	23.1	55.6	534	107	20.0	*	-	*	-	0	0.0	0	0.0	0	0.0
MACOMB	9.3	61.2	56,757	11,769	20.7	99	0.8	57	0.5	42	0.4	*	-	*	-
MANISTEE	27.6	61.8	1,250	334	26.7	17	5.1	*	-	*	-	*	-	0	0.0
MARQUETTE	29.0	73.6	4,058	546	13.5	7	1.3	*	-	*	-	*	-	0	0.0
MASON	26.1	59.6	1,853	511	27.6	19	3.7	*	-	*	-	*	-	0	0.0
MECOSTA	16.1	51.7	2,519	381	15.1	8	2.1	*	-	*	-	*	-	*	-

Table 1. Blood lead levels for children under age six by county, 2016, data suppressed*

CHILDREN UNDER 6	Housing[a]		Population[a]	All Blood Samples[†]				Capillary[†]		Venous					
				Tested		≥ 5 µg/dL		≥ 5 µg/dL		≥ 5 µg/dL		5-14 µg/dL		≥ 15 µg/dL	
County	% Pre-1950	% Pre-1980		N	% of Pop	N	% of Tested	N	% of Tested	N	% of Tested	N	% of Tested	N	% of Tested
MENOMINEE	32.3	66.3	1,342	254	18.9	8	3.1	*	-	*	-	*	-	*	-
MIDLAND	12.8	60.3	5,338	505	9.5	*	-	*	-	*	-	*	-	0	0.0
MISSAUKEE	16.4	56.2	1,103	117	10.6	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
MONROE	22.6	60.9	10,109	1,432	14.2	22	1.5	7	0.5	15	1.0	*	-	*	-
MONTCALM	23.9	58.1	4,352	833	19.1	15	1.8	9	1.1	6	0.7	*	-	*	-
MONTMORENCY	10.3	64.7	429	78	18.2	*	-	*	-	0	0.0	0	0.0	0	0.0
MUSKEGON	27.6	68.0	12,940	2,612	20.2	157	6.0	89	3.4	68	2.6	60	2.3	8	0.3
NEWAYGO	17.9	51.5	3,385	477	14.1	12	2.5	*	-	*	-	*	-	0	0.0
OAKLAND	14.0	62.8	81,661	15,882	19.4	196	1.2	108	0.7	88	0.6	82	0.5	6	0.0
OCEANA	21.9	54.3	1,887	477	25.3	13	2.7	*	-	*	-	*	-	0	0.0
OGEMAW	15.6	60.0	1,237	271	21.9	*	-	*	-	0	0.0	0	0.0	0	0.0
ONTONAGON	39.0	74.0	161	42	26.1	*	-	0	0.0	*	-	*	-	0	0.0
OSCEOLA	17.3	58.1	1,576	325	20.6	9	2.8	*	-	*	-	*	-	0	0.0
OSCODA	12.7	67.1	450	109	24.2	*	-	*	-	0	0.0	0	0.0	0	0.0
OTSEGO	9.3	51.8	1,627	397	24.4	*	-	0	0.0	*	-	*	-	0	0.0
OTTAWA	14.1	45.3	20,968	3,081	14.7	57	1.9	41	1.3	16	0.5	*	-	*	-
PRESQUE ISLE	21.0	66.5	582	97	16.7	*	-	*	-	0	0.0	0	0.0	0	0.0
ROSCOMMON	9.3	60.8	952	176	18.5	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
SAGINAW	25.2	76.4	13,455	3,470	25.8	92	2.7	67	1.9	25	0.7	*	-	*	-

Table 1. Blood lead levels for children under age six by county, 2016, data suppressed*

CHILDREN UNDER 6	Housing[a]		Population[a]	All Blood Samples[†]				Capillary[†]		Venous					
				Tested		≥ 5 µg/dL		≥ 5 µg/dL		≥ 5 µg/dL		5-14 µg/dL		≥ 15 µg/dL	
County	% Pre-1950	% Pre-1980		N	% of Pop	N	% of Tested	N	% of Tested	N	% of Tested	N	% of Tested	N	% of Tested
SAINT CLAIR	25.1	61.6	10,224	2,941	28.8	152	5.2	123	4.2	29	1.0	22	0.7	7	0.2
SAINT JOSEPH	26.2	67.6	4,909	1,052	21.4	67	6.4	53	5.0	14	1.3	8	0.8	6	0.6
SANILAC	29.3	65.4	2,771	356	12.8	10	2.8	*	-	*	-	*	-	0	0.0
SCHOOLCRAFT	24.8	61.3	489	84	17.2	*	-	*	-	0	0.0	0	0.0	0	0.0
SHIAWASSEE	30.3	70.1	4,206	1,451	34.5	49	3.4	30	2.1	19	1.3	*	-	*	-
TUSCOLA	28.4	70.4	3,307	902	27.3	17	1.9	8	0.9	9	1.0	9	1.0	0	0.0
VAN BUREN	25.1	60.7	5,475	966	17.6	42	4.3	26	2.7	16	1.7	16	1.7	0	0.0
WASHTENAW	16.9	56.4	21,875	3,207	14.7	32	1.0	15	0.5	17	0.5	*	-	*	-
WAYNE, excluding Detroit	21.1	76.6	80,037	19,857	24.8	425	2.1	205	1.0	220	1.1	198	1.0	22	0.1
WAYNE, Detroit only	58.0	91.9	58,565	23,662	40.4	2,073	8.8	683	2.9	1,390	5.9	1,252	5.3	138	0.6
WEXFORD	21.3	58.1	2,439	356	14.6	7	2.0	*	-	*	-	*	-	*	-
MICHIGAN	**23.1**	**65.8**	**690,245**	**157,892**	**22.9**	**5,724**	**3.6**	**2,792**	**1.8**	**2,932**	**1.9**	**2,614**	**1.7**	**318**	**0.2**

* Suppression of non-zero counts less than six (6), and complementary suppression of values 6 and greater so that suppressed values cannot be calculated

- Percentage for suppressed counts

[†] Includes tests where the type of sample was not reported

[a] U.S. Census American Community Survey 2016 5-year population estimates (table B25034 – Housing; table B09001 – Population)

Table 2. Blood lead levels for children ages one and two by county, 2016, data suppressed*

CHILDREN ONE AND TWO	Housing[a]		Population[b]	All Blood Samples[†]				Capillary[†]		Venous					
				Tested		≥ 5 µg/dL		≥ 5 µg/dL		≥ 5 µg/dL		5-14 µg/dL		≥ 15 µg/dL	
County	% Pre-1950	% Pre-1980		N	% of Pop	N	% of Tested	N	% of Tested	N	% of Tested	N	% of Tested	N	% of Tested
ALCONA	14.7	67.6	108	57	52.8	*	-	*	-	0	0.0	0	0.0	0	0.0
ALGER	21.8	58.9	136	50	36.8	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
ALLEGAN	22.5	52.3	2,890	1,075	37.2	20	1.9	10	0.9	10	0.9	*	-	*	-
ALPENA	23.3	73.8	576	273	47.4	*	-	*	-	*	-	*	-	*	-
ANTRIM	17.0	52.3	423	209	49.4	*	-	*	-	*	-	*	-	0	0.0
ARENAC	15.6	58.9	283	174	61.5	*	-	*	-	0	0.0	0	0.0	0	0.0
BARAGA	27.2	67.2	141	97	68.8	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
BARRY	24.9	58.2	1,299	339	26.1	13	3.8	*	-	*	-	*	-	*	-
BAY	32.6	77.1	2,123	1,213	57.1	42	3.5	28	2.3	14	1.2	14	1.2	0	0.0
BENZIE	18.2	45.9	326	189	58.0	*	-	*	-	*	-	*	-	0	0.0
BERRIEN	26.0	70.3	3,639	1,469	40.4	47	3.2	22	1.5	25	1.7	*	-	*	-
BRANCH	29.6	64.0	1,049	284	27.1	14	4.9	*	-	*	-	*	-	*	-
CALHOUN	32.6	75.2	3,413	1,549	45.4	101	6.5	33	2.1	68	4.4	62	4.0	6	0.4
CASS	21.4	62.2	1,048	515	49.1	18	3.5	12	2.3	6	1.2	*	-	*	-
CHARLEVOIX	19.6	56.0	430	188	43.7	*	-	*	-	0	0.0	0	0.0	0	0.0
CHEBOYGAN	21.7	56.7	431	195	45.2	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
CHIPPEWA	20.3	58.3	757	221	29.2	8	3.6	*	-	*	-	*	-	0	0.0
CLARE	11.7	60.3	638	307	48.1	6	2.0	*	-	*	-	*	-	0	0.0

Table 2. Blood lead levels for children ages one and two by county, 2016, data suppressed*

CHILDREN ONE AND TWO	Housing[a]		Population[b]	All Blood Samples[†]				Capillary[†]		Venous					
				Tested		≥ 5 µg/dL		≥ 5 µg/dL		≥ 5 µg/dL		5-14 µg/dL		≥ 15 µg/dL	
County	% Pre-1950	% Pre-1980		N	% of Pop	N	% of Tested	N	% of Tested	N	% of Tested	N	% of Tested	N	% of Tested
CLINTON	20.1	51.1	1,667	441	26.5	*	-	*	-	*	-	*	-	0	0.0
CRAWFORD	10.9	56.6	258	101	39.1	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
DELTA	32.8	69.8	766	356	46.5	13	3.7	*	-	*	-	*	-	0	0.0
DICKINSON	37.1	72.1	495	217	43.8	*	-	*	-	*	-	*	-	0	0.0
EATON	19.8	58.6	2,440	784	32.1	24	3.1	10	1.3	14	1.8	*	-	*	-
EMMET	21.6	48.0	656	238	36.3	*	-	*	-	*	-	*	-	0	0.0
GENESEE	19.1	70.3	9,850	5,474	55.6	98	1.8	33	0.6	65	1.2	54	1.0	11	0.2
GLADWIN	10.9	54.5	510	216	42.4	*	-	0	0.0	*	-	*	-	0	0.0
GOGEBIC	45.3	74.2	244	144	59.0	7	4.9	*	-	*	-	*	-	*	-
GRAND TRAVERSE	14.4	44.0	1,967	967	49.2	18	1.9	*	-	*	-	*	-	*	-
GRATIOT	34.3	70.3	811	330	40.7	7	2.1	*	-	*	-	*	-	0	0.0
HILLSDALE	33.1	64.8	1,100	400	36.4	25	6.3	17	4.3	8	2.0	8	2.0	0	0.0
HOUGHTON	47.4	73.8	733	518	70.7	16	3.1	*	-	*	-	*	-	0	0.0
HURON	28.1	67.6	581	263	45.3	*	-	*	-	0	0.0	0	0.0	0	0.0
INGHAM	23.9	69.0	6,605	2,676	40.5	87	3.3	41	1.5	46	1.7	*	-	*	-
IONIA	31.8	61.4	1,463	770	52.6	18	2.3	6	0.8	12	1.6	*	-	*	-
IOSCO	19.0	69.6	470	180	38.3	9	5.0	*	-	*	-	*	-	*	-
IRON	42.5	71.5	201	89	44.3	*	-	*	-	0	0.0	0	0.0	0	0.0

Table 2. Blood lead levels for children ages one and two by county, 2016, data suppressed*

CHILDREN ONE AND TWO	Housing[a]		Population[b]	All Blood Samples[†]				Capillary[†]		Venous					
				Tested		≥ 5 µg/dL		≥ 5 µg/dL		≥ 5 µg/dL		5-14 µg/dL		≥ 15 µg/dL	
County	% Pre-1950	% Pre-1980		N	% of Pop	N	% of Tested	N	% of Tested	N	% of Tested	N	% of Tested	N	% of Tested
ISABELLA	14.9	48.3	1,362	432	31.7	*	-	*	-	*	-	*	-	0	0.0
JACKSON	28.9	67.8	3,646	2,167	59.4	165	7.6	108	5.0	57	2.6	*	-	*	-
KALAMAZOO	21.0	61.7	6,268	2,239	35.7	91	4.1	56	2.5	35	1.6	*	-	*	-
KALKASKA	12.1	50.2	354	155	43.8	6	3.9	*	-	*	-	*	-	0	0.0
KENT	22.8	59.8	17,871	7,937	44.4	461	5.8	320	4.0	141	1.8	121	1.5	20	0.3
KEWEENAW	46.0	68.9	36	29	80.6	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
LAKE	10.9	50.8	193	71	36.8	*	-	*	-	0	0.0	0	0.0	0	0.0
LAPEER	17.9	55.0	1,733	778	44.9	25	3.2	*	-	*	-	*	-	*	-
LEELANAU	15.8	46.2	345	166	48.1	11	6.6	*	-	*	-	*	-	0	0.0
LENAWEE	31.5	66.7	2,185	761	34.8	50	6.6	20	2.6	30	3.9	*	-	*	-
LIVINGSTON	10.6	42.2	3,875	768	19.8	7	0.9	*	-	*	-	*	-	*	-
LUCE	20.9	60.5	106	68	64.2	*	-	*	-	0	0.0	0	0.0	0	0.0
MACKINAC	23.1	55.6	171	95	55.6	*	-	*	-	0	0.0	0	0.0	0	0.0
MACOMB	9.3	61.2	19,501	7,568	38.8	61	0.8	37	0.5	24	0.3	*	-	*	-
MANISTEE	27.6	61.8	391	270	69.1	14	5.2	*	-	*	-	*	-	0	0.0
MARQUETTE	29.0	73.6	1,234	457	37.0	6	1.3	*	-	*	-	*	-	0	0.0
MASON	26.1	59.6	619	160	25.8	*	-	*	-	0	0.0	0	0.0	0	0.0
MECOSTA	16.1	51.7	826	238	28.8	*	-	*	-	*	-	*	-	0	0.0
MENOMINEE	32.3	66.3	439	206	46.9	7	3.4	*	-	*	-	*	-	*	-

Table 2. Blood lead levels for children ages one and two by county, 2016, data suppressed*

CHILDREN ONE AND TWO	Housing[a]		Population[b]	All Blood Samples[†]				Capillary[†]		Venous					
				Tested		≥ 5 µg/dL		≥ 5 µg/dL		≥ 5 µg/dL		5-14 µg/dL		≥ 15 µg/dL	
County	% Pre-1950	% Pre-1980		N	% of Pop	N	% of Tested	N	% of Tested	N	% of Tested	N	% of Tested	N	% of Tested
MIDLAND	12.8	60.3	1,817	320	17.6	*	-	0	0.0	*	-	*	-	0	0.0
MISSAUKEE	16.4	56.2	385	100	26.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
MONROE	22.6	60.9	3,162	1,004	31.8	16	1.6	*	-	*	-	*	-	*	-
MONTCALM	23.9	58.1	1,442	529	36.7	12	2.3	*	-	*	-	*	-	*	-
MONTMORENCY	10.3	64.7	121	55	45.5	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
MUSKEGON	27.6	68.0	4,260	1,722	40.4	94	5.5	51	3.0	43	2.5	*	-	*	-
NEWAYGO	17.9	51.5	1,150	359	31.2	8	2.2	*	-	*	-	*	-	0	0.0
OAKLAND	14.0	62.8	27,437	9,067	33.0	113	1.2	63	0.7	50	0.6	*	-	*	-
OCEANA	21.9	54.3	554	279	50.4	*	-	*	-	*	-	*	-	0	0.0
OGEMAW	15.6	60.0	368	176	47.8	*	-	*	-	0	0.0	0	0.0	0	0.0
ONTONAGON	39.0	74.0	48	35	72.9	*	-	0	0.0	*	-	*	-	0	0.0
OSCEOLA	17.3	58.1	528	223	42.2	6	2.7	*	-	*	-	*	-	0	0.0
OSCODA	12.7	67.1	178	66	37.1	*	-	*	-	0	0.0	0	0.0	0	0.0
OTSEGO	9.3	51.8	536	226	42.2	*	-	0	0.0	*	-	*	-	0	0.0
OTTAWA	14.1	45.3	7,179	2,557	35.6	48	1.9	35	1.4	13	0.5	*	-	*	-
PRESQUE ISLE	21.0	66.5	199	77	38.7	*	-	*	-	0	0.0	0	0.0	0	0.0
ROSCOMMON	9.3	60.8	338	156	46.2	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
SAGINAW	25.2	76.4	4,426	2,528	57.1	62	2.5	45	1.8	17	0.7	*	-	*	-
SAINT CLAIR	25.1	61.6	3,176	1,609	50.7	76	4.7	55	3.4	21	1.3	*	-	*	-

Table 2. Blood lead levels for children ages one and two by county, 2016, data suppressed*

CHILDREN ONE AND TWO	Housing[a]		Population[b]	All Blood Samples[†]				Capillary[†]		Venous					
				Tested		≥ 5 µg/dL		≥ 5 µg/dL		≥ 5 µg/dL		5-14 µg/dL		≥ 15 µg/dL	
County	% Pre-1950	% Pre-1980		N	% of Pop	N	% of Tested	N	% of Tested	N	% of Tested	N	% of Tested	N	% of Tested
SAINT JOSEPH	26.2	67.6	1,616	707	43.8	54	7.6	42	5.9	12	1.7	6	0.8	6	0.8
SANILAC	29.3	65.4	915	165	18.0	*	-	*	-	0	0.0	0	0.0	0	0.0
SCHOOLCRAFT	24.8	61.3	122	63	51.6	*	-	*	-	0	0.0	0	0.0	0	0.0
SHIAWASSEE	30.3	70.1	1,471	824	56.0	38	4.6	24	2.9	14	1.7	*	-	*	-
TUSCOLA	28.4	70.4	1,127	616	54.7	13	2.1	6	1.0	7	1.1	7	1.1	0	0.0
VAN BUREN	25.1	60.7	1,844	610	33.1	21	3.4	10	1.6	11	1.8	11	1.8	0	0.0
WASHTENAW	16.9	56.4	7,275	2,313	31.8	24	1.0	9	0.4	15	0.6	*	-	*	-
WAYNE[c]	21.1	76.6	46,418	21,339	46.0	1,357	6.4	489	2.3	868	4.1	769	3.6	99	0.5
WEXFORD	21.3	58.1	838	285	34.0	*	-	*	-	*	-	*	-	*	-
MICHIGAN	**23.1**	**65.8**	**230,612**	**95,143**	**41.3**	**3,508**	**3.7**	**1,766**	**1.9**	**1,742**	**1.8**	**1,534**	**1.6**	**208**	**0.2**

* Suppression of non-zero counts less than six (6), and complementary suppression of values 6 and greater so that suppressed values cannot be calculated

- Percentage for suppressed counts

[†] Includes tests where the type of sample was not reported

[a] U.S. Census American Community Survey 2016 5-year population estimates table B25034

[b] CDC National Center for Health Care Statistics 2016 Vintage Bridged-Race Postcensal Population Estimate

[c] No breakdown for Detroit - estimate for the population of Detroit is not available from the CDC National Center for Health Statistics

Table 3. Blood lead levels for children under age six enrolled in Medicaid‡ by county, 2016, data suppressed*

CHILDREN UNDER 6	Housing[a]		Population[a]	All Blood Samples†				Capillary†		Venous					
				Tested		≥ 5 µg/dL		≥ 5 µg/dL		≥ 5 µg/dL		5-14 µg/dL		≥ 15 µg/dL	
County	% Pre-1950	% Pre-1980		N	% of Pop	N	% of Tested	N	% of Tested	N	% of Tested	N	% of Tested	N	% of Tested
ALCONA	14.7	67.6	264	79	29.9	*	-	79	29.9	*	-	79	29.9	*	-
ALGER	21.8	58.9	149	52	34.9	0	0.0	52	34.9	0	0.0	52	34.9	0	0.0
ALLEGAN	22.5	52.3	3,561	995	27.9	25	2.5	995	27.9	25	2.5	995	27.9	25	2.5
ALPENA	23.3	73.8	562	313	55.7	6	1.9	313	55.7	6	1.9	313	55.7	6	1.9
ANTRIM	17.0	52.3	779	238	30.6	*	-	238	30.6	*	-	238	30.6	*	-
ARENAC	15.6	58.9	492	217	44.1	*	-	217	44.1	*	-	217	44.1	*	-
BARAGA	27.2	67.2	289	101	34.9	*	-	101	34.9	*	-	101	34.9	*	-
BARRY	24.9	58.2	1,584	335	21.1	14	4.2	335	21.1	14	4.2	335	21.1	14	4.2
BAY	32.6	77.1	3,092	1,064	34.4	49	4.6	1,064	34.4	49	4.6	1,064	34.4	49	4.6
BENZIE	18.2	45.9	504	176	34.9	7	4.0	176	34.9	7	4.0	176	34.9	7	4.0
BERRIEN	26.0	70.3	5,349	1,765	33.0	60	3.4	1,765	33.0	60	3.4	1,765	33.0	60	3.4
BRANCH	29.6	64.0	1,535	572	37.3	23	4.0	572	37.3	23	4.0	572	37.3	23	4.0
CALHOUN	32.6	75.2	4,985	1,798	36.1	131	7.3	1,798	36.1	131	7.3	1,798	36.1	131	7.3
CASS	21.4	62.2	1,676	447	26.7	18	4.0	447	26.7	18	4.0	447	26.7	18	4.0
CHARLEVOIX	19.6	56.0	736	256	34.8	*	-	256	34.8	*	-	256	34.8	*	-
CHEBOYGAN	21.7	56.7	865	241	27.9	0	0.0	241	27.9	0	0.0	241	27.9	0	0.0
CHIPPEWA	20.3	58.3	1,230	233	18.9	6	2.6	233	18.9	6	2.6	233	18.9	6	2.6
CLARE	11.7	60.3	1,162	324	27.9	8	2.5	324	27.9	8	2.5	324	27.9	8	2.5

Table 3. Blood lead levels for children under age six enrolled in Medicaid‡ by county, 2016, data suppressed*

CHILDREN UNDER 6	Housing[a]		Population[a]	All Blood Samples†				Capillary†		Venous					
				Tested		≥ 5 µg/dL		≥ 5 µg/dL		≥ 5 µg/dL		5-14 µg/dL		≥ 15 µg/dL	
County	% Pre-1950	% Pre-1980		N	% of Pop	N	% of Tested	N	% of Tested	N	% of Tested	N	% of Tested	N	% of Tested
CLINTON	20.1	51.1	1,593	490	30.8	*	-	490	30.8	*	-	490	30.8	*	-
CRAWFORD	10.9	56.6	340	130	38.2	*	-	*	-	0	0.0	0	0.0	0	0.0
DELTA	32.8	69.8	1,264	367	29.0	13	3.5	*	-	*	-	*	-	0	0.0
DICKINSON	37.1	72.1	689	183	26.6	*	-	*	-	*	-	*	-	0	0.0
EATON	19.8	58.6	3,083	807	26.2	19	2.4	9	1.1	10	1.2	*	-	*	-
EMMET	21.6	48.0	782	305	39.0	*	-	*	-	*	-	*	-	0	0.0
GENESEE	19.1	70.3	18,054	9,049	50.1	187	2.1	53	0.6	134	1.5	114	1.3	20	0.2
GLADWIN	10.9	54.5	651	266	40.9	*	-	*	-	*	-	*	-	0	0.0
GOGEBIC	45.3	74.2	429	157	36.6	*	-	*	-	*	-	*	-	0	0.0
GRAND TRAVERSE	14.4	44.0	2,283	642	28.1	11	1.7	*	-	*	-	*	-	0	0.0
GRATIOT	34.3	70.3	1,409	435	30.9	9	2.1	*	-	*	-	*	-	0	0.0
HILLSDALE	33.1	64.8	1,527	674	44.1	36	5.3	24	3.6	12	1.8	*	-	*	-
HOUGHTON	47.4	73.8	1,106	298	26.9	15	5.0	*	-	*	-	*	-	0	0.0
HURON	28.1	67.6	1,016	299	29.4	*	-	*	-	*	-	*	-	0	0.0
INGHAM	23.9	69.0	8,916	3,449	38.7	98	2.8	39	1.1	59	1.7	*	-	*	-
IONIA	31.8	61.4	2,205	670	30.4	19	2.8	*	-	*	-	*	-	*	-
IOSCO	19.0	69.6	781	225	28.8	6	2.7	*	-	*	-	0	0.0	*	-
IRON	42.5	71.5	370	91	24.6	*	-	*	-	*	-	*	-	0	0.0
ISABELLA	14.9	48.3	1,796	398	22.2	*	-	*	-	0	0.0	0	0.0	0	0.0

Table 3. Blood lead levels for children under age six enrolled in Medicaid‡ by county, 2016, data suppressed*

CHILDREN UNDER 6	Housing[a]		Population[a]	All Blood Samples†				Capillary†		Venous					
				Tested		≥ 5 µg/dL		≥ 5 µg/dL		≥ 5 µg/dL		5-14 µg/dL		≥ 15 µg/dL	
County	% Pre-1950	% Pre-1980		N	% of Pop	N	% of Tested	N	% of Tested	N	% of Tested	N	% of Tested	N	% of Tested
JACKSON	28.9	67.8	5,498	1,805	32.8	166	9.2	106	5.9	60	3.3	54	3.0	6	0.3
KALAMAZOO	21.0	61.7	7,745	2,350	30.3	105	4.5	70	3.0	35	1.5	29	1.2	6	0.3
KALKASKA	12.1	50.2	696	170	24.4	*	-	*	-	*	-	*	-	0	0.0
KENT	22.8	59.8	21,620	6,694	31.0	496	7.4	329	4.9	167	2.5	141	2.1	26	0.4
KEWEENAW	46.0	68.9	85	16	18.8	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
LAKE	10.9	50.8	362	84	23.2	*	-	*	-	0	0.0	0	0.0	0	0.0
LAPEER	17.9	55.0	2,528	661	26.1	23	3.5	*	-	*	-	*	-	*	-
LEELANAU	15.8	46.2	466	143	30.7	8	5.6	*	-	*	-	*	-	0	0.0
LENAWEE	31.5	66.7	3,524	731	20.7	51	7.0	19	2.6	32	4.4	*	-	*	-
LIVINGSTON	10.6	42.2	2,785	608	21.8	8	1.3	*	-	*	-	*	-	*	-
LUCE	20.9	60.5	176	63	35.8	*	-	*	-	0	0.0	0	0.0	0	0.0
MACKINAC	23.1	55.6	287	76	26.5	*	-	*	-	0	0.0	0	0.0	0	0.0
MACOMB	9.3	61.2	22,754	6,952	30.6	66	0.9	39	0.6	27	0.4	*	-	*	-
MANISTEE	27.6	61.8	736	219	29.8	14	6.4	*	-	*	-	*	-	0	0.0
MARQUETTE	29.0	73.6	1,501	416	27.7	6	1.4	*	-	*	-	*	-	0	0.0
MASON	26.1	59.6	1,206	323	26.8	17	5.3	*	-	*	-	*	-	0	0.0
MECOSTA	16.1	51.7	1,393	297	21.3	7	2.4	*	-	*	-	*	-	*	-
MENOMINEE	32.3	66.3	712	164	23.0	*	-	*	-	*	-	0	0.0	*	-
MIDLAND	12.8	60.3	2,000	305	15.3	*	-	*	-	*	-	*	-	0	0.0

Table 3. Blood lead levels for children under age six enrolled in Medicaid‡ by county, 2016, data suppressed*

CHILDREN UNDER 6	Housing[a]		Population[a]	All Blood Samples†				Capillary†		Venous					
				Tested		≥ 5 µg/dL		≥ 5 µg/dL		≥ 5 µg/dL		5-14 µg/dL		≥ 15 µg/dL	
County	% Pre-1950	% Pre-1980		N	% of Pop	N	% of Tested	N	% of Tested	N	% of Tested	N	% of Tested	N	% of Tested
MISSAUKEE	16.4	56.2	646	104	16.1	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
MONROE	22.6	60.9	3,405	785	23.1	15	1.9	6	0.8	9	1.1	*	-	*	-
MONTCALM	23.9	58.1	2,257	697	30.9	13	1.9	*	-	*	-	*	-	*	-
MONTMORENCY	10.3	64.7	228	71	31.1	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
MUSKEGON	27.6	68.0	7,792	1,731	22.2	131	7.6	72	4.2	59	3.4	52	3.0	7	0.4
NEWAYGO	17.9	51.5	1,888	353	18.7	11	3.1	*	-	*	-	*	-	0	0.0
OAKLAND	14.0	62.8	22,603	6,800	30.1	100	1.5	66	1.0	34	0.5	*	-	*	-
OCEANA	21.9	54.3	1,156	366	31.7	10	2.7	*	-	*	-	*	-	0	0.0
OGEMAW	15.6	60.0	757	229	30.3	*	-	*	-	0	0.0	0	0.0	0	0.0
ONTONAGON	39.0	74.0	74	30	40.5	*	-	0	0.0	*	-	*	-	0	0.0
OSCEOLA	17.3	58.1	916	272	29.7	9	3.3	*	-	*	-	*	-	0	0.0
OSCODA	12.7	67.1	216	97	44.9	*	-	*	-	0	0.0	0	0.0	0	0.0
OTSEGO	9.3	51.8	825	347	42.1	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
OTTAWA	14.1	45.3	6,851	1,331	19.4	25	1.9	17	1.3	8	0.6	*	-	*	-
PRESQUE ISLE	21.0	66.5	323	85	26.3	*	-	*	-	0	0.0	0	0.0	0	0.0
ROSCOMMON	9.3	60.8	670	165	24.6	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
SAGINAW	25.2	76.4	7,399	2,409	32.6	80	3.3	57	2.4	23	1.0	*	-	*	-
SAINT CLAIR	25.1	61.6	4,870	2,302	47.3	128	5.6	101	4.4	27	1.2	20	0.9	7	0.3
SAINT JOSEPH	26.2	67.6	2,524	809	32.1	55	6.8	44	5.4	11	1.4	*	-	*	-

Table 3. Blood lead levels for children under age six enrolled in Medicaid‡ by county, 2016, data suppressed*

CHILDREN UNDER 6	Housing[a]		Population[a]	All Blood Samples†				Capillary†		Venous					
				Tested		≥ 5 µg/dL		≥ 5 µg/dL		≥ 5 µg/dL		5-14 µg/dL		≥ 15 µg/dL	
County	% Pre-1950	% Pre-1980		N	% of Pop	N	% of Tested	N	% of Tested	N	% of Tested	N	% of Tested	N	% of Tested
SANILAC	29.3	65.4	1,378	269	19.5	8	3.0	*	-	*	-	*	-	0	0.0
SCHOOLCRAFT	24.8	61.3	320	67	20.9	*	-	*	-	0	0.0	0	0.0	0	0.0
SHIAWASSEE	30.3	70.1	1,961	951	48.5	34	3.6	20	2.1	14	1.5	*	-	*	-
TUSCOLA	28.4	70.4	1,726	670	38.8	14	2.1	8	1.2	6	0.9	6	0.9	0	0.0
VAN BUREN	25.1	60.7	3,101	683	22.0	37	5.4	22	3.2	15	2.2	15	2.2	0	0.0
WASHTENAW	16.9	56.4	5,991	1,627	27.2	18	1.1	11	0.7	7	0.4	7	0.4	0	0.0
WAYNE[b]	37.6	83.4	83,886	32,399	38.6	2,065		535	2.7	1,240	6.2	1,122	5.6	118	0.6
WEXFORD	21.3	58.1	1,473	309	21.0	7	2.3	*	-	*	-	*	-	*	-
MICHIGAN	**23.1**	**65.8**	**318,418**	**106,176**	**33.3**	**4,550**	**4.3**	**2,118**	**2.0**	**2,432**	**2.3**	**2,167**	**2.0**	**265**	**0.2**

* Suppression of non-zero counts less than six (6), and complementary suppression of values 6 and greater so that suppressed values cannot be calculated

- Percentage for suppressed counts

‡ A child enrolled in Medicaid at any time in the year is included in the definition of Medicaid enrollment.

† Includes tests where the type of sample was not reported

[a] U.S. Census American Community Survey 2016 5-year population estimates (table B25034 – Housing; table B09001 – Population)

[b] No breakdown for Detroit - estimate for the population of Detroit is not available from the U.S. Census American Community Survey

Table 4. Blood lead levels for children ages one and two enrolled in Medicaid‡ by county, 2016, data suppressed*

CHILDREN ONE AND TWO	Housing[a]		All Blood Samples†			Capillary†		Venous					
	% Pre-1950	% Pre-1980	Tested	≥ 5 µg/dL		≥ 5 µg/dL		≥ 5 µg/dL		5-14 µg/dL		≥ 15 µg/dL	
County			N[b]	N	% of Tested	N	% of Tested	N	% of Tested	N	% of Tested	N	% of Tested
ALCONA	14.7	67.6	47	*	-	*	-	0	0.0	0	0.0	0	0.0
ALGER	21.8	58.9	38	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
ALLEGAN	22.5	52.3	654	14	2.1	6	0.9	8	1.2	*	-	*	-
ALPENA	23.3	73.8	253	*	-	*	-	*	-	*	-	*	-
ANTRIM	17.0	52.3	153	*	-	*	-	0	0.0	0	0.0	0	0.0
ARENAC	15.6	58.9	136	*	-	*	-	0	0.0	0	0.0	0	0.0
BARAGA	27.2	67.2	71	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
BARRY	24.9	58.2	239	12	5.0	*	-	*	-	*	-	*	-
BAY	32.6	77.1	836	40	4.8	27	3.2	13	1.6	13	1.6	0	0.0
BENZIE	18.2	45.9	114	*	-	*	-	*	-	*	-	0	0.0
BERRIEN	26.0	70.3	1,191	38	3.2	14	1.2	24	2.0	*	-	*	-
BRANCH	29.6	64.0	226	13	5.8	*	-	*	-	*	-	*	-
CALHOUN	32.6	75.2	943	78	8.3	24	2.5	54	5.7	*	-	*	-
CASS	21.4	62.2	371	11	3.0	*	-	*	-	*	-	0	0.0
CHARLEVOIX	19.6	56.0	162	*	-	*	-	0	0.0	0	0.0	0	0.0
CHEBOYGAN	21.7	56.7	184	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
CHIPPEWA	20.3	58.3	159	6	3.8	*	-	*	-	*	-	0	0.0
CLARE	11.7	60.3	264	6	2.3	*	-	*	-	*	-	0	0.0

Table 4. Blood lead levels for children ages one and two enrolled in Medicaid‡ by county, 2016, data suppressed*

CHILDREN ONE AND TWO	Housing[a]		All Blood Samples†			Capillary†		Venous					
	% Pre-1950	% Pre-1980	Tested	≥ 5 µg/dL		≥ 5 µg/dL		≥ 5 µg/dL		5-14 µg/dL		≥ 15 µg/dL	
County			N[b]	N	% of Tested	N	% of Tested	N	% of Tested	N	% of Tested	N	% of Tested
CLINTON	20.1	51.1	276	*	-	*	-	0	0.0	0	0.0	0	0.0
CRAWFORD	10.9	56.6	94	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
DELTA	32.8	69.8	317	13	4.1	*	-	*	-	*	-	0	0.0
DICKINSON	37.1	72.1	162	*	-	*	-	*	-	*	-	0	0.0
EATON	19.8	58.6	534	16	3.0	8	1.5	8	1.5	*	-	*	-
EMMET	21.6	48.0	220	*	-	*	-	*	-	*	-	0	0.0
GENESEE	19.1	70.3	4,090	89	2.2	30	0.7	59	1.4	48	1.2	11	0.3
GLADWIN	10.9	54.5	196	*	-	0	0.0	*	-	*	-	0	0.0
GOGEBIC	45.3	74.2	113	*	-	*	-	*	-	*	-	0	0.0
GRAND TRAVERSE	14.4	44.0	412	11	2.7	*	-	*	-	*	-	0	0.0
GRATIOT	34.3	70.3	273	*	-	*	-	*	-	*	-	0	0.0
HILLSDALE	33.1	64.8	308	20	6.5	14	4.5	6	1.9	6	1.9	0	0.0
HOUGHTON	47.4	73.8	268	10	3.7	*	-	*	-	*	-	0	0.0
HURON	28.1	67.6	179	*	-	*	-	0	0.0	0	0.0	0	0.0
INGHAM	23.9	69.0	1,848	66	3.6	30	1.6	36	1.9	*	-	*	-
IONIA	31.8	61.4	519	13	2.5	*	-	*	-	*	-	*	-
IOSCO	19.0	69.6	160	6	3.8	*	-	*	-	0	0.0	*	-
IRON	42.5	71.5	76	*	-	*	-	0	0.0	0	0.0	0	0.0
ISABELLA	14.9	48.3	287	*	-	*	-	0	0.0	0	0.0	0	0.0

Table 4. Blood lead levels for children ages one and two enrolled in Medicaid‡ by county, 2016, data suppressed*

CHILDREN ONE AND TWO	Housing[a]		All Blood Samples†			Capillary†		Venous					
			Tested	≥ 5 µg/dL		≥ 5 µg/dL		≥ 5 µg/dL		5-14 µg/dL		≥ 15 µg/dL	
County	% Pre-1950	% Pre-1980	N[b]	N	% of Tested	N	% of Tested	N	% of Tested	N	% of Tested	N	% of Tested
JACKSON	28.9	67.8	1,283	126	9.8	82	6.4	44	3.4	*	-	*	-
KALAMAZOO	21.0	61.7	1,318	67	5.1	41	3.1	26	2.0	*	-	*	-
KALKASKA	12.1	50.2	112	*	-	*	-	*	-	*	-	0	0.0
KENT	22.8	59.8	5,175	359	6.9	252	4.9	107	2.1	89	1.7	18	0.3
KEWEENAW	46.0	68.9	12	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
LAKE	10.9	50.8	62	*	-	*	-	0	0.0	0	0.0	0	0.0
LAPEER	17.9	55.0	505	18	3.6	*	-	*	-	*	-	*	-
LEELANAU	15.8	46.2	79	6	7.6	*	-	*	-	*	-	0	0.0
LENAWEE	31.5	66.7	449	32	7.1	14	3.1	18	4.0	*	-	*	-
LIVINGSTON	10.6	42.2	469	6	1.3	*	-	*	-	*	-	*	-
LUCE	20.9	60.5	57	*	-	*	-	0	0.0	0	0.0	0	0.0
MACKINAC	23.1	55.6	68	*	-	*	-	0	0.0	0	0.0	0	0.0
MACOMB	9.3	61.2	3,981	39	1.0	25	0.6	14	0.4	*	-	*	-
MANISTEE	27.6	61.8	173	12	6.9	*	-	*	-	*	-	0	0.0
MARQUETTE	29.0	73.6	350	*	-	*	-	*	-	*	-	0	0.0
MASON	26.1	59.6	115	*	-	*	-	0	0.0	0	0.0	0	0.0
MECOSTA	16.1	51.7	174	*	-	*	-	*	-	*	-	0	0.0
MENOMINEE	32.3	66.3	133	*	-	*	-	*	-	0	0.0	*	-
MIDLAND	12.8	60.3	168	*	-	0	0.0	*	-	*	-	0	0.0

Table 4. Blood lead levels for children ages one and two enrolled in Medicaid‡ by county, 2016, data suppressed*

CHILDREN ONE AND TWO	Housing[a]		All Blood Samples†			Capillary†		Venous					
	% Pre-1950	% Pre-1980	Tested	≥ 5 µg/dL		≥ 5 µg/dL		≥ 5 µg/dL		5-14 µg/dL		≥ 15 µg/dL	
County			N[b]	N	% of Tested	N	% of Tested	N	% of Tested	N	% of Tested	N	% of Tested
MISSAUKEE	16.4	56.2	94	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
MONROE	22.6	60.9	543	11	2.0	*	-	*	-	*	-	*	-
MONTCALM	23.9	58.1	435	10	2.3	*	-	*	-	*	-	*	-
MONTMORENCY	10.3	64.7	53	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
MUSKEGON	27.6	68.0	1,085	79	7.3	44	4.1	35	3.2	*	-	*	-
NEWAYGO	17.9	51.5	265	7	2.6	*	-	*	-	*	-	0	0.0
OAKLAND	14.0	62.8	3,526	58	1.6	39	1.1	19	0.5	*	-	*	-
OCEANA	21.9	54.3	222	*	-	*	-	*	-	*	-	0	0.0
OGEMAW	15.6	60.0	148	*	-	*	-	0	0.0	0	0.0	0	0.0
ONTONAGON	39.0	74.0	23	*	-	0	0.0	*	-	*	-	0	0.0
OSCEOLA	17.3	58.1	188	6	3.2	*	-	*	-	*	-	0	0.0
OSCODA	12.7	67.1	60	*	-	*	-	0	0.0	0	0.0	0	0.0
OTSEGO	9.3	51.8	199	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
OTTAWA	14.1	45.3	1,052	23	2.2	17	1.6	6	0.6	*	-	*	-
PRESQUE ISLE	21.0	66.5	70	*	-	*	-	0	0.0	0	0.0	0	0.0
ROSCOMMON	9.3	60.8	146	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
SAGINAW	25.2	76.4	1,666	53	3.2	37	2.2	16	1.0	*	-	*	-
SAINT CLAIR	25.1	61.6	1,227	67	5.5	47	3.8	20	1.6	*	-	*	-
SAINT JOSEPH	26.2	67.6	526	44	8.4	35	6.7	9	1.7	*	-	*	-

Table 4. Blood lead levels for children ages one and two enrolled in Medicaid‡ by county, 2016, data suppressed*

CHILDREN ONE AND TWO	Housing[a]		All Blood Samples†			Capillary†		Venous					
			Tested	≥ 5 µg/dL		≥ 5 µg/dL		≥ 5 µg/dL		5-14 µg/dL		≥ 15 µg/dL	
County	% Pre-1950	% Pre-1980	N[b]	N	% of Tested	N	% of Tested	N	% of Tested	N	% of Tested	N	% of Tested
SANILAC	29.3	65.4	109	*	-	*	-	0	0.0	0	0.0	0	0.0
SCHOOLCRAFT	24.8	61.3	51	*	-	*	-	0	0.0	0	0.0	0	0.0
SHIAWASSEE	30.3	70.1	563	26	4.6	16	2.8	10	1.8	*	-	*	-
TUSCOLA	28.4	70.4	457	10	2.2	*	-	*	-	*	-	0	0.0
VAN BUREN	25.1	60.7	423	21	5.0	10	2.4	11	2.6	11	2.6	0	0.0
WASHTENAW	16.9	56.4	1,040	12	1.2	*	-	*	-	*	-	0	0.0
WAYNE[b]	21.1	76.6	14,950	1,111	7.4	348	2.3	763	5.1	679	4.5	84	0.6
WEXFORD	21.3	58.1	256	*	-	*	-	*	-	*	-	*	-
MICHIGAN	**23.1**	**65.8**	**60,433**	**2,746**	**4.5**	**1,330**	**2.2**	**1,416**	**2.3**	**1,244**	**2.1**	**172**	**0.3**

* Suppression of non-zero counts less than six (6), and complementary suppression of values 6 and greater so that suppressed values cannot be calculated
- Percentage for suppressed counts
‡ A child enrolled in Medicaid at any time in the year is included in the definition of Medicaid enrollment.
† Includes tests where the type of sample was not reported
[a] U.S. Census American Community Survey 2016 5-year population estimates table B25034
[b] Percentage of population tested was not calculated: no population estimates for children ages one and two enrolled in Medicaid or public health coverage available

Table 5. Blood lead levels[†] for children under age six in targeted communities, 2016, data suppressed*

CHILDREN UNDER 6	Housing[a]		Population[a]	All Blood Samples[†]				Capillary[†]		Venous						
				Tested		≥ 5 µg/dL		≥ 5 µg/dL		≥ 5 µg/dL			5-14 µg/dL		≥ 15 µg/dL	
City	% Pre-1950	% Pre-1980		N	% of Pop	N	% of Tested	N	% of Tested	N	% of Tested	% of all EBLL	N	% of Tested	N	% of Tested
ADRIAN	39.8	77.0	1,354	560	41.4	47	8.4	19	3.4	28	5.0	59.6	*	-	*	-
DETROIT	58.0	91.9	58,565	23,678	40.4	2,073	8.8	683	2.9	1,390	5.9	67.1	1,252	5.3	138	0.6
FLINT	37.0	92.3	8,784	7,381	84.0	177	2.4	47	0.6	130	1.8	73.4	110	1.5	20	0.3
GRAND RAPIDS	45.8	81.6	18,297	6,644	36.3	540	8.1	347	5.2	193	2.9	35.7	165	2.5	28	0.4
HAMTRAMCK	69.6	92.0	2,520	1,184	47.0	96	8.1	35	3.0	61	5.2	63.5	55	4.6	6	0.5
HIGHLAND PARK	55.4	84.1	762	336	44.1	47	14.0	10	3.0	37	11.0	78.7	*	-	*	-
JACKSON	63.0	91.0	3,524	2,221	63.0	186	8.4	115	5.2	71	3.2	38.2	64	2.9	7	0.3
LANSING	33.2	83.3	9,802	3,743	38.2	123	3.3	50	1.3	73	2.0	59.3	65	1.7	8	0.2
MUSKEGON	51.3	86.9	2,952	1,807	61.2	140	7.7	78	4.3	62	3.4	44.3	54	3.0	8	0.4
MICHIGAN	**23.1**	**65.8**	**690,245**	**157,892**	**22.9**	**5,724**	**3.6**	**2,792**	**1.8**	**2,932**	**1.9**	**51.2**	**2,614**	**1.7**	**318**	**0.2**

* Suppression of non-zero counts less than six (6), and complementary suppression of values 6 and greater so that suppressed values cannot be calculated

- Percentage for suppressed counts

[†] Includes tests where the type of sample was not reported

[a] U.S. Census American Community Survey 2016 5-year population estimates (table B25034 – Housing; table B09001 – Population)

Table 6. Blood lead levels[†] for children under age six in targeted communities, 2013 to 2016

CHILDREN UNDER 6	2013			2014				2015				2016			
	Tested	≥ 5 µg/dL		Tested		≥ 5 µg/dL		Tested		≥ 5 µg/dL		Tested		≥ 5 µg/dL	
Community	N	#	%	N	Change[§]	#	%	N	Change[§]	#	%	N	Change[§]	#	%
ADRIAN [c]	~	~	~	~	~	~	~	345	~	59	17.1	560	62.3%	47	8.4
DETROIT	25,026	1,996	8.0	22,842	- 8.7%	1,876	8.2	21,549	- 5.7%	1,612	7.5	23,678	9.9%	2,073	8.8
FLINT	2,345	85	3.6	2,343	- 0.1%	106	4.5	2,703	15.4%	100	3.7	7,381	173.1%	177	2.4
GRAND RAPIDS	4,639	426	9.2	4,379	- 5.6%	359	8.2	4,282	- 2.2%	467	10.9	6,644	55.2%	540	8.1
HAMTRAMCK	1,004	75	7.5	1,008	0.4%	79	7.8	948	- 6.0%	56	5.9	1,184	24.9%	96	8.1
HIGHLAND PARK	322	50	15.5	289	- 10.2%	46	15.9	314	8.7%	50	15.9	336	7.0%	47	14.0
JACKSON	1,135	121	10.7	976	- 14.0%	93	9.5	1,117	14.4%	98	8.8	2,221	98.8%	186	8.4
LANSING	3,135	187	6.0	2,995	- 4.5%	103	3.4	2,924	- 2.4%	102	3.5	3,743	28.0%	123	3.3
MUSKEGON	1,268	119	9.4	1,177	- 7.2%	123	10.5	799	- 32.1%	73	9.1	1,807	126.2%	140	7.7
MICHIGAN	**86,583**	**3,911**	**4.5**	**86,055**	**- 0.6%**	**3,546**	**4.1**	**89,015**	**+ 3.4%**	**3,455**	**3.9**	**157,892**	**+ 77.4%**	**5,724**	**3.6**

[†] Includes tests where the type of sample was not reported
[§] Percent change in number tested from previous year
[c] Adrian added to list of targeted communities in 2015
~ Results not reported before city added to list of targeted communities

Table 7. Blood lead levels[†] for children ages one and two in targeted communities, 2016, data suppressed

AREAS IN THE TABLE SHADED IN YELLOW INDICATE WHERE CORRECTIONS HAVE BEEN MADE FROM THE ORIGINAL REPORT.

CHILDREN ONE AND TWO	Housing		All Blood Samples[†]			Capillary[†] Samples		Venous Samples						
			Tested	≥ 5 µg/dL		≥ 5 µg/dL		≥ 5 µg/dL			5-14 µg/dL		≥ 15 µg/dL	
Community	% Pre-1950	% Pre-1980	N	N	% of Tested	N	% of Tested	N	%	% all EBLL	N	% of Tested	N	% of Tested
ADRIAN	39.8	77.0	355	32	9.0	14	3.9	18	5.1	56.3	*	-	*	-
DETROIT	58.0	91.9	10,065	1,106	11.0	364	3.6	742	7.4	67.1	658	6.5	84	0.8
FLINT	37.0	92.3	3,106	83	2.7	24	0.8	59	1.9	71.1	48	1.5	11	0.4
GRAND RAPIDS	45.8	81.6	5,219	401	7.7	268	5.1	133	2.5	33.2	113	2.2	20	0.4
HAMTRAMCK	69.6	92.0	576	51	8.9	19	3.3	32	5.6	62.7	*	-	*	-
HIGHLAND PARK	55.4	84.1	151	25	16.6	8	5.3	17	11.3	68.0	*	-	*	-
JACKSON	63.0	91.0	1,650	140	8.5	86	5.2	54	3.3	38.6	*	-	*	-
LANSING	33.2	83.3	2,123	87	4.1	38	1.8	49	2.3	56.3	*	-	*	-
MUSKEGON	51.3	86.9	1,155	85	7.4	47	4.1	38	3.3	44.7	*	-	*	-
MICHIGAN	**23.1**	**65.8**	**95,143**	**3,508**	**3.7**	**1,766**	**1.9**	**1,416**	**2.3**	**51.6**	**1,534**	**1.6**	**208**	**0.2**

* Suppression of non-zero counts less than six (6), and complementary suppression of values 6 and greater so that suppressed values cannot be calculated

- Percentage for suppressed counts

[†] Includes tests where the type of sample was not reported

Table 8. Blood lead levels[†] for children ages one and two in targeted communities, 2013 to 2016

CHILDREN ONE AND TWO	2013			2014				2015				2016			
	Tested	≥ 5 µg/dL		Tested		≥ 5 µg/dL		Tested		≥ 5 µg/dL		Tested		≥ 5 µg/dL	
Community	N	#	%	N	Change[§]	#	%	N	Change[§]	#	%	N	Change[§]	#	%
ADRIAN [c]	~	~	~	~	~	~	~	194	~	36	18.6	355	83.0%	32	9.0
DETROIT	10,496	1,077	10.3	9,641	- 8.1%	965	10.0	9,089	- 5.7%	810	8.9	10,065	10.7%	1,106	11.0
FLINT	1,508	66	4.4	1,502	- 0.4%	71	4.7	1,556	3.6%	67	4.3	3,106	99.6%	83	2.7
GRAND RAPIDS	3,663	335	9.1	3,464	- 5.4%	284	8.2	3,415	- 1.4%	366	10.7	5,219	52.8%	401	7.7
HAMTRAMCK	445	45	10.1	455	2.2%	46	10.1	426	- 6.4%	36	8.5	576	35.2%	51	8.9
HIGHLAND PARK	131	26	19.8	127	- 3.1%	25	19.7	125	- 1.6%	26	20.8	151	20.8%	25	16.6
JACKSON	778	93	12.0	740	- 4.9%	74	10.0	807	9.1%	73	9.0	1,650	104.5%	140	8.5
LANSING	1,799	111	6.2	1,751	- 2.7%	62	3.5	1,721	- 1.7%	54	3.1	2,123	23.4%	87	4.1
MUSKEGON	671	77	11.5	705	5.1%	83	11.8	427	- 39.4%	44	10.3	1,155	170.5%	85	7.4
MICHIGAN	**88,851**	**3,595**	**4.0**	**87,917**	**- 1.1%**	**1,796**	**2.0**	**86,435**	**- 1.7%**	**2,996**	**3.5**	**95,143**	**+ 10.1%**	**3,508**	**3.7**

[†] Includes tests where the type of sample was not reported
[§] Percent change in number tested from previous year
[c] Adrian added to list of targeted communities in 2015
~ Results not reported before city added to list of targeted communities

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