



2019 Annual Surveillance Data Report on Childhood Blood Lead Testing in Michigan

Issued 8/24/2023

Prepared by

Childhood Lead Poisoning Prevention Program (CLPPP)
Michigan Department of Health and Human Services

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Executive Summary

This report summarizes data on blood lead testing and elevated blood lead levels throughout Michigan for use by the public, public health professionals and researchers. This report focuses on testing in 2019, with comparison to years 2003 through 2018. During this period, the State of Michigan defined an elevated blood lead level (EBLL) as 5 micrograms per deciliter of blood ($\mu\text{g}/\text{dL}$) or higher, as recommended by the Centers for Disease Control and Prevention's Advisory Committee on Childhood Lead Poisoning Prevention (ACCLPP).^{1,3} The ACCLPP definition of an EBLL was changed to 3.5 $\mu\text{g}/\text{dL}$ or higher in 2021. This report uses the previous definition (5 $\mu\text{g}/\text{dL}$) throughout to stay consistent with the definition during the period covered.

Key Findings

- In 2019, 143,224 Michigan children under 6 years of age had a blood lead test. This is 20.9 percent of the population in this age group.
 - 2.7 percent (3,907) of these children had an EBLL.
 - 55.5 percent (2,167) of elevated results were from venous blood tests, the most accurate type of test.
- More children under age 6 were tested and had an EBLL in Detroit than in any county or any other selected community in Michigan, with 1,297 (6.7 percent) having an EBLL.
- Highland Park had the highest percent of children with EBLL (12.4 percent, 41 children) of any selected community.
- The top three counties with the highest numbers of children under 6 with an EBLL were:
 1. Wayne County excluding Detroit (304 children);
 2. Kent County (222 children); and
 3. Oakland County (208 children).
- The top three counties with the highest percent of tested children under 6 with an EBLL were:
 1. Cass County (6.4 percent, 24 children);
 2. Branch County (5.9 percent, 25 children); and
 3. Muskegon County (5.9 percent, 191 children).

Recommendations and Next Steps for MDHHS

Continue work with local health departments and other agencies to:

- Increase the total number of children tested.
- Reduce the number of children with an EBLL.
- Support services for children with an EBLL to identify and remove sources of lead and mitigate negative effects of exposure.
- Increase the proportion of children with capillary EBLLs receiving a confirmatory venous test.

Improve the accuracy and timeliness of the surveillance system by:

- Increasing the number of labs reporting electronically.
- Providing data quality feedback to laboratories.
- Consulting a group of CLPPP data users and stakeholders to improve reports.
- Continuing to streamline and improve the analysis process.

Definitions³

Abatement - Work done to remove or cover lead paint in a home. This work can include replacing windows and covering lead paint surfaces with a sealer (encapsulation). Abatement is a long-term lead management.

Anemia - Having fewer than the normal amount of red blood cells in your blood. Anemia can make someone tired and short of breath. It can also make it easier for someone to get lead poisoning.

Blood Lead Level - The amount of lead in a person's blood when they had their blood drawn.

Blood Lead Tests - A test to find out how much lead is in the blood. A small amount of blood is taken from the finger or arm. A blood lead test shows if a child has been exposed to lead.

Capillary Blood Sample - A small amount of blood taken from the finger to test for lead, sometimes called a "finger-prick."

Chelation - A medical treatment used to remove lead from the body when blood lead levels are very high. Chelation therapy uses drugs that bind to metals in the blood. Once this happens, the metal is then removed from the body through urination.

Elevated Blood Lead Level (EBLL) - A blood lead level of 5 µg/dL or higher (results 4.5 – 4.9 µg/dL are rounded up and considered an elevated result). Elevated means high or raised. See [Meaning of an Elevated Result](#) and [More about Rounding and the Limit of Detection](#) in the [Technical Appendix](#) for more information.

Lead - A metal that can harm the body and can harm brain development in children. Lead can be in paint, pipes and plumbing fixtures, dishes, pottery, toys, jewelry, candy, spices, cosmetics, and folk medicine. It can also be found in many industries like auto repair, construction, manufacturing, and plumbing.

Lead Dust - Tiny pieces of lead that are sometimes too small to see. When old paint peels and cracks, it makes lead dust. Home repair projects can also make lead dust. If children breathe in or swallow lead dust, they can get very sick.

Limit of Detection (or limit of reporting) - Laboratory blood lead testing has limits on how much lead it can measure in the blood. Different types of tests have different limits. For example, capillary blood testing in a doctor's office has a lower limit of detection of 3.3 µg/dL. Results below this will be recorded as <3.3 µg/dL, meaning the blood lead level is lower than the machine can accurately measure, but it is not necessarily zero.

Micrograms per deciliter (µg/dL) - The unit used to measure the amount of lead in the blood.

Nursing Case Management (NCM) - Aid for families of children with elevated blood lead levels. Case management is done by a nurse, generally from a local health department. NCM services may include helping families get their home inspected (professionally checked) for lead hazards or making sure children see their doctor for another blood lead test to make sure the child's blood lead levels are not increasing.

Solder - Metal that is melted and used to connect other pieces of metal together. For example, plumbers may use solder to connect pipes. Some solder is made from lead.

Venous Blood Sample - A small amount of blood taken from a vein in the arm to test for lead.

Report Abbreviations

BLL: Blood Lead Level

CDC: Centers for Disease Control and Prevention

CLPPP: Childhood Lead Poisoning Prevention Program

ACCLPP: CDC's Advisory Committee on Childhood Lead Poisoning Prevention

CMS: U.S. Centers for Medicare and Medicaid Services

EBLL: Elevated Blood Lead Level (≥ 5 $\mu\text{g}/\text{dL}$ of lead in the blood)

MCIR: Michigan Care Improvement Registry (Michigan's immunization registry)

MDHHS: Michigan Department of Health and Human Services

MiCLPS: Michigan Childhood Lead Poisoning Surveillance data management system

NCM: Nursing Case Management

ACS: The American Community Survey conducted by the U.S Census Bureau

NVSS: National Vital Statistics System

Introduction

The MDHHS Childhood Lead Poisoning Prevention Program

The MDHHS Childhood Lead Poisoning Prevention Program (CLPPP) began in 1992 and was formalized into state law in 1998 under Michigan’s Public Health Code.* The mission of CLPPP is to prevent childhood lead poisoning across the state through surveillance, outreach, and health services.

Health Hazards of Lead

According to the CDC’s ACCLPP, there is currently no recognized safe level of lead in the blood in children.³

Young children are particularly vulnerable to lead exposure. They tend to put their hands, toys, and other items into their mouths, increasing their chances of eating lead.^{5,6} Children are the primary focus of lead testing because they are the most likely to engage in these behaviors. They are also smaller, so the same amount of lead will have more impact in a child than in an adult.⁷ Focusing on testing children also allows for early intervention to mitigate the potential negative health impacts from lead exposure. The effects of lead on the developing child can be devastating since the central nervous system is undergoing a period of rapid and critical growth.^{3,5,7-9} In children, exposure to lead has been linked to:

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

Lead Sources

Lead generally enters the body through breathing, eating, or drinking. The most common source of lead is from deteriorating lead paint in homes built before the lead paint ban in 1978.^{3 6, 9, 10, 12} Deteriorating paint may be peeling, chipping, blistering, flaking, worn, chalking or cracking and becomes separated from the painted surface. This creates lead-containing paint chips and dust that can settle on windowsills, floors, porches, and in the soil around the outside of a home. Repair and renovation of these homes can create hazardous lead dust if lead-safe work practices are not followed.^{7,11,12}

Cracked and flaking paint on a wall



Since the Flint water crisis, there has been increased concern about lead in drinking water. The focus of this report is on blood lead testing among all Michigan children; for information about the water crisis, visit the State of Michigan’s Flint water response website (Michigan.gov/Flintwater). Additional information and community water supply lead testing results can be found on the Mi Lead Safe website under “Water supply lead results” (Michigan.gov/MiLeadSafe).

* MCL 333-5474 <http://legislature.mi.gov/mcl-333-5474>

There are many possible sources of lead in and around the home, including: ^{5,10-12,25}

- Deteriorating paint.
- Soil on properties near high-traffic streets and highways, from prior use of leaded gasoline exhaust.
- Soil on current or former industrial sites such as mines or smelters.
- Leaded plumbing, pipes, and other plumbing fixtures and solder.
- Pottery with glazes containing lead.
- Hobby supplies, including lead buckshot, fishing weights, and lead came for stained glass.
- Imported cosmetics.
- Imported toys, jewelry, or furniture with lead paint or parts.
- Imported sauces, spices, candy, health supplements, folk remedies, and Ayurvedic medicines. ^{3,5-7,13}

The chances of children being exposed to lead are higher for those living in older homes and in poverty; EBLLs are also more common in the children of some ethnic and racial groups. ^{5,7,13,14} Michigan’s urban areas tend to have aging homes, aging plumbing, and substandard living conditions, potentially increasing the risk of lead exposure for those who live in those areas.

Blood Lead Testing and Surveillance (Monitoring)

Exposure to lead is measured by blood tests, where a laboratory determines how much lead is in the blood. This amount is called a blood lead level (BLL). Any blood lead test result above the limit of detection means the person has been exposed to lead.

All blood lead test results must be sent to the MDHHS CLPPP within five working days after test completion. [†] CLPPP monitors these results and produces reports for the public. CLPPP also uses the data to identify and implement public health actions.

Targeted Testing

Children are the primary focus of testing because they are the most likely to engage in behaviors that increase exposure to lead if it is present in their environment. Focusing on testing children also allows for early intervention to mitigate the potential negative health impacts from lead exposure. Children enrolled in Michigan Medicaid programs are required to be tested for lead at 12 and 24 months of age. Children between the ages of 36 and 72 months who have not previously been tested, also require testing. ¹⁵ Testing is also required for Michigan children enrolled in the Women, Infants & Children (WIC) program. [‡]

For children not enrolled in Medicaid or WIC, MDHHS follows CDC guidance for targeted testing and recommends blood lead testing for all children determined to be at risk of lead exposure. CLPPP provides information to help providers and families determine a child’s lead risk, including a lead risk screening questionnaire and other resources. ¹⁶

Elevated Blood Lead Levels

There is currently no recognized safe level of lead in blood. CDC uses a blood lead “reference value” (BLRV) to identify children with higher levels of lead in their blood compared to most children. This level is based on the U.S. population of children ages 1–5 years who are in the top 2.5 percent of children when tested for lead in their blood, according to data from the National Health and Nutrition Examination Survey (NHANES). In 2021, CDC changed the BLRV to 3.5 µg/dL. In 2022, MDHHS also changed its BLRV to 3.5 µg/dL. ^{1,3,5-7} This blood lead

[†] MCL 333.20531 <http://legislature.mi.gov/mcl-333-20531>

[‡] MCL 400.1111 <http://legislature.mi.gov/mcl-400-1111>

level is used to initiate a recommendation from MDHHS to the local health department and provider that actions be taken to educate the family to immediately minimize risk of ongoing exposure, identification and removal of lead sources, periodic retests to monitor the child's blood lead level and provide follow-up medical treatment as needed.⁷ For more about how this value was defined for 2019, see the [Meaning of an Elevated Result](#) section in the [Technical Appendix](#).

Confirmatory Venous Testing

Blood lead tests are performed on capillary blood samples (from a finger-prick) or venous blood samples (from a blood draw). Capillary tests are often used because they are easier to do, but they are less reliable than venous tests. Capillary test results are often false positives, meaning the BLL appears to be elevated when it is not elevated. For example, 60 percent of elevated capillary tests were false positives in a recent study.¹⁷ A confirmatory venous blood test should be used to verify elevated levels from capillary blood tests.

Methods

This section includes an overview of the analysis methods used to prepare this report. More detailed information about the analysis is available by topic in the [Technical Appendix](#).

Data Used for Analysis

Blood lead testing data in this report are obtained from the CLPPP blood lead surveillance database, where laboratory reports of blood lead test results are stored. See the [Data Elements](#) section of the Technical Appendix for more information about the surveillance database. Demographic and testing variables used for this analysis are listed under [Data Elements](#) in the Technical Appendix. Population and risk factor data for children under 6 years old were drawn from the American Community Survey, National Vital Statistics System, and U.S. Census estimates described in [Housing Stock and Population Estimates](#) in the Technical Appendix. Medicaid eligible population estimates were downloaded from the December 2019 MDHHS [Medicaid Green Book of Key Program Statistics](#).

Many children had more than one blood lead test within a calendar year. To report the number of *children* who were tested in a year (instead of the number of *tests* overall), only one test was counted for each child. The highest BLL obtained from a venous test, the most accurate test, was selected for each child. If no venous test was performed, the highest BLL obtained from a capillary test was selected. If the only test results were of unknown sample type, then the highest of these results was selected. This process is called [deduplication](#).

Testing Years

The focus of this report is on blood lead test results from 2019 and earlier years are included for comparison. Blood lead test results are available as early as 1998, but laboratory reporting of test results was inconsistent until 2003. Therefore, only years 2003 through 2019 are included in this report.

Data are current as of February 3, 2022.

Population

Blood lead test results are presented for Michigan children under age 6, as this age group is targeted for testing and is the focus of CLPPP intervention activities. For all tests included in this report, the blood collection date was before the child's 6th birthday.

Geographic Areas

The child's residential address is reported by the parent, guardian, or physician to the testing laboratory. After CLPPP receives this information, the reported address is corrected for spelling and other errors. Records that were missing key parts of the address or had a non-Michigan address, based on city and ZIP code, were not included in this report. See [Address Processing](#) in the Technical Appendix for more information.

Results in this report are presented for three types of geographies: (1) the state of Michigan, (2) counties, and (3) selected communities. Detroit is treated as a separate "county" compared to the rest of Wayne County. These county geographies are listed as "Wayne, Detroit" and "Wayne, excl. Detroit" in the tables).

Selected communities are areas with a history of high numbers of children with an EBLL and where MDHHS funds interventions to reduce the risk of lead exposure in children. These communities include the cities of Adrian, the City of Detroit, Flint, Grand Rapids, Hamtramck, Highland Park, Jackson, Lansing and Muskegon.

Risk Factors for Lead Exposure: Housing and Poverty

Two indicators of older housing are included in the [Reference Tables](#) of this report: the 2019 percentages of housing constructed before 1980 (two years after the lead paint ban), and houses constructed before 1950 (when homes are known to have had high levels of leaded paint).^{3,7,9,13,14} See [Housing Stock and Population Estimates](#) in the Technical Appendix for more information.

CLPPP defines a child enrolled in Medicaid as a child with at least one blood lead test while they were enrolled in a Medicaid program in the year. Medicaid status is included as a proxy for poverty, which is a risk factor for lead exposure. It is also included because Medicaid requires testing of all Medicaid-enrolled children under age 6.

Analysis

Measures

Blood lead test results were summed to create counts and to calculate proportions (percentages) for groups residing in the different geographic areas. The following measures are included:

- **Blood Lead Testing Coverage:** Among children under 6 years old, the number and percentage who have had a venous or capillary blood lead test. The percent is the number who have had at least one blood lead test divided by the total number of children under 6 years old in the population (see [Housing Stock and Population Estimates](#) in the Technical Appendix), multiplied by 100.
- **Elevated Blood Lead Levels:** Among children under 6 years old who have had a blood lead test, the number and percentage with an EBLL (≥ 5 $\mu\text{g}/\text{dL}$). The percent is the number who had an elevated test result divided by the total number of children under 6 who had at least one test, multiplied by 100.
- **Venous EBLL Testing Percentage:** Among children under 6 years old who have had an EBLL, the number and percent with a *venous* (confirmed) EBLL. The percent is the number who had at least one venous EBLL test result divided by the number of children under 6 who have had at least one EBLL test from any sample type, multiplied by 100.
- **High Blood Lead Levels:** Among children under 6 years old who have had a blood lead test, the number and percent with a venous BLL at or above 45 $\mu\text{g}/\text{dL}$. The percent is the number who had at least one venous blood lead test result above 45 $\mu\text{g}/\text{dL}$ divided by the total number of children who have had at least one test, multiplied by 100. At this blood lead level, the child's physician will consult with Michigan's Poison Control Center and consider hospitalization and/or chelation to remove lead from the body.

Reference Tables ([Appendix 3](#)): Reference tables include percent of pre-1950 and pre-1980 homes, population of children <6, number of children with at least one test, percent tested, and number and percent of EBLLs from all samples, capillary samples and venous samples. The first table is by county, and the second is for the nine selected communities.

Data Suppression

Data suppression of counts 1 through 5 is a common practice for many types of reports produced by CDC and other agencies.¹⁸ Counts of 1 through 5 are suppressed (not reported); other counts are not reported if they can be used to calculate the suppressed counts. These counts are replaced with an asterisk (*) in the tables. Tables without suppression will be made available to local health departments upon request.

Data are suppressed when the number of children tested was not large enough to generate a reliable rate of children with EBLLs. Data suppression is also used to protect privacy in areas where it might be possible to identify the person or people tested and their result(s) in areas where very few people are tested for blood lead.

Rates and percentages based on small counts are more likely to show large relative changes when comparing data across years and are otherwise less reliable as rates or percentages based on larger counts. As an example, if one child out of 10 tested in 2018 had an EBLL (10 percent of 10 children), and two children out of 10 tested in 2019 had an EBLL (20 percent of 10 children), the percentage of children with EBLLs would double from 10 percent to 20 percent in one year because one more child had an EBLL in 2019. On the other hand, if 10 children out of 100 tested in 2018 had an EBLL (10 percent of 100 children), and 11 children out of 100 tested in 2019 had an EBLL (11 percent of 100 children), the same increase (one additional child with an EBLL in 2019) had a less dramatic change in the percentage (i.e., less than a doubling).

Changes Since Last Report

The CLPPP program is continuously working to improve the quality of reports. Changes in the way CLPPP prepares the data are intended to make these reports more accurate and easier to understand. However, they may result in slightly different data compared to earlier annual reports.

- All blood lead data found in this report are available on the [MiTracking website, except for the selected community geographies](#). Data posted on MiTracking are available for public use and will be updated on a quarterly basis. If these data are needed in the format of earlier annual reports, they are also available upon request from MDHHS-CLPPP@Michigan.gov. Additional data are available using the "Advanced Query" option in MiTracking, including:
 - Blood lead metrics at both the 3.5 µg/dL and 5 µg/dL blood lead reference value.
 - Counts of venous BLL categories 5-9 µg/dL, 10-14 µg/dL, 15-19 µg/dL, and 20-44 µg/dL for children < 6 by county and city (previously in the annual report reference tables).
 - Reference tables for children 1-2 years old enrolled in Medicaid (previously in a Medicaid supplemental report).
 - Reference tables for ZIP codes (previously in a ZIP code supplemental report).
- For every new report, CLPPP updates all numbers to reflect any newly reported or updated test results, even if those test results are for past years. This change is made so that newer reports are based on the best data available. For this reason, there may be slight differences in the numbers presented in this report compared to numbers presented in reports released previously.

Blood Lead Surveillance Results in 2019

Blood Lead Testing Coverage

Michigan Overall

Year-by-Year Comparisons

In 2019, there were 143,224 Michigan children under 6 years old who had a blood lead test, representing 20.9 percent of the population in that age group ([Table 1](#), [Figure 1](#)). Testing rates have increased since 2003, when only 12.6 percent (100,226 children) were tested. The testing rate increased to 21.0 percent in 2010 and remained between 20.4 percent and 22.8 percent through 2019.

There was a notable increase in testing in 2016 associated with the Flint Water crisis. Efforts were made to test all City of Flint residents and, with news coverage of the crisis, increased public awareness likely led to more testing in Michigan overall. The year 2016 had the highest number (157,570) and percent (22.8 percent) of the population under age 6 tested for lead in Michigan since the beginning of the CLPPP surveillance program.

Table 1. Yearly Blood Lead Testing Coverage for Michigan Children Under 6 Years Old, 2003 - 2019

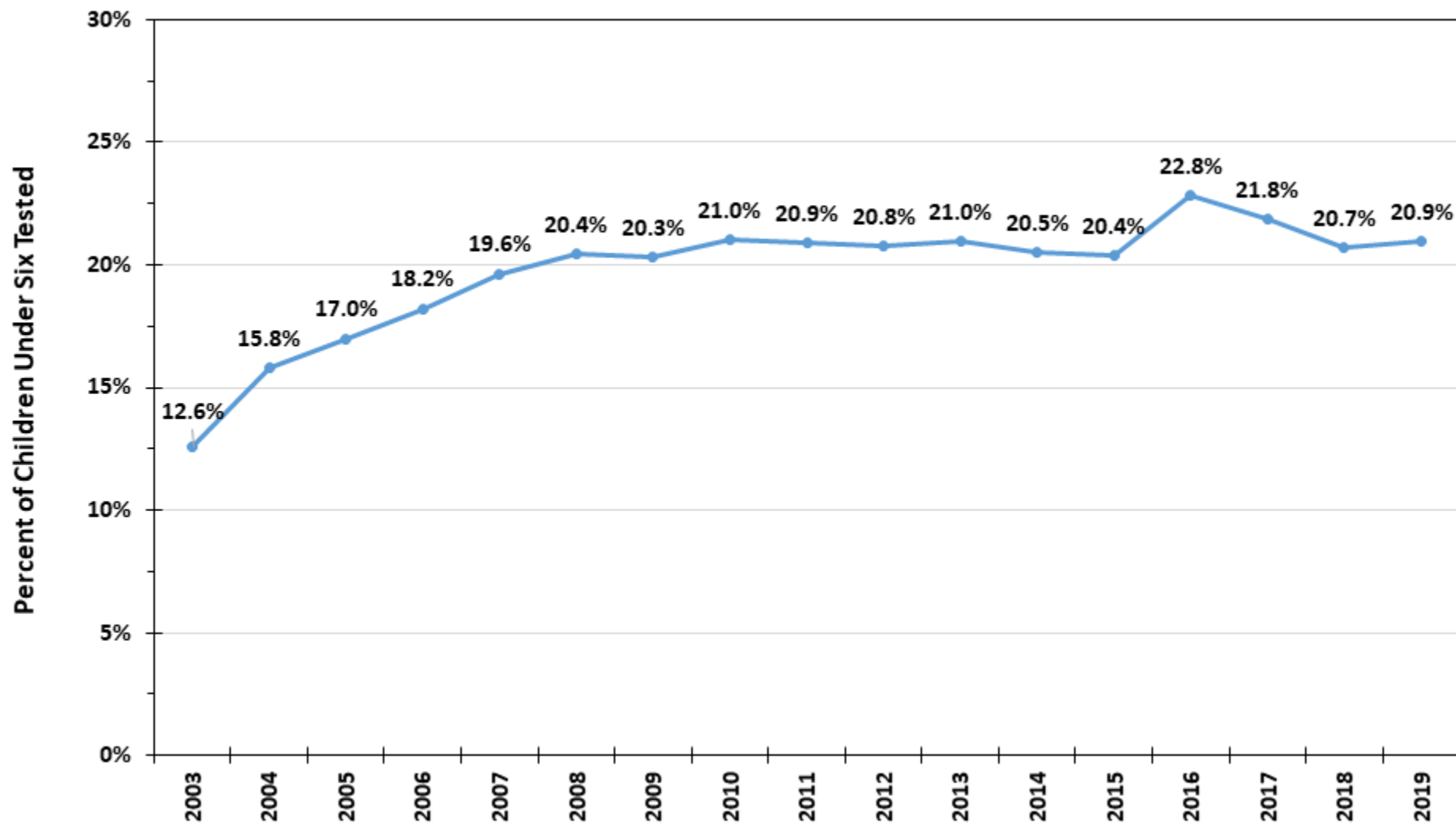
Year	Population ^a	# Tested	% Tested ^b	Year	Population ^a	# Tested	% Tested ^b
2003	797,847	100,226	12.6	2012	716,637	148,885	20.8
2004	793,480	125,388	15.8	2013	707,903	148,425	21.0
2005	785,850	133,454	17.0	2014	701,063	143,855	20.5
2006	776,156	141,303	18.2	2015	694,168	141,508	20.4
2007	762,649	149,797	19.6	2016	690,245	157,570	22.8
2008	749,205	153,200	20.4	2017	687,562	150,156	21.8
2009	759,362	154,359	20.3	2018	685,986	142,100	20.7
2010	741,970	155,940	21.0	2019	683,842	143,224	20.9
2011	728,409	152,177	20.9				

^a 2009 - 2019: [American Community Survey 5-year population estimates](#), Table B09001

2003 - 2008: [2010 CDC NVSS bridged-race population estimates](#)

^b Percent is among the population (% Tested = (# Tested / Population) x 100)

Figure 1. Annual Percent of Michigan Children Under 6 Years Old Tested for Blood Lead, 2003 - 2019



Population data from:

2009 - 2019: [American Community Survey 5-year population estimates](#), Table B09001

2003 - 2008: [2010 CDC NVSS bridged-race population estimates](#)

Blood lead data from MDHHS Data Warehouse Lead Screening Table. Data current as of February 3, 2022.

Comparisons by Child Characteristics

- Over one-half (53.8 percent) of 1-year-old children in Michigan were tested for lead in 2019 ([Table 2](#)). Just over a quarter (28.1 percent) of 2-year-old children were tested for lead and all other ages were tested less.
- The testing rate for children enrolled in Medicaid was twice the rate in non-Medicaid children (28.1 percent vs 14.2 percent, respectively). Over half of children (53.4 percent) enrolled in Medicaid who were 1 to 2 years old were tested for blood lead. Higher testing rates in the Medicaid population is due to the requirement that children enrolled in Medicaid be tested before their third birthday.¹⁵
- Testing coverage was nearly the same for males and females (20.3 percent and 20.2 percent, respectively).

Table 2. Blood Lead Testing Coverage for Michigan Children Under 6 Years Old by Characteristic, 2019

Characteristic	Population	# Tested	% Tested ^d	
Child Age	Age < 1	109,018 ^a	16,194	14.9
	Age 1	110,855 ^a	59,685	53.8
	Age 2	113,925 ^a	32,065	28.1
	Age 3	115,735 ^a	13,973	12.1
	Age 4	116,909 ^a	15,159	13.0
	Age 5	117,356 ^a	6,148	5.2
Child Sex	Female	334,250	67,561	20.2
	Male	349,548	70,873	20.3
	Sex Not Reported	Not Applicable	4,790	Not Applicable
Child Medicaid Status	Medicaid	331,334 ^b	93,259	28.1
	Non-Medicaid	352,498 ^c	49,965	14.2
	Medicaid Age 1-2	107,699 ^b	57,559	53.4
	Medicaid Age 1	54,239	36,463	67.2
	Medicaid Age 2	53,460	21,096	39.5
	Non-Medicaid Age 1	56,616	23,222	41.0
	Non-Medicaid Age 2	60,465	10,969	18.1
Total Children < 6		683,842	143,224	20.9

^a 2019 [US Census population estimates](#), Table PEPSYASEX. Note that population estimates for children under 6 years old may be different in other tables, where different population estimates are used.

^b [December 2019 Medicaid Green Book](#) estimate of Medicaid eligible population

^c Michigan population estimate minus the Medicaid eligible population estimate

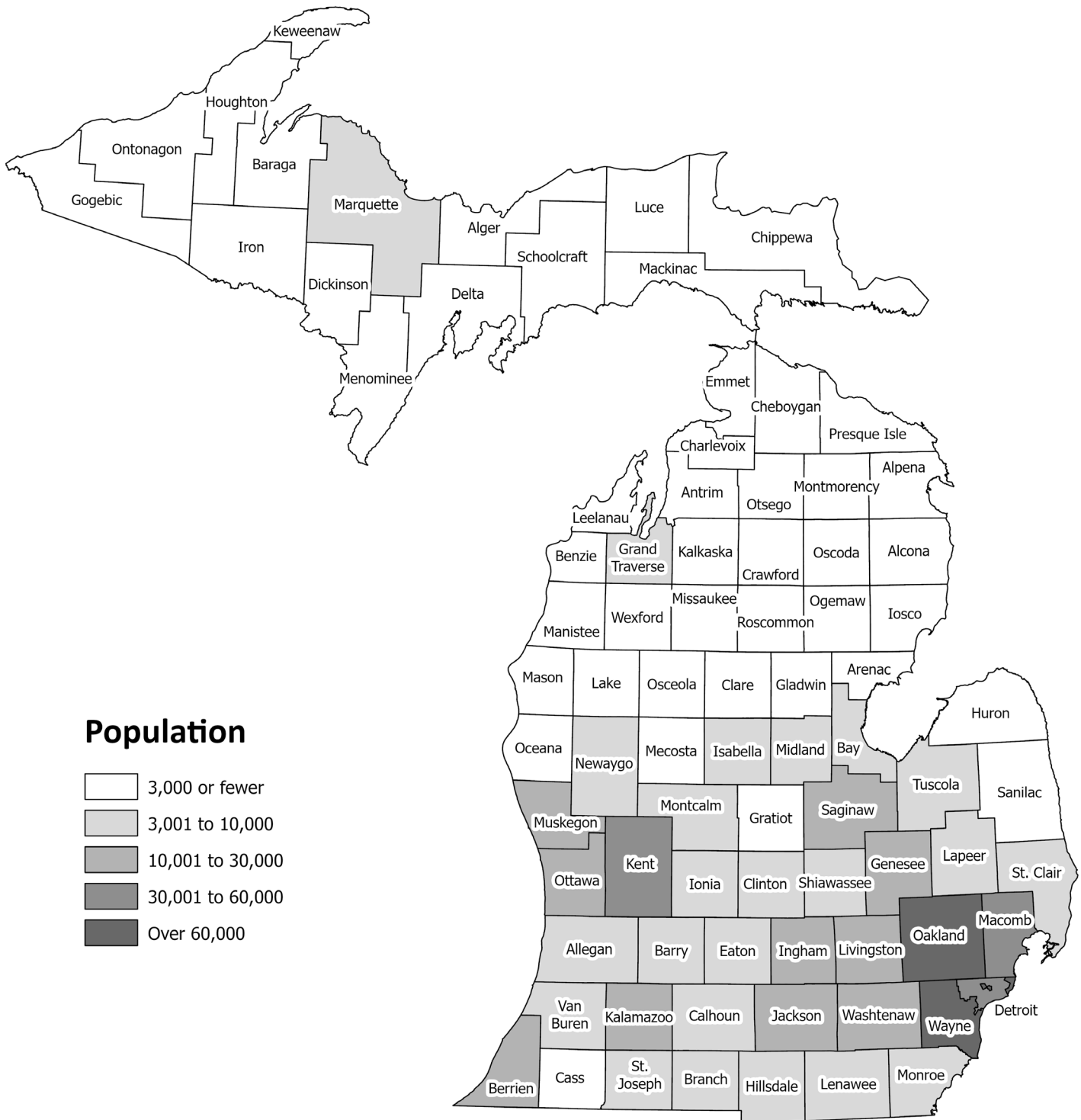
^d Percent is among the population (% Tested = (# Tested / Population) x 100)

Michigan Counties

Counties with the highest populations of the children under 6 years old were also the areas where the highest numbers were tested ([Figure 2](#), [Figure 3](#), [Table 3](#)). The counties with the highest testing rates ([Figure 4](#), [Table 3](#)) were:

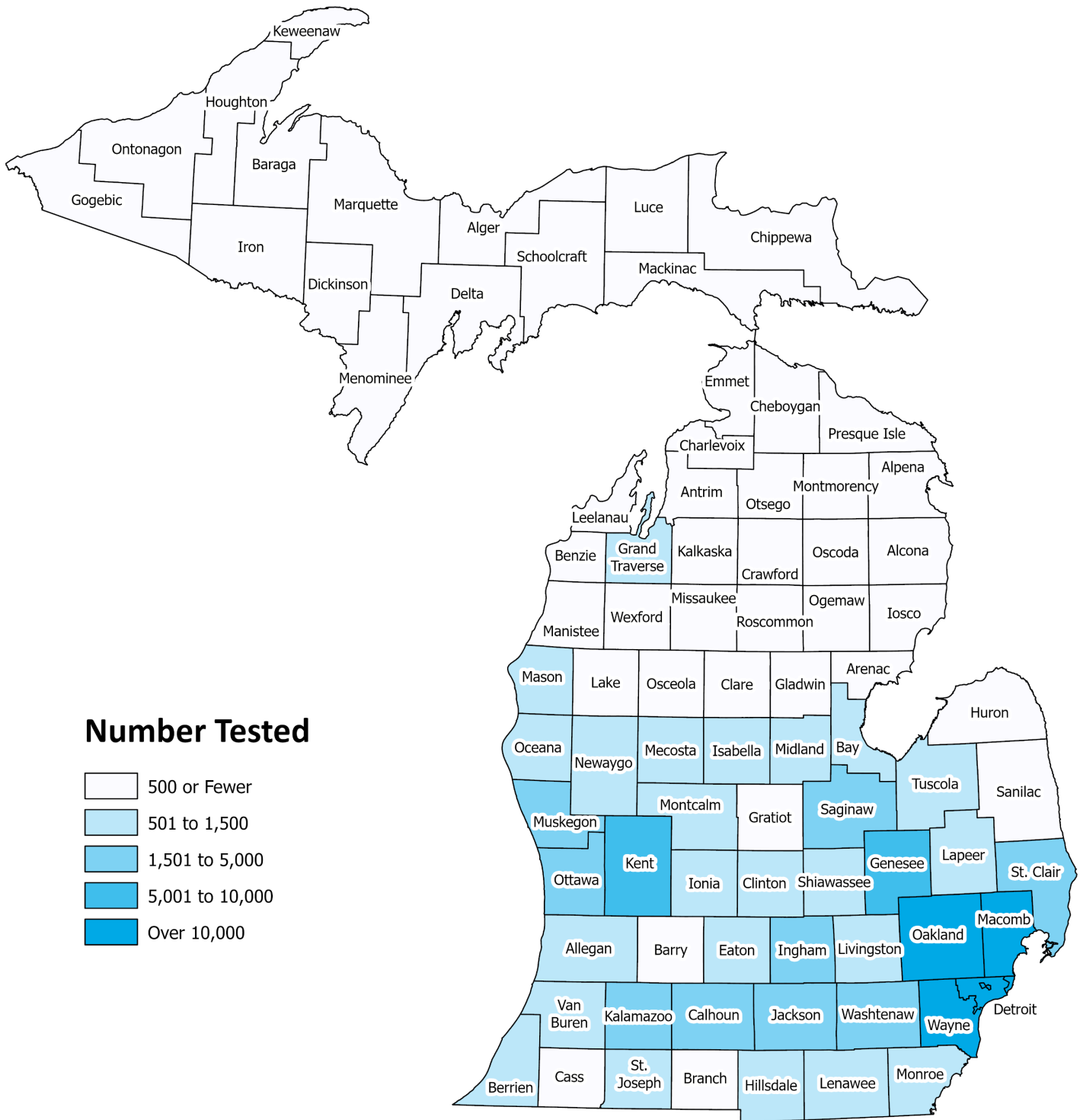
- Among the 15 counties with a population of children under 6 years old over 10,000: Wayne, Detroit (33.0 percent, 19,270 children), Muskegon (25.9 percent, 3,250 children), Jackson (25.7 percent, 2,780 children), Ingham (23.4 percent, 4,544 children), and Wayne, excl. Detroit (22.9 percent, 18,306 children).
- Among the 69 counties with populations less than 10,000: Arenac (30.5 percent, 251 children), Mason (30.3 percent, 550 children), Oceana (28.7 percent, 539 children), Shiawassee (28.5 percent, 1,160 children), and Manistee (28.4 percent, 331 children).
- In 2019, Michigan and a majority (50 out of 84) of counties saw increases in testing rates compared to 2018 after a decline in testing rates in 2017 and 2018. Of the 50 counties that saw improvements in testing rates, those with most improvement since 2018 included Presque Isle (8.2 percent increase), Kalkaska (7.9 percent increase), and Newaygo (7.3 percent increase). Of the 34 counties that saw decreases in testing rates since 2018, the largest decreases were seen in Baraga (8.4 percent decrease), Gogebic (7 percent decrease), and Chippewa (6.0 percent decrease). (Data not shown.)

Figure 2. Population of Michigan Children Under 6 Years Old by County of Residence, 2019



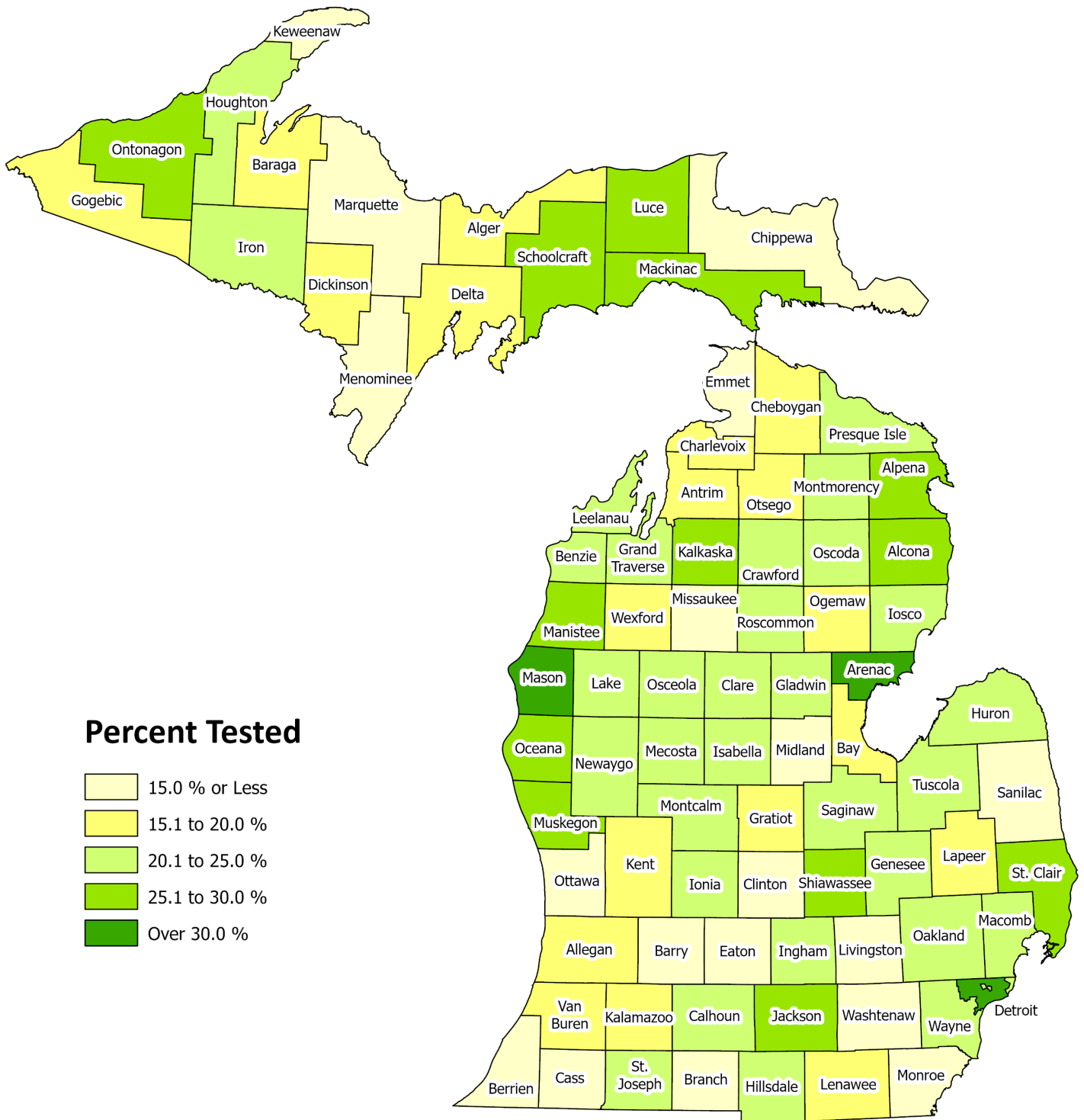
Population data from 2019 [American Community Survey Five-Year Population Estimates](#), Table B09001

Figure 3. Number of Michigan Children Under 6 Years Old Tested for Blood Lead by County of Residence, 2019



Blood lead data from MDHHS Data Warehouse Lead Screening Table. Data current as of February 3, 2022.

Figure 4. Percent of Michigan Children Under 6 Years Old Tested for Blood Lead by County of Residence, 2019



Population data from 2019 [American Community Survey Five-Year Population Estimates](#), Table B09001
Blood lead data from MDHHS Data Warehouse Lead Screening Table. Data current as of February 3, 2022.

Table 3: County Blood Lead Testing Coverage for Michigan Children Under 6 Years Old, 2019

County	Population ^a	# Tested	% Tested ^b	County	Population ^a	# Tested	% Tested ^b
MICHIGAN	683,842	143,224	20.9	LAKE	603	125	20.7
ALCONA	387	107	27.6	LAPEER	5,406	960	17.8
ALGER	417	67	16.1	LEELANAU	1,027	244	23.8
ALLEGAN	8,452	1,379	16.3	LENAWEE	6,283	969	15.4
ALPENA	1,531	391	25.5	LIVINGSTON	11,832	1,194	10.1
ANTRIM	1,225	241	19.7	LUCE	323	83	25.7
ARENAC	822	251	30.5	MACKINAC	466	130	27.9
BARAGA	437	81	18.5	MACOMB	57,232	13,063	22.8
BARRY	3,953	416	10.5	MANISTEE	1,165	331	28.4
BAY	6,146	1,202	19.6	MARQUETTE	3,858	436	11.3
BENZIE	990	222	22.4	MASON	1,816	550	30.3
BERRIEN	10,748	1,380	12.8	MECOSTA	2,481	527	21.2
BRANCH	3,248	424	13.1	MENOMINEE	1,286	160	12.4
CALHOUN	9,650	2,247	23.3	MIDLAND	5,661	559	9.9
CASS	2,970	377	12.7	MISSAUKEE	1,177	140	11.9
CHARLEVOIX	1,418	238	16.8	MONROE	9,477	1,365	14.4
CHEBOYGAN	1,237	236	19.1	MONTCALM	4,253	887	20.9
CHIPPEWA	2,229	277	12.4	MONTMORENCY	361	89	24.7
CLARE	2,050	494	24.1	MUSKEGON	12,557	3,250	25.9
CLINTON	5,265	666	12.6	NEWAYGO	3,368	749	22.2
CRAWFORD	763	164	21.5	OAKLAND	81,687	16,791	20.6
DELTA	2,149	356	16.6	OCEANA	1,875	539	28.7
DICKINSON	1,531	244	15.9	OGEMAW	1,184	201	17.0
EATON	7,357	1,079	14.7	ONTONAGON	164	43	26.2
EMMET	1,804	244	13.5	OSCEOLA	1,534	369	24.1
GENESEE	28,750	6,068	21.1	OSCODA	490	99	20.2
GLADWIN	1,623	349	21.5	OTSEGO	1,532	304	19.8
GOGEBIC	700	118	16.9	OTTAWA	21,534	3,056	14.2
GRAND TRAVERSE	5,611	1,327	23.6	PRESQUE ISLE	568	125	22.0
GRATIOT	2,447	443	18.1	ROSCOMMON	998	222	22.2
HILLSDALE	3,286	666	20.3	SAGINAW	13,061	2,914	22.3
HOUGHTON	2,316	493	21.3	SAINT CLAIR	9,499	2,641	27.8
HURON	1,866	411	22.0	SAINT JOSEPH	4,702	984	20.9
INGHAM	19,433	4,544	23.4	SANILAC	2,684	391	14.6
IONIA	4,285	942	22.0	SCHOOLCRAFT	393	106	27.0
IOSCO	1,363	283	20.8	SHIAWASSEE	4,066	1,160	28.5
IRON	518	114	22.0	TUSCOLA	3,446	825	23.9
ISABELLA	4,009	857	21.4	VAN BUREN	5,440	876	16.1
JACKSON	10,838	2,780	25.7	WASHTENAW	21,138	2,973	14.1
KALAMAZOO	18,972	3,028	16.0	WAYNE, DETROIT	58,458	19,270	33.0
KALKASKA	1,082	288	26.6	WAYNE, EXCL. DETROIT	79,906	18,306	22.9
KENT	52,460	9,345	17.8	WEXFORD	2,412	364	15.1
KEWEENAW	101	15	14.9	MICHIGAN	683,842	143,224	20.9

^a Population data from 2018 [American Community Survey Five-year Population Estimates](#), Table B09001

^b Percent is among population of children under 6 years old (% Tested = (# Children < 6 Tested / Population Children < 6) × 100)

Selected Communities

The testing rate for children under 6 years old was higher in all nine selected communities compared to Michigan overall ([Table 4](#)). The highest rates were in Jackson (73.4 percent, 2,090 children), Hamtramck (47.3 percent, 1,134 children), and Muskegon (44.7 percent, 2,500 children).

Table 4: Selected Community Blood Lead Testing Coverage for Michigan Children Under 6 Years Old, 2019

Community	Population ^a	# Tested	% Tested ^b
ADRIAN	1,781	439	24.6
CITY OF DETROIT	58,458	19,270	33.0
FLINT	10,557	3,129	29.6
GRAND RAPIDS	18,335	5,891	32.1
HAMTRAMCK	2,398	1,134	47.3
HIGHLAND PARK	806	331	41.1
JACKSON	2,848	2,090	73.4
LANSING	9,783	3,711	37.9
MUSKEGON	5,592	2,500	44.7
MICHIGAN	683,842	143,224	20.9

^a Population data from 2019 [American Community Survey Five-year Population Estimates](#), Table B09001

^b Percent is among population of children under 6 years old (% Tested = (# Children < 6 Tested / Population Children < 6) × 100)

Elevated Blood Lead Levels

Michigan Overall

Year-by-Year Comparisons

The percent of children with EBLLs among children tested has declined over the years ([Table 5](#), [Figure 5](#)), from 20.0 percent in 2003 to 2.7 percent in 2019 (an 86.5 percent reduction). However, this decline has slowed in the last five years (3.4 percent in 2015 to 2.7 percent in 2019). Year-to-year comparisons are difficult to interpret given policy and testing changes throughout the 2003-2019 period.

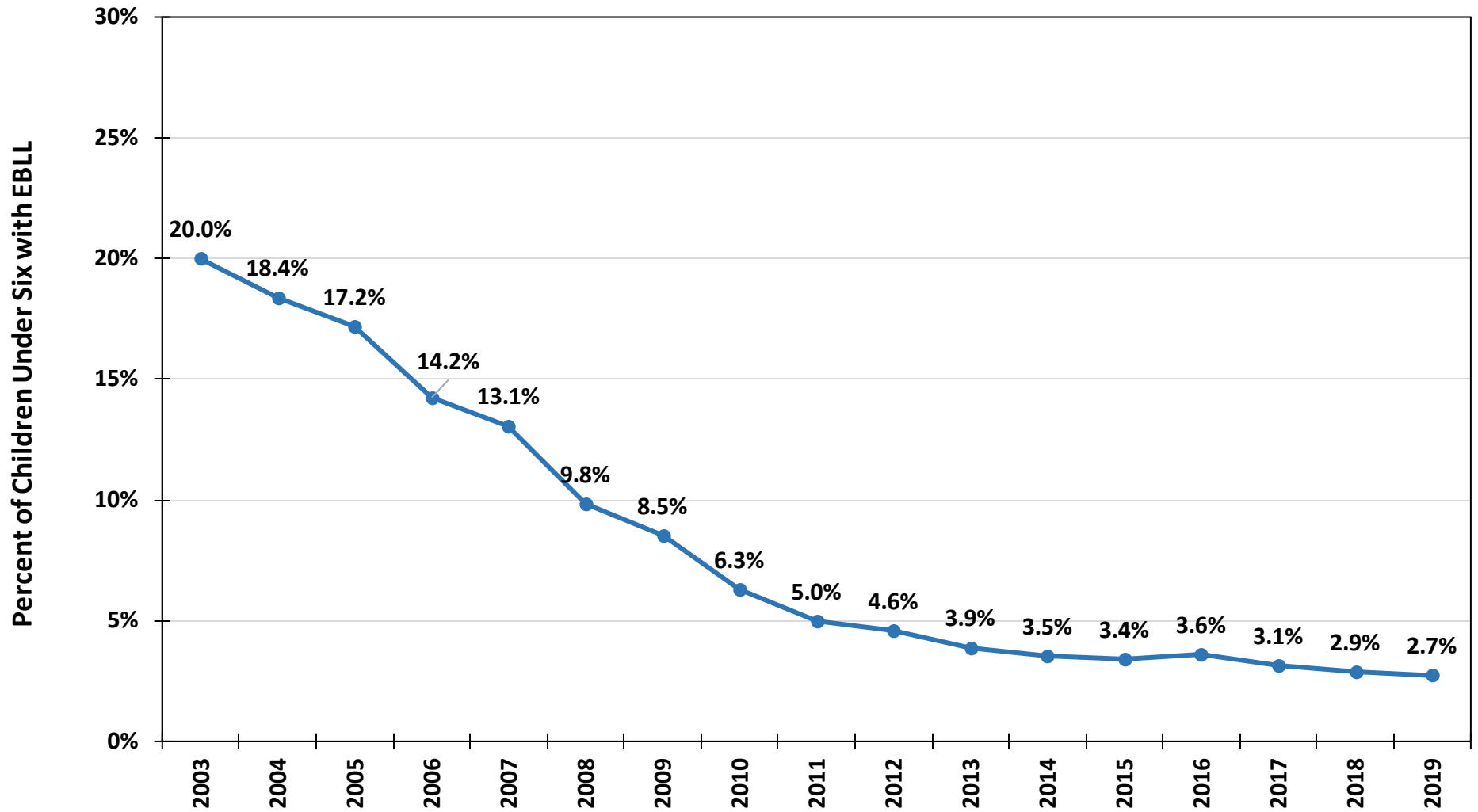
- There have been changes in blood lead testing rules and practices (see [Blood Lead Testing History](#) in the Technical Appendix). Most notably, the testing rate among all children under age 6 rose after Michigan added requirements for Medicaid testing in 2004¹⁵; the rate increased from 12.6 percent in 2003 to 19.6 percent in 2007 ([Figure 1](#)).
- Testing rates between 2006 and 2015 were consistently around 20.0-21.0 percent. In 2016, there was [increased blood lead testing](#) across the entire state. The increase in blood lead testing may mean that the children tested in 2016 may have different underlying risks for lead exposure than typical years, which could affect the numbers and percentages of children with elevated blood lead levels.

Table 5. Annual Elevated Blood Lead Levels (EBLLs, ≥ 5 $\mu\text{g}/\text{dL}$) Among Tested Michigan Children Under 6 Years Old, 2003-2019

Year	# Tested	# EBLL	% EBLL ^a	Year	# Tested	# EBLL	% EBLL ^a
2003	100,226	20,023	20.0	2012	148,885	6,817	4.6
2004	125,388	23,056	18.4	2013	148,425	5,742	3.9
2005	133,454	22,896	17.2	2014	143,855	5,067	3.5
2006	141,303	20,119	14.2	2015	141,508	4,796	3.4
2007	149,797	19,554	13.1	2016	157,570	5,641	3.6
2008	153,200	15,032	9.8	2017	150,156	4,700	3.1
2009	154,359	13,145	8.5	2018	142,100	4,074	2.9
2010	155,940	9,770	6.3	2019	143,224	3,907	2.7
2011	152,177	7,561	5.0				

^a Percent is among those tested (% EBLL = (# EBLL / # Tested) \times 100)

Figure 5. Annual Percent of Elevated Blood Lead Levels (EBLLs, $\geq 5 \mu\text{g}/\text{dL}$) Among Tested Michigan Children Under 6 Years Old, 2003 -2019



Blood lead data from MDHHS Data Warehouse Lead Screening Table. Data current as of February 3, 2022.

Comparisons by Child Characteristics

- Children who were 3 years old had the highest EBLL percentage (4.2 percent, see [Table 6](#)). Some of this difference may be explained by lower testing rates (12.1 percent, see [Table 2](#)) in this age group (see [Targeted Testing](#)).
- The EBLL percent was over twice as high in Medicaid-enrolled children (3.4 percent) compared to non-Medicaid-enrolled children (1.4 percent). This is likely a true difference because (1) the rate of testing among Medicaid-enrolled children was higher than for non-Medicaid-enrolled children (28.1 percent and 14.2 percent, respectively; see [Table 2](#)) and (2) those enrolled in Medicaid are more likely to be exposed to lead.²¹
- The EBLL percent was not substantially different between males (2.9 percent) and females (2.6 percent).

Table 6. Elevated Blood Lead Levels (EBLLs, ≥ 5 $\mu\text{g}/\text{dL}$) Among Tested Michigan Children Under 6 Years Old by Child Characteristics, 2019

Characteristic	# Tested	# EBLL	% EBLL ^a
Age < 1	16,194	243	1.5
Age 1	59,685	1,398	2.3
Age 2	32,065	1,003	3.1
Age 3	13,973	580	4.2
Age 4	15,159	481	3.2
Age 5	6,148	202	3.3
Medicaid	93,259	3,193	3.4
Non-Medicaid	49,965	714	1.4
Medicaid Age 1-2	57,559	1,929	3.4
Medicaid Age 1	36,463	1,087	3.0
Medicaid Age 2	21,096	842	4.0
Female	67,561	1,762	2.6
Male	70,873	2,049	2.9
Sex Not Reported	4,790	96	2.0
Total	143,224	3,907	2.7

^a Percent is among those tested (% EBLL = (# EBLL / # Tested) \times 100)

Michigan Counties

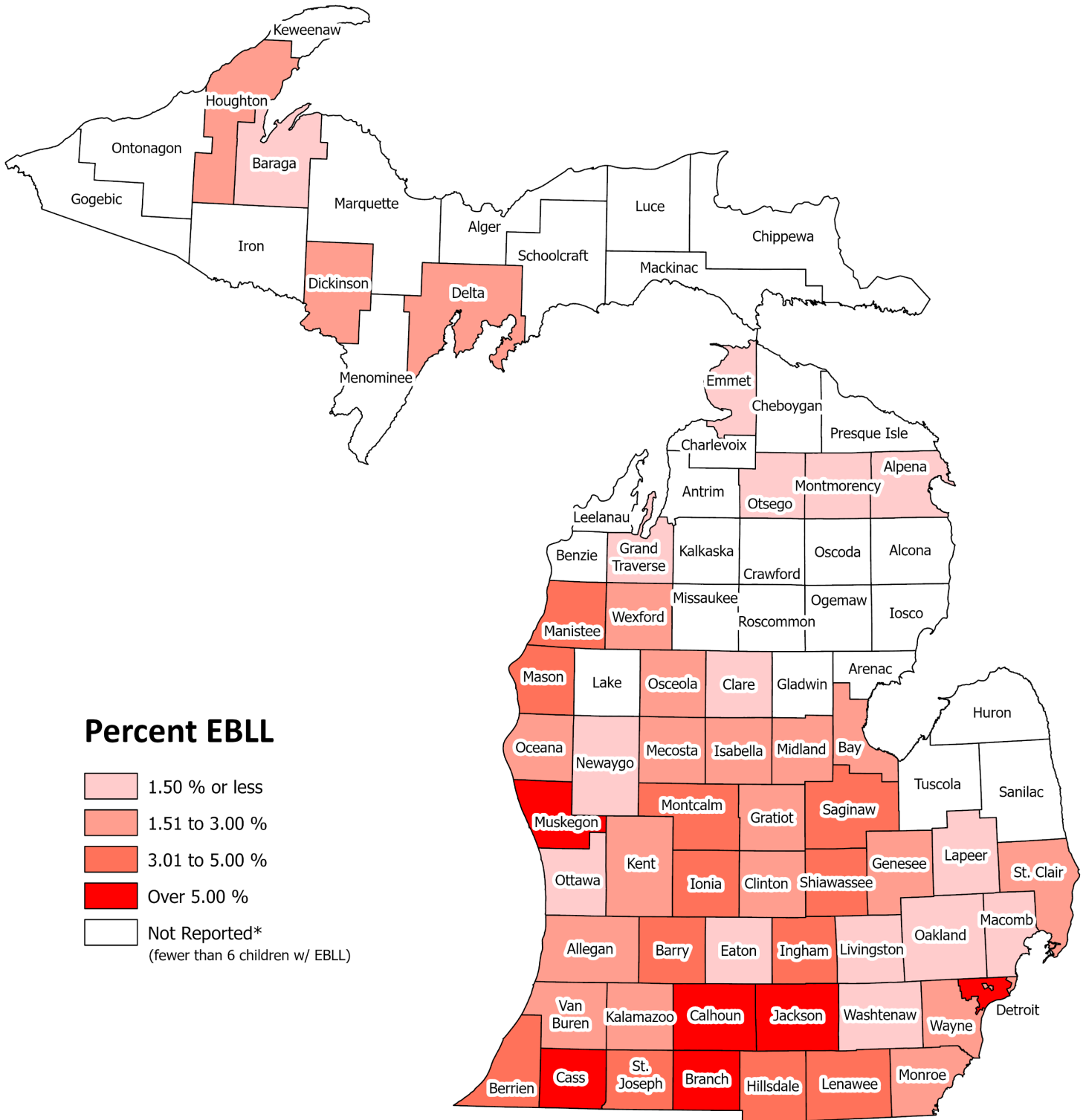
Thirty-one counties had an EBLL percentage less than the state overall (2.7 percent), including 14 counties below 1.5 percent EBLL. Twenty-two counties had a higher EBLL percentage than the state and the remaining 31 counties had numbers of EBLLs requiring [data suppression](#) ([Figure 6](#), [Table 7](#)). Among the counties with unsuppressed counts of EBLLs:

- Those with the highest numbers of children with an EBLL were the City of Detroit (labeled as “Wayne, Detroit”) (1,297 children), Wayne County excluding Detroit (labeled as “Wayne, Excl. Detroit”) (304 children), and Kent (222 children).
- Those with the highest percent of children under 6 with an EBLL among all tested were the City of Detroit (labeled as “Wayne, Detroit”) (6.7 percent, 1,297 children), Cass (6.4 percent, 24 children), Branch (5.9 percent, 25 children), Muskegon (5.9 percent, 191 children), Jackson (5.6 percent, 155 children) and Calhoun (5.2 percent, 117 children).

- Twenty-seven counties had a lower EBLL percentage in 2019 than in 2018. Counties with the largest decrease included Ionia (1.6-percent absolute decrease), Barry (1.5-percent decrease), Lapeer (1.2-percent decrease), Bay (1.1-percent decrease) and Kent (1.0-percent decrease).⁵

⁵ See the MiTracking data portal (<https://mitracking.state.mi.us/>) for the most up-to-date data from 2019.

Figure 6. Percent of Tested Michigan Children Under 6 Years Old with Elevated Blood Lead Levels (EBLLs, $\geq 5 \mu\text{g}/\text{dL}$) by County of Residence, 2019



Blood lead data from MDHHS Data Warehouse Lead Screening Table. Data current as of February 3, 2022.

*Percentages based on counts between one (1) and five (5) are [suppressed](#).

Table 7: County Elevated Blood Lead Levels (EBLLs, $\geq 5 \mu\text{g}/\text{dL}$) Among Tested Children Under 6 Years Old, 2019

County	# Tested	# EBLL	% EBLL ^a	County	# Tested	# EBLL	% EBLL ^a
MICHIGAN	143,224	3,907	2.7	LAKE	125	*	-
ALCONA	107	*	-	LAPEER	960	11	1.1
ALGER	67	*	-	LEELANAU	244	*	-
ALLEGAN	1,379	38	2.8	LENAWEE	969	44	4.5
ALPENA	391	6	1.5	LIVINGSTON	1,194	6	0.5
ANTRIM	241	*	-	LUCE	83	*	-
ARENAC	251	*	-	MACKINAC	130	*	-
BARAGA	81	0	0.0	MACOMB	13,063	101	0.8
BARRY	416	14	3.4	MANISTEE	331	11	3.3
BAY	1,202	30	2.5	MARQUETTE	436	*	-
BENZIE	222	*	-	MASON	550	21	3.8
BERRIEN	1,380	43	3.1	MECOSTA	527	10	1.9
BRANCH	424	25	5.9	MENOMINEE	160	*	-
CALHOUN	2,247	117	5.2	MIDLAND	559	9	1.6
CASS	377	24	6.4	MISSAUKEE	140	*	-
CHARLEVOIX	238	*	-	MONROE	1,365	27	2.0
CHEBOYGAN	236	*	-	MONTCALM	887	28	3.2
CHIPPEWA	277	*	-	MONTMORENCY	89	0	0.0
CLARE	494	6	1.2	MUSKEGON	3,250	191	5.9
CLINTON	666	13	2.0	NEWAYGO	749	10	1.3
CRAWFORD	164	*	-	OAKLAND	16,791	208	1.2
DELTA	356	10	2.8	OCEANA	539	16	3.0
DICKINSON	244	6	2.5	OGEMAW	201	*	-
EATON	1,079	16	1.5	ONTONAGON	43	*	-
EMMET	244	0	0.0	OSCEOLA	369	8	2.2
GENESEE	6,068	104	1.7	OSCODA	99	*	-
GLADWIN	349	*	-	OTSEGO	304	0	0.0
GOGEBIC	118	*	-	OTTAWA	3,056	41	1.3
GRAND TRAVERSE	1,327	6	0.5	PRESQUE ISLE	125	*	-
GRATIOT	443	10	2.3	ROSCOMMON	222	*	-
HILLSDALE	666	21	3.2	SAGINAW	2,914	103	3.5
HOUGHTON	493	9	1.8	SAINT CLAIR	2,641	80	3.0
HURON	411	*	-	SAINT JOSEPH	984	45	4.6
INGHAM	4,544	154	3.4	SANILAC	391	*	-
IONIA	942	29	3.1	SCHOOLCRAFT	106	*	-
IOSCO	283	*	-	SHIAWASSEE	1,160	38	3.3
IRON	114	*	-	TUSCOLA	825	*	-
ISABELLA	857	15	1.8	VAN BUREN	876	17	1.9
JACKSON	2,780	155	5.6	WASHTENAW	2,973	34	1.1
KALAMAZOO	3,028	81	2.7	WAYNE, DETROIT	19,270	1,297	6.7
KALKASKA	288	*	-	WAYNE, EXCL. DETROIT	18,306	304	1.7
KENT	9,345	222	2.4	WEXFORD	364	6	1.6
KEWEENAW	15	*	-	MICHIGAN	143,224	3,907	2.7

* Counts between one (1) and five (5) are [suppressed](#) and replaced with an asterisk (*). Percentages for suppressed counts are not calculated and appear as (-).

^a Percent is among those tested (% EBLL = (# EBLL / # Tested) × 100)

Selected Communities

Eight of the nine selected communities had higher EBLL percentages than the state (2.7 percent) in 2019 ([Table 8](#)).

- The highest numbers of children with an EBLL were in the City of Detroit (1,297 children), Grand Rapids (187 children), and Muskegon (174 children).
- The highest EBLL percentages of tested children were in Highland Park (12.4%, 41 children), Muskegon (7.0 percent, 174 children), and the City of Detroit (6.7 percent, 1,297 children).
- The City of Grand Rapids had the second highest number of children with an EBLL (187 children) but the second lowest the EBLL percentage (3.2 percent). In comparison to the slowing decline seen in the state overall, EBLL percentages have decreased notably since 2016 in some selected communities ([Figure 7](#), [Table 9](#)). However, comparisons between years in these selected communities are subject to the same limitations listed for statewide year-to-year comparisons (see [Year-by-Year Comparisons](#)).
- Between 2018 and 2019, for children under 6 years old:
 - The percent with an EBLL rose in Adrian (2.1-percent absolute increase), Jackson (1.0-percent increase), Lansing (0.8-percent increase), and Flint (0.2-percent increase).
 - The percent with an EBLL dropped the most in Highland Park (2.3-percent decrease) and Grand Rapids (1.3-percent decrease).
 - Lesser drops in EBLL percentage were seen in the City of Detroit (0.3-percent decrease), Muskegon (0.2-percent decrease), and Hamtramck (0.1-percent decrease).

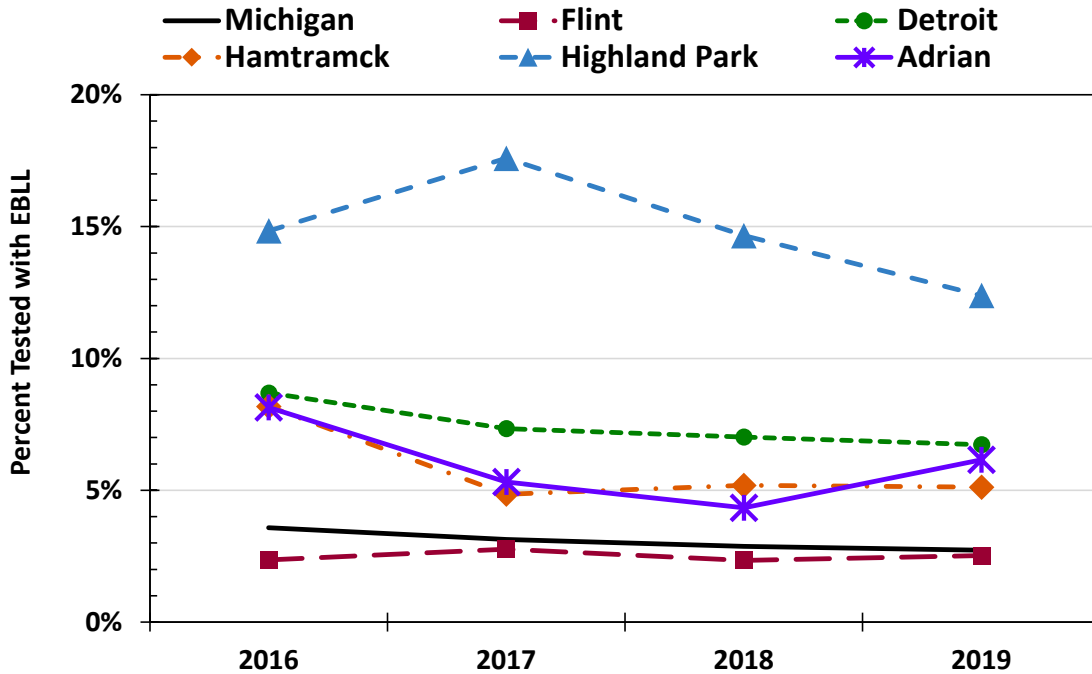
Table 8. Selected Community Elevated Blood Lead Levels (EBLLs, ≥ 5 $\mu\text{g}/\text{dL}$) Among Tested Michigan Children Under 6 Years Old, 2019

Community	# Tested	# EBLL	% EBLL ^a
ADRIAN	439	27	6.2
CITY OF DETROIT	19,270	1,297	6.7
FLINT	3,129	79	2.5
GRAND RAPIDS	5,891	187	3.2
HAMTRAMCK	1,134	58	5.1
HIGHLAND PARK	331	41	12.4
JACKSON	2,090	132	6.3
LANSING	3,711	138	3.7
MUSKEGON	2,500	174	7.0
MICHIGAN	143,224	3,907	2.7

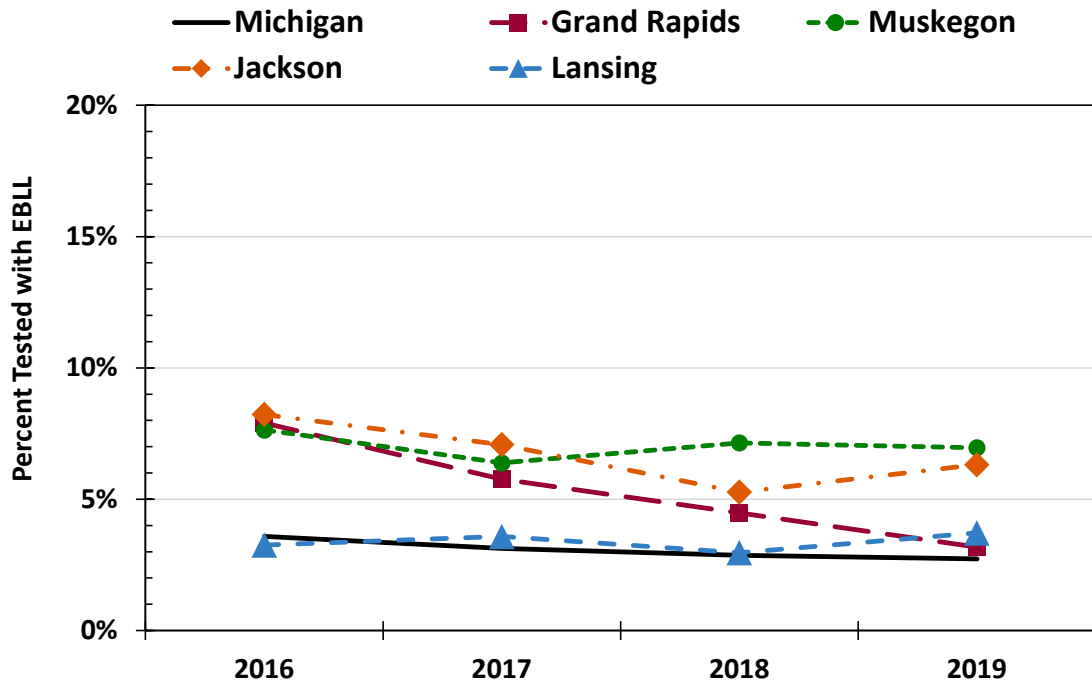
^a Percent is among those tested (% EBLL = (# EBLL / # Tested) \times 100).

Figure 7. Percent of Children Under 6 Years Old with Elevated Blood Lead Levels (EBLLs, ≥ 5 $\mu\text{g}/\text{dL}$)^a in Selected Communities, 2016-2019

State of Michigan and Cities in Eastern Michigan



State of Michigan and Cities in Central and Western Michigan



^a Blood lead data from MDHHS Data Warehouse Lead Screening Table. Data current as of February 3, 2022.

Table 9. Selected Communities Elevated Blood Lead Levels (EBLLs, $\geq 5 \mu\text{g}/\text{dL}$) for Children Under 6 Years Old, 2016 – 2019

Community	# Tested 2016	# EBLL 2016	% EBLL ^a 2016	# Tested 2017	# EBLL 2017	% EBLL ^a 2017	# Tested 2018	# EBLL 2018	% EBLL ^a 2018	# Tested 2019	# EBLL 2019	% EBLL ^a 2019
ADRIAN	553	45	8.1	602	32	5.3	554	24	4.3	439	27	6.2
CITY OF DETROIT	23,607	2,051	8.7	22,269	1,634	7.3	19,915	1,398	7.0	19,270	1,297	6.7
FLINT	7,349	173	2.4	3,473	96	2.8	3,330	78	2.3	3,129	79	2.5
GRAND RAPIDS	6,616	523	7.9	6,443	371	5.8	6,049	271	4.5	5,891	187	3.2
HAMTRAMCK	1,174	96	8.2	1,134	55	4.9	1,196	62	5.2	1,134	58	5.1
HIGHLAND PARK	337	50	14.8	324	57	17.6	307	45	14.7	331	41	12.4
JACKSON	2,213	182	8.2	1,993	141	7.1	2,240	118	5.3	2,090	132	6.3
LANSING	3,715	121	3.3	3,685	132	3.6	3,680	109	3.0	3,711	138	3.7
MUSKEGON	1,807	138	7.6	1,849	118	6.4	2,015	144	7.1	2,500	174	7.0
MICHIGAN	157,570	5,641	3.6	150,156	4,700	3.1	142,100	4,074	2.9	143,224	3,907	2.7

^a Percent is among all tested children under 6 years old ($\% \text{ Tested} = (\# \text{ EBLL} / \# \text{ All Children Tested}) \times 100$).

Venous Testing

Michigan Overall

Capillary tests are useful for screening, but they are less accurate than venous tests. The CDC and MDHHS CLPPP recommends that any elevated capillary blood lead test be followed by a venous blood test to confirm that a child truly has an EBLL.³

The proportion of EBLLs from venous tests decreased from 2003 (66.4 percent) through 2013 (47.6 percent) ([Table 10](#)). In 2006, the Food and Drug Administration (FDA) approved point-of-care lead testing. To date, the only point of care machine approved by the FDA is the LeadCare® blood lead testing system. This allowed capillary blood lead tests to be done in any clinic,²³ where a blood draw for a venous test may not be readily available. Expanded capillary point-of-care testing *without* venous confirmatory testing may have contributed to the decrease in the proportion of venous EBLLs since 2006.

The BLL considered to be ‘elevated’ changed from 10 µg/dL to 5 µg/dL in 2012,¹ so confirmatory venous testing was recommended at lower blood lead levels than before. The proportion of venous EBLLs did not change in the year following this new recommendation but did increase substantially in 2014 (from 48.6 percent in 2012 to 53.4 percent in 2014). Additionally, CLPPP has been working with local health departments and healthcare providers for the last several years to increase venous confirmatory testing. Recent efforts appear to have been successful, with the proportion of venous EBLL at 58.9 percent in 2018 - its highest level since 2006.

Table 10. Number and Percentage of Elevated Blood Lead Levels (EBLLs, ≥ 5 µg/dL) based on Venous Blood Lead Tests for Michigan Children Under 6 Years Old by Year, 2003–2019

Year	# All EBLL	# Venous EBLL	% Venous EBLL ^a	Year	# All EBLL	# Venous EBLL	% Venous EBLL ^a
2003	20,023	13,297	66.4	2012	6,817	3,310	48.6
2004	23,056	14,583	63.3	2013	5,742	2,735	47.6
2005	22,896	14,114	61.6	2014	5,067	2,706	53.4
2006	20,119	11,515	57.2	2015	4,796	2,491	51.9
2007	19,554	10,576	54.1	2016	5,641	2,901	51.4
2008	15,032	8,200	54.6	2017	4,700	2,620	55.7
2009	13,145	6,575	50.0	2018	4,074	2,398	58.9
2010	9,770	5,093	52.1	2019	3,907	2,167	55.5
2011	7,561	3,997	52.9				

^a Percent is among those with EBLL (% Venous EBLL= (# Venous EBLL / # All EBLL) × 100)

Michigan Counties

In 2019, for children under 6 years old ([Table 11](#)) in counties with at least six children (unsuppressed counts) with a venous EBLL:

- Counties with the lowest proportion of EBLLs from venous tests were Jackson (18.1 percent), Ingham (24.7 percent), and Saint Clair (26.3 percent).
- Fourteen counties (including Detroit) had higher proportions of EBLL from venous tests than Michigan.
- Counties with the highest venous EBLL percentages were Kent (70.3 percent), Berrien (65.1 percent), and Washtenaw (64.7 percent).

Table 11. County Elevated Blood Lead Levels (EBLLs, $\geq 5 \mu\text{g}/\text{dL}$) from Venous Blood Lead Tests for Michigan Children Under 6 Years Old, 2019

County	# All EBLL ^a	# Venous EBLL	% Venous EBLL ^b	County	# All EBLL	# Venous EBLL	% Venous EBLL ^b
MICHIGAN	3,907	2,167	55.5	LAKE	*	*	-
ALCONA	*	*	-	LAPEER	11	*	-
ALGER	*	0	0.0	LEELANAU	*	0	0.0
ALLEGAN	38	16	42.1	LENAWEE	44	26	59.1
ALPENA	6	*	-	LIVINGSTON	6	*	-
ANTRIM	*	*	-	LUCE	*	*	-
ARENAC	*	*	-	MACKINAC	*	*	-
BARAGA	0	0	-	MACOMB	101	47	46.5
BARRY	14	*	-	MANISTEE	11	6	54.5
BAY	30	13	43.3	MARQUETTE	*	*	-
BENZIE	*	0	0.0	MASON	21	9	42.9
BERRIEN	43	28	65.1	MECOSTA	10	*	-
BRANCH	25	15	60.0	MENOMINEE	*	0	0.0
CALHOUN	117	73	62.4	MIDLAND	9	*	-
CASS	24	11	45.8	MISSAUKEE	*	0	0.0
CHARLEVOIX	*	*	-	MONROE	27	12	44.4
CHEBOYGAN	*	*	-	MONTCALM	28	8	28.6
CHIPPEWA	*	0	0.0	MONTMORENCY	0	0	-
CLARE	6	*	-	MUSKEGON	191	65	34.0
CLINTON	13	*	-	NEWAYGO	10	*	-
CRAWFORD	*	*	-	OAKLAND	208	96	46.2
DELTA	10	6	60.0	OCEANA	16	*	-
DICKINSON	6	6	100.0	OGEMAW	*	*	-
EATON	16	*	-	ONTONAGON	*	*	-
EMMET	0	0	-	OSCEOLA	8	*	-
GENESEE	104	54	51.9	OSCODA	*	0	0.0
GLADWIN	*	*	-	OTSEGO	0	0	0.0
GOGEBIC	*	*	-	OTTAWA	41	21	51.2
GRAND TRAVERSE	6	*	-	PRESQUE ISLE	*	*	-
GRATIOT	10	*	-	ROSCOMMON	*	0	0.0
HILLSDALE	21	13	61.9	SAGINAW	103	41	39.8
HOUGHTON	9	8	88.9	SAINT CLAIR	80	21	26.3
HURON	*	*	-	SAINT JOSEPH	45	25	55.6
INGHAM	154	38	24.7	SANILAC	*	*	-
IONIA	29	13	44.8	SCHOOLCRAFT	*	*	-
IOSCO	*	*	-	SHIAWASSEE	38	17	44.7
IRON	*	0	0.0	TUSCOLA	*	*	-
ISABELLA	15	*	-	VAN BUREN	17	9	52.9
JACKSON	155	28	18.1	WASHTENAW	34	22	64.7
KALAMAZOO	81	51	63.0	WAYNE, DETROIT	1,297	927	71.5
KALKASKA	*	*	-	WAYNE, EXCL. DETROIT	304	195	64.1
KENT	222	156	70.3	WEXFORD	6	*	-
KEWEENAW	*	*	-	MICHIGAN	3,907	2,167	55.5

^a Counts between 1 and 5 are [suppressed](#) and replaced with an asterisk (*). Percentages for suppressed counts are not calculated and appear as (-).

^b Percent is among those with EBLLs (% Venous EBLLs = (# Venous EBLLs / # All EBLLs) \times 100).

Selected Communities

Four selected communities had higher proportions of EBLLs in children under 6 years old detected by venous tests than Michigan overall ([Table 12](#)).

- Communities with the *highest* venous EBLL percentages in 2019 were Highland Park (85.4 percent), Grand Rapids (74.3 percent), Hamtramck (72.4 percent), and Detroit (71.5 percent).
- Communities with the *lowest* venous EBLL percentages in 2019 were Jackson (18.2 percent), Lansing (24.6 percent), and Muskegon (35.1 percent).

Table 12. Selected Communities Number and Percent of Elevated Blood Lead Levels (EBLLs, ≥ 5 $\mu\text{g}/\text{dL}$) from Venous Blood Lead Tests for Michigan Children Under 6 Years Old, 2019

Community	# All EBLL	# Venous EBLL	% Venous EBLL ^a
ADRIAN	27	12	44.4
CITY OF DETROIT	1,297	927	71.5
FLINT	79	42	53.2
GRAND RAPIDS	187	139	74.3
HAMTRAMCK	58	42	72.4
HIGHLAND PARK	41	35	85.4
JACKSON	132	24	18.2
LANSING	138	34	24.6
MUSKEGON	174	61	35.1
MICHIGAN	3,907	2,167	55.5

^a Percent is among those with EBLLs (% Venous EBLLs = (# Venous EBLLs / # All EBLLs) \times 100)

Highest Blood Lead Levels

Children with a venous BLL of 45 µg/dL or higher may require immediate medical treatment, called chelation, to remove lead from the body. In 2019, there were 17 children in Michigan with venous BLLs ≥ 45 µg/dL, the highest number since 2008 (24 children) (Table 13). These children were in Detroit, Bay, Kalamazoo, Kent, Monroe, Muskegon, Oakland, Saginaw, Shiawassee, and Wayne (excluding Detroit) counties; most of these children lived in the City of Detroit (data suppressed).

Since 2003, the number of children under 6 that may have required chelation has been 33 or fewer each year, and prior to 2019 had been 15 or fewer since 2009.

Table 13. Michigan Children Under 6 Years Old with Venous Blood Lead Levels ≥45 µg/dL by Year, 2003 – 2019

Year	# Tested	# Venous ≥45 µg/dL	% Venous ≥45 µg/dL ^a	Year	# Tested	# Venous ≥45 µg/dL	% Venous ≥45 µg/dL ^a
2003	100,226	33	0.03	2012	148,885	9	0.01
2004	125,388	33	0.03	2013	148,425	13	0.01
2005	133,454	30	0.02	2014	143,855	8	0.01
2006	141,303	20	0.01	2015	141,508	9	0.01
2007	149,797	16	0.01	2016	157,570	7	< 0.00
2008	153,200	24	0.02	2017	150,156	8	0.01
2009	154,359	12	0.01	2018	142,100	13	0.01
2010	155,940	15	0.01	2019	143,224	17	0.01
2011	152,177	14	0.01				

^a Percent is among those tested (% Venous EBLL ≥ 45 µg/dL = (# Venous EBLL ≥45 µg/dL / # Tested) × 100)

Discussion

This section presents an interpretation of the results of this report as a whole. For answers to specific questions about this report, see [Appendix 1: Frequently Asked Questions and Additional Resources](#) or contact MDHHS-CLPPP@Michigan.gov.

Blood Lead in Michigan

The percentages of tested children with an EBLL and a high EBLL have decreased since 2003; this shows progress. However, current EBLL percentages and the fact that *any* children may have needed chelation show that many Michigan children continue to be exposed to lead. This may be due to the age of Michigan homes, lack of parent/guardian home ownership, and the expense of safe lead removal.

Removing sources of lead in the child's environment *before* they have an EBLL is the most effective way to prevent EBLs in children.^{3,7,11,19} However, due to limited resources, MDHHS and local health departments are only able to provide services, such as home lead abatement, after a child is found to have an EBLL.

Older housing poses the most substantial risk for child lead exposure. The MDHHS Lead Services Section provides environmental investigations and lead abatement of homes statewide to maximize the number of children

residing in lead-safe housing in Michigan. Beginning in 2017, CMS approved a Health Services Initiative supporting environmental investigations and home abatement for eligible households. The MDHHS Lead Services Section continues to work closely with CLPPP to ensure that homes occupied by a child with an elevated blood lead level are of highest priority, and the section continues to provide lead abatement services within high-risk communities as primary prevention.

Areas with the Highest Burden

Compared to other areas in Michigan, Detroit continued to bear the greatest burden of lead in 2019. Detroit had the highest number of children with an EBLL, one of the highest percentages of children with an EBLL, and the highest number of children who may have needed chelation. This is likely because Detroit has many children living in poverty and older housing, which increases their risk of lead exposure.^{5,7,14} Other selected communities also have higher percentages of children with an EBLL compared to Michigan overall, particularly the cities of Highland Park and Muskegon. Based on this information, MDHHS plans to continue funding efforts in these areas to reduce lead exposure.

Challenges and Limitations

Blood Lead Surveillance and Data Quality

Findings in this report are subject to the following limitations related to the blood lead surveillance system.

Blood Lead Test Submission

- While law states that test results are to be submitted to MDHHS CLPPP within five business days (see [Michigan's Public Health Code](#)), many tests are reported months and sometimes years after they were done.
- In the past, many labs sent test results that required extra handling by CLPPP data technicians before they could be sent to the Data Warehouse. For example, some files with blood lead test results from a LeadCare II analyzer that were manually typed in by office staff had typing errors and correcting these files was a slow process. CLPPP has been transitioning more labs to electronic messaging, a process where all blood lead test reports are sent to a “data hub” that standardizes and formats the test reports so that they can be sent directly to MiCLPS, the CLPPP data management system. The transitions have been under way since 2018, which has increased data quality and decreased processing times.

Data Limitations

- All blood lead test results sent to CLPPP are stored in the MDHHS Data Warehouse, where a unique identifying number, the Master Person Index (MPI), is assigned to each person. When blood lead test records are stored in the Data Warehouse, the MPI is assigned to each blood lead test record based on the person’s name, date of birth, and other information. If the name and birth date in a test record do not match the name and birth date that was reported in earlier test records, the new record may not be connected to the correct person and a different MPI may be assigned. If this happens, a child may be counted more than once per year and the reported number of children tested may be larger than the actual number.
- Laboratories across Michigan do not report race and ethnicity information in a consistent way, so this information is currently unavailable for this report. CLPPP is working to provide this data in future reports (see [Future Steps](#)).
- The addresses used in this report were the addresses reported in blood lead test results, which originate from a child’s health record. Errors in addresses may have resulted in a child’s test results being excluded

from or miscategorized into the wrong county. These addresses were not verified or geocoded until November 2017. Cities in this report are determined from the mailing address. They do not represent municipalities that are not part of a mailing address (like townships). For example, addresses in Delta Township will be counted in Lansing, because Lansing is in the mailing address.

Interpretation of Results

- Michigan does not have mandatory blood lead testing, except for testing of children enrolled in Medicaid¹⁵ and WIC. ** Instead, a child's healthcare provider *recommends* a blood lead test based on their professional judgement of the child's risk - this is [targeted testing](#).
 - The true *number* of children with an EBLL is probably higher than reported because not all children are tested.
 - The true *percentage* of Michigan children with an EBLL may be lower than reported due to targeted testing practices.
 - Results in this report are not representative of all children in the state, counties, or selected communities. Children who were tested may have different characteristics (like age, race, Medicaid status) or may be living in conditions where exposure to lead is higher (like living in older housing) than children who were not tested.
 - For example: In 2019, 28.1 percent of *tested* children under 6 years old were enrolled in Medicaid, while 48.5 percent of *all* Michigan children under 6 years old were enrolled in Medicaid ([Table 2](#)).
- Comparing EBLL percentages between children in different areas (counties, ZIP codes) is difficult because of the difference in testing rates and risks of lead exposure between areas.
- Capillary blood lead tests are known to produce false positives,¹⁷ where a test result indicates that the lead level is higher than it truly is. Based on reported data, 44.5 percent of EBLLs were from unconfirmed capillary tests in 2019.
- Comparisons of EBLL percentages between years should be interpreted with caution for the reasons listed previously (see [Year-by-Year Comparisons](#)).
- CLPPP reports on the number and percent of Medicaid enrolled children under 6 years old and at ages 1 and 2 that were tested in that year. Medicaid requires that enrolled children be tested before their third birthday.¹⁵ Medicaid testing rates published in this report should not be used to determine how well Michigan physicians are complying with the Medicaid testing requirement.

Comparing Findings with Other Lead Reports

- Other agencies periodically obtain CLPPP data for their own analyses. Their results may not be the same as those reported by MDHHS CLPPP. This may be because they use different methods to determine the population, total number of children tested, which test chosen for each child for the year (deduplication), and the definition of an EBLL. These inconsistencies can make it difficult to compare results between agency reports.
- The CLPPP dataset is regularly updated to reflect new data. Information about past years presented in this report may not exactly match the information from past reports. The most complete information is always contained in the most recent report and on the MiTracking website.

** MCL 400.1111 <http://legislature.mi.gov/doc.aspx?mcl-400-1111>

Future Steps

CLPPP Programmatic Activities

CLPPP will continue activities throughout the state with the goal of further reducing blood lead levels and overall lead exposure. Highlights include:

- Continued and improved training and technical assistance to help local health departments and other partners provide services to children with an EBLL.
- Continued work with Medicaid, health care providers, and local health departments to emphasize the importance of the confirmatory venous blood tests.
- Routinely aiding local health departments in obtaining Medicaid reimbursement covering the cost of in-home nursing case management for Medicaid-enrolled children with venous confirmed EBLLs. This should result in more children receiving these services.

Continue work with local health departments and other agencies to:

- Increase the number of children tested overall.
- Reduce number of children exposed to lead (reducing number with an EBLL).
- Support services for children with an EBLL to find and remove sources of lead and mitigate negative effects of exposure.
- Increase the percentage of children with capillary EBLLs receiving a confirmatory venous test.

Improvements to the CLPPP Surveillance Database

- Progress towards obtaining race and ethnicity: CLPPP has recently made progress towards providing this information by getting permission from Michigan Vital Records to use the race and ethnicity information collected at birth. Race and ethnicity information are planned to be available in future reports.
- Unique identifier improvements: The MDHHS Data Warehouse assigns a unique identifying number (MPI) to all individuals with health data in the Data Warehouse. CLPPP uses the identifier to link multiple test results from the same person and links blood lead test results to records from other MDHHS programs like the Michigan Care Improvement Registry (MCIR) and Medicaid. This process is not perfect, and CLPPP constantly works with the MDHHS Data Warehouse to improve the performance of the MPI assignment process.
- Increased reporting efficiency: laboratories can now submit blood lead test results through electronic messages that are directly imported to MiCLPS. This reduces processing time and errors, allowing more time for data cleanup. As of December 31, 2019, eight laboratories were reporting blood lead test results in this way.

Improving Laboratory Reporting and Surveillance Data Analysis

CLPPP has begun several initiatives to improve accuracy and timeliness of reporting, including:

- Helping more laboratories adopt electronic reporting of test results, thereby improving data quality and freeing CLPPP staff to focus on other initiatives.
- Producing quarterly 'report cards' for laboratories that submit data to CLPPP. Ideally, increased feedback will lead to improvements in the quality of information reported to CLPPP. Measures may include:
 - Timeliness of submitting test results.
 - A reduction in the number of test results that did not meet state-mandated reporting requirements (meaning that key information was missing, incomplete, or incorrect).

CLPPP is undertaking several initiatives to provide more useful data summaries for public health officials and the public, including:

- Providing local health departments with regular updates of confirmatory testing rates to inform new and existing interventions to increase confirmatory testing.
- Actively seeking feedback from stakeholders to inform data collection, sharing, and presentation.
- Continuing to improve analysis and data quality practices, including better address cleanup, laying groundwork to speed up analysis times, and synchronizing reports.
- Expanding analyses, such as identifying factors like household or neighborhood characteristics, that can be used to identify high-risk groups in Michigan for targeted interventions.

Appendix 1: Frequently Asked Questions and Additional Resources

Where can I find more information about lead?

Good resources include:

- [Mi Lead Safe.](#)
- [Childhood Lead Poisoning Prevention Program | CDC.](#)
- [Lead | US EPA.](#)

What if I am concerned that I or my child was exposed to lead?

Contact your primary care provider or local health department to see if a blood lead test is right for you. You can use the [MDHHS Local Health Department Map](#) to find contact information for your local health department.

What does MDHHS CLPPP do for children with elevated blood lead levels (EBLLs)?

Every week, CLPPP alerts local health departments of any child who has an EBLL. The local health departments follow up with the child and their caregivers, supplying any or all the following services:

- Information about lead, identifying and removing sources of lead in the home, their child’s test result and what it means for their health, and approaches to reduce any negative health effects from lead exposure (like good nutrition).
- Encouragement to get a confirmatory venous test (if needed).
- In-home nursing case management (NCM), which includes at least two home visits to look for lead hazards, assessing the child’s growth and development, and educating caregivers on nutrition and cleaning to reduce lead and its effects.
- Referral to other programs. These may include the MDHHS Lead Safe Home Program, for help with identification and safe removal of lead in the home; WIC, for help with the child’s nutrition; and other services.

CLPPP supports local health department NCM activities by having nurse consultants available for training, expertise and consultations; providing a web-based application to track nursing case management activities; and managing the system for local health departments to obtain reimbursement for NCM services provided to eligible children.

MDHHS CLPPP works to increase lead awareness and testing through education and outreach to different audiences and partners, including foster care programs, health care providers, parents of young children, daycares, schools, landlords and homeowners. CLPPP provides lead poisoning prevention materials with information on safe cleaning, nutrition, blood lead testing, safe home renovations and lead facts. CLPPP provides grants to local health departments to provide education and outreach within their regions of the state.

What do you mean by “percent elevated” or “percent EBLL”?

Blood lead test information is presented in whole numbers and in percentages. The percent EBLL is the proportion of children with a blood lead test result of 5 µg/dL or higher *among the children who were tested* for that geography. This is NOT the proportion among all children in that geography. CLPPP cannot accurately measure the proportion of all children who have an EBLL because not all children are tested for blood lead.

For example, it is correct to say that “Among those tested for lead, 7.4 percent of Detroit children under 6 years old had an elevated blood lead level.” or “7.4 percent of Detroit children under 6 years old who were tested for

lead had elevated levels.” It is **NOT correct** to say that “7.4 percent of Detroit children less than 6 have elevated blood lead levels”.

What is the difference between the venous blood lead level categories?

Venous test results are summarized using five categories of blood lead level: 5 to 9 µg/dL, 10 to 14 µg/dL, 15 to 19 µg/dL, 20 to 39 µg/dL, and ≥45 µg/dL. These categories were chosen to meet the needs of local health departments across Michigan. This report includes venous results of ≥5 µg/dL by county and venous results of ≥45 µg/dL in Michigan. For data on the venous blood lead level categories list above for different geographies, visit the [MDHHS - MITracking website](#). A child qualifies for services regardless of which category they fall into. However, they will be offered more extensive services by the local health department if they have a higher blood lead level.

The most important distinction is for the last group, children with ≥45 µg/dL of lead in the blood, who need immediate treatment for acute lead poisoning. A clinician will decide the most appropriate treatment while the local health department will work to provide services to remove the source of lead as soon as possible.

Why do you suppress data? What if I need data that has been suppressed?

CLPPP suppresses counts 1 through 5 (replaced with an asterisk (*) in the tables). Counts are suppressed if the number of children tested or identified as having an EBLL is low, because the results for those small numbers of children may not adequately represent all children in the area. Percentages or fractions based on small numbers are not as reliable as percentages based on larger numbers (see [Data Suppression](#) for more information). Data are also suppressed to keep the privacy of people who had a blood lead test.

CLPPP will release unsuppressed versions of the report tables through a data use agreement, data sharing agreement or other approved method. To inquire about a one of these methods, contact CLPPP at DHHS-Teams-CLPPP-Pb-Data-Team@michigan.gov.

Why are the counts for 2019 (or earlier years) different from the 2018 (or earlier) annual report?

CLPPP’s database is continuously updated with any new test results that are submitted; this can include results that were not reported in time for prior years’ reports. CLPPP also works to improve data quality and the analysis process each year. Therefore, counts may change slightly from what was reported previously.

How can I get other blood lead testing information from CLPPP?

The most up-to-date blood lead testing data can be found on [MDHHS - MITracking \(michigan.gov\)](#). Data with interpretation and context are in these CLPPP annual reports, and supplemental documents are available on the web at [Michigan.gov/mileadsafe](#) under Lead Data and Reports. If other information is needed, please email MDHHS-CLPPPDATA@Michigan.gov. The CLPPP team can provide non-identifiable summary data (counts and percentages); they may ask you to fill out a data request form to better understand your needs. If the information needed is not summary-level (i.e., not aggregated, with information about individual tests or children) or is needed for research purposes, a Data Use Agreement and/or Institutional Review Board (IRB) approval may be required.

Who do I contact if I have other questions about this report?

Email CLPPP at MDHHS-CLPPP@michigan.gov.

Appendix 2: Technical Information about Data Analysis

Data Elements

Table A1. Contents of the Michigan CLPPP Surveillance Database

Type of Data	Description
Patient Information	Name, Residential Address, Date of Birth, Sex, Race ^a , Ethnicity ^a , Parent/Guardian Contact Information, Social Security Number, Medicaid ID Number (if applicable)
Testing Information	Ordering Physician Contact Information, Laboratory Contact Information, Blood Lead Test Number, Date of Sample Collection, Date of Testing, Type of Blood Sample, Test Result

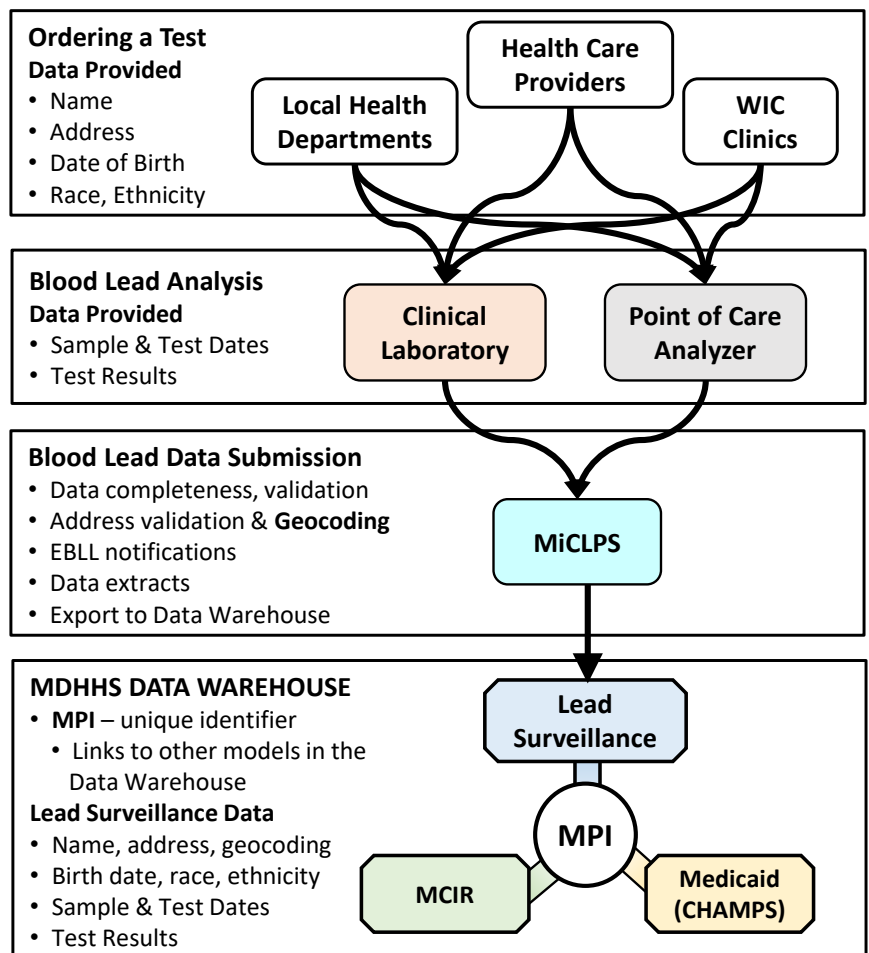
^aMany laboratories do not consistently or correctly report this information. Therefore, it is considered unreliable.

Data Flow and Data Quality

Results and other information flow from the patient to CLPPP and partners as illustrated in Figure A1. Typically, information about the patient and blood samples are collected at a doctor’s office or health department. Then, the blood is tested on-site by a portable blood lead analyzer or sent to a laboratory. All blood lead test results must be submitted to the MDHHS CLPPP (see [Michigan's Public Health Code](#)) within five working days after test completion.

CLPPP accesses blood lead test results reported by laboratories in MiCLPS, the data management system. Test results are reported by laboratories in a variety of formats, including HL7 messages and Excel files. Data points are manually reviewed, and the laboratories/ordering physicians are contacted to fix errors, such as the patient’s name or birthdate. This does not include changing blood lead test results but includes corrections for inconsistencies in dates (for example, testing date is before the child’s date of birth), incomplete addresses, and other errors. Starting in November 2017, addresses are automatically validated and geocoded by computer.

Figure A1. Flow of Blood Lead Surveillance Data



After the first phase of data cleanup is completed (including the first step of [Address Processing](#)), data are uploaded each week to the MDHHS Data Warehouse. This is the place where health data collected by MDHHS is stored. A computer algorithm then links all blood lead tests for the same child together by assigning a unique identifier to each child. This also links blood lead test results to the child’s Medicaid information and the state’s immunization registry, MCIR. This allows health care providers to see their patient’s blood lead level when the child’s record is opened in MCIR.

This database is updated continuously as laboratories submit new blood lead tests or any corrections to old tests, so that it always has the most current information. As new information is incorporated, CLPPP identifies and corrects errors with the help of the submitting laboratories. Further data cleanup is done at the time of analysis and report creation.

Address Processing

Addresses are reported to CLPPP by the testing laboratory and loaded into MiCLPS. The following process is currently used to verify and geocode addresses:

1. When addresses are loaded into MiCLPS, they are verified using geocoding from the State of Michigan’s Center for Shared Solutions (CSS).
 - a. If an address is correct, it is not changed. County is assigned using the geocoding software.
 - b. If the address is incorrect but of good enough quality, it is automatically corrected, and the county is assigned using the geocoding software. In 2019, more than 97 percent of addresses reported to CLPPP were able to be geocoded.
 - c. If the address is missing or of poor quality, it is flagged for manual review by CLPPP staff. To obtain the correct address:
 - i. CLPPP contacts the submitting laboratory for the address.
 - ii. If the submitting laboratory does not respond and the child is enrolled in Medicaid, CLPPP staff uses information from the Medicaid record to correct the address and assign county.
 - iii. If the above is unsuccessful or the child is not enrolled in Medicaid, CLPPP staff uses information from MCIR to correct the address and assign county.
 - iv. If all steps above are unsuccessful, CLPPP assigns the county of the testing laboratory to the test result and leaves the rest of the address fields as they are. This is rare.
2. Records are sent to the MDHHS Data Warehouse.
3. When records are extracted for analysis, addresses are further cleaned and standardized. This is primarily done to correct records collected before the automatic verification and geocoding was put into place in November 2017.
 - a. Out-of-state records are removed from analysis. These are records have a city, ZIP code, or county placing them in another state (for example, City of Cleveland).
 - b. Records with insufficient address information are removed from analysis. These include records with no reported city, ZIP code, and county.
 - c. Common spelling errors are fixed (for example, “Washtenau” County is corrected to “Washtenaw” County).
 - d. Corrections from manual address review are applied (for example, records with City of Grand Rapids are assigned to Kent County).

The Medicaid Green Book

The MDHHS Green Book provides comprehensive information about certain Medicaid assistance programs. The Green Book is a monthly report of key program statistics for the entire state and by individual county back to

2002. The statistics are laid out in 75 tables. The reports are presented in PDF format with tabs and bookmarks. The population of children “eligible” for Medicaid (meaning enrolled) used in this report come from Table 70 (Distribution of Children by Age: Medicaid) in the December 2019 Green Book, available at <https://www.michigan.gov/mdhhs/inside-mdhhs/reports-stats/green-book>.

Housing Stock and Population Estimates

The U.S. Census American Community Survey (ACS) produces estimates of socioeconomic and housing characteristics, which are available through the [Census Data Explorer](#). These estimates describe the average characteristics of an area (such as a state, county, or city) over a specific period. This analysis used five-year estimates when available, which are considered to be more accurate than one-year estimates because five years of data are used. For example, a 2019 five-year estimate is based on data collected from January 2015 to December 2019. It can also be written as a 2015-2019 five-year estimate. For more information, see the [ACS General Handbook](#).

Population by year of age is based on estimates using data from the 2010 decennial census, available from the Census Data Explorer. For data before 2011, population estimates are available from the National Center for Health Statistics, which produces bridged-race population estimates. These estimates were downloaded from the [National Vital Statistics System website](#).

Source tables used in this analysis were:

- Housing age in 2019: The 2014-2018 ACS five-year estimate for 2019, Table B25034 (Year Structure was Built).
- Yearly population estimates for children under 6 years old in 2009 – 2019: ACS five-year estimates, Table B09001 (Population Under 18 Years of Age).
- Yearly population estimates for children under 6 years old in 2003 – 2008: NVSS 2010 bridged-race population estimates.
- Population of children under 6 years old with certain demographic characteristics in 2019: U.S. Census 2019 Table PEPSYASEX (Annual Estimates of the Resident Population by Single Year of Age and Sex for the United States, States, and Puerto Rico Commonwealth).
- Yearly population estimates for children under 6 years old eligible for Medicaid: the December 2019 Medicaid Green Book.

Software

Summary-level data were generated using SAS 9.4. Tables were formatted and graphs generated using Microsoft Excel 2010. Maps were made with Arc GIS 10.7.1.

More about Deduplication

Children often receive more than one blood lead test per year. To summarize the data in counts of children and not counts of tests, tests were deduplicated by keeping the highest and most accurate test value. If a child had multiple tests within a calendar year:

1. The highest BLL obtained from a venous test was used.
2. If no venous test was performed, the highest BLL obtained from a capillary test was used.
3. If the only test results had unknown sample type, then the highest of these results was used.

For example: A child had a capillary test with a result of 9 µg/dL in January. Since this test was elevated, their doctor ordered a confirmatory venous test in February, which came back at 5 µg/dL. After receiving case

management services, a follow-up venous test was done in June to see if the interventions worked. The result was 3 µg/dL. According to the algorithm, the venous test at 5 µg/dL would be kept and the child would be counted as elevated in the summary data.

Meaning of “Elevated Blood Lead Level”

An EBLL in this report is a blood lead test result ≥ 5 µg/dL, the reference value recommended by the CDC and used by MDHHS that applied to children in 2019. This value was based on the 97.5th percentile of BLLs in children 1 to 5 years old in the United States according to the 2007-2010 National Health and Nutrition Examination Survey (NHANES).² This meant that only 2.5 percent of surveyed children had blood lead levels greater than or equal to 5 µg/dL. The CDC lowered the Blood Lead Reference Value in October 2021 to ≥ 3.5 µg/dL based on updated data from NHANES, and MDHHS adopted this as its definition of EBLL in May 2022.²⁴

More about Rounding and the Limit of Detection

Prior to November 2017, the CLPPP surveillance database followed the requirements specified by administrative rules in the Public Health Code for laboratory reporting of lead test results, which said that blood lead test results were to be reported as whole numbers, rounded to the nearest whole number. Starting in November 2017, the CLPPP database was changed to collect non-rounded results and indications that a result is below the limit of detection (limit of reporting), and laboratories were asked to submit unrounded test results. This change was codified in amendments to the laboratory [reporting rules in 2020](#).

Before this change, a child with a result between 4.5 and 4.9 µg/dL would have been reported to CLPPP as 5 µg/dL and they would have qualified for nursing case management services. To keep the same level of service as in the past and to keep the data analysis consistent, CLPPP continued to round all blood lead values for data analysis and continued to consider values of 4.5-4.9 µg/dL to meet the definition of EBLL.¹

Point-of-care blood lead analyzers have a limit of detection of 3.3 µg/dL. Before this change, a result below this limit of detection was rounded down and reported as 3 µg/dL. Other testing methods are more precise and can have results equal to 3 µg/dL. This means that the CLPPP database was unable to distinguish between a result below 3 µg/dL and equal to 3 µg/dL. Now, the less-than sign (<) is stored with these test results, allowing results from point of care blood lead analyzers of 3 µg/dL, indicating that lead was detected, to be distinguished from results that were below the limit of detection.

History of Blood Lead Testing and Requirements through 2019

- Since 1989, the U.S. CMS has required lead testing for all children enrolled in Medicaid. At the time, CMS did not allow states to change this requirement.²¹
- From 1978 to 1997, the CDC recommended universal testing for all children under 6 years old.²²
- In 1997, the CDC recommended that states move away from universal testing for all children under 6 years old. Instead, they recommended testing children at highest risk. Since children enrolled in Medicaid are at higher risk, they recommended that all children enrolled in Medicaid still be tested for lead before their third birthday.^{20,21}
- In 2004, Michigan passed legislation requiring children aged 1 or 2 enrolled in Medicaid be screened, and if compliance was less than 80 percent in 2007, further actions would be taken to improve compliance (see [MCL 400.111k](#)).
- In 2006, the Food and Drug Administration approved point-of-care capillary blood lead testing, expanding capillary blood lead testing.²³

- In 2012, the blood lead level considered to be “elevated” changed from 10 µg/dL to 5 µg/dL.³ As a result, venous follow-up testing was recommended at lower blood lead levels than before.
- In 2016, there was increased blood lead testing across the entire state, likely due to increased public awareness about lead because of the Flint water crisis ([Figure 1](#)).

Appendix 3: Reference Data Tables

Appendix 3 includes the following:

- **Table A2. Blood Lead Testing and Levels for Children Under 6 Years Old by County of Residence and Sample Type, 2019.** This table has data suppression: counts between 1 and 5 are [suppressed](#) and replaced with an asterisk (*). Percentages for suppressed counts are not calculated and appear as (-).
- **Table A3. Blood Lead Testing and Levels for Children Under 6 Years Old in Selected Communities and by Sample Type, 2019**

Table A2. County Blood Lead Testing and Levels for Children Under 6 Years Old by Sample Type, 2019

County	% Pre-1950 Homes ^a	% Pre-1980 Homes ^a	Population < 6 ^a	# Tested ^b	% Tested ^c	# EBLLe ^d	% EBLLe ^e	# Capillary EBLLe ^f	% Capillary EBLLe ^f	# Venous EBLLe ^g	% Venous EBLLe ^g
ALCONA	20.6	69.5	387	107	27.6	*	-	*	-	*	-
ALGER	15.6	60.8	417	67	16.1	*	-	*	-	0	0.0
ALLEGAN	11.5	43.8	8,452	1,379	16.3	38	2.8	22	1.6	16	1.2
ALPENA	23.5	67.3	1,531	391	25.5	6	1.5	*	-	*	-
ANTRIM	12.9	58.4	1,225	241	19.7	*	-	*	-	*	-
ARENAC	16.1	62.6	822	251	30.5	*	-	*	-	*	-
BARAGA	16.6	56.2	437	81	18.5	0	0.0	0	0.0	0	0.0
BARRY	13.6	46.6	3,953	416	10.5	14	3.4	*	-	*	-
BAY	25.2	60.9	6,146	1,202	19.6	30	2.5	17	1.4	13	1.1
BENZIE	13.1	50.8	990	222	22.4	*	-	*	-	0	0.0
BERRIEN	24.3	60.3	10,748	1,380	12.8	43	3.1	15	1.1	28	2.0
BRANCH	15.2	49.8	3,248	424	13.1	25	5.9	10	2.4	15	3.5
CALHOUN	22.4	54.1	9,650	2,247	23.3	117	5.2	44	2.0	73	3.2
CASS	19.8	53.9	2,970	377	12.7	24	6.4	13	3.4	11	2.9
CHARLEVOIX	15.7	58	1,418	238	16.8	*	-	0	0.0	*	-
CHEBOYGAN	12.8	53.5	1,237	236	19.1	*	-	*	-	*	-
CHIPPEWA	18.4	51.1	2,229	277	12.4	*	-	*	-	0	0.0
CLARE	15.9	62.9	2,050	494	24.1	6	1.2	*	-	*	-

Data are current as of February 3, 2022.

^a US Census data from [American Community Survey](#) Tables B09001 (Population of Children) and B25034 (Year (house) Structure was Built).

^b Includes tests with unknown sample type.

^c Percent is among population of children less than six years old (% Tested= (# All Tested/Population) x 100).

^d Counts between 1 and 5 are [suppressed](#) and replaced with an asterisk (*). Percentages for suppressed counts are not calculated and appear as (-).

^e Percent is among all tested children less than 6 years old (% Tested= (# in EBLLe category/# Tested) x 100).

^f Percent is among those with EBLLe (% Capillary EBLLe= (# Capillary EBLLe / # All EBLLe) x 100).

^g Percent is among those with EBLLe (% Venous EBLLe= (# Venous EBLLe / # All EBLLe) x 100).

Table A2. County Blood Lead Testing and Levels for Children Under 6 Years Old by Sample Type, 2019

County	% Pre-1950 Homes ^a	% Pre-1980 Homes ^a	Population < 6 ^a	# Tested ^b	% Tested ^c	# EBLL ^d	% EBLL ^e	# Capillary EBLL	% Capillary EBLL ^f	# Venous EBLL	% Venous EBLL ^g
CLINTON	10.6	44.8	5,265	666	12.6	13	2.0	*	-	*	-
CRAWFORD	15.7	64.3	763	164	21.5	*	-	*	-	*	-
DELTA	17.7	53.3	2,149	356	16.6	10	2.8	*	-	*	-
DICKINSON	17.4	54.5	1,531	244	15.9	6	2.5	0	0.0	6	2.5
EATON	10.4	54.4	7,357	1,079	14.7	16	1.5	*	-	*	-
EMMET	10.3	49.9	1,804	244	13.5	0	0.0	0	0.0	0	0.0
GENESEE	25.8	66.4	28,750	6,068	21.1	104	1.7	50	0.8	54	0.9
GLADWIN	15.4	60.8	1,623	349	21.5	*	-	*	-	*	-
GOGEBIC	16	48.3	700	118	16.9	*	-	*	-	*	-
GRAND TRAVERSE	8.3	45.1	5,611	1,327	23.6	6	0.5	*	-	*	-
GRATIOT	22.4	56.1	2,447	443	18.1	10	2.3	*	-	*	-
HILLSDALE	13.2	48.9	3,286	666	20.3	21	3.2	8	1.2	13	2.0
HOUGHTON	11.8	38.1	2,316	493	21.3	9	1.8	*	-	*	-
HURON	22	58.7	1,866	411	22.0	*	-	*	-	*	-
INGHAM	20.7	60.9	19,433	4,544	23.4	154	3.4	116	2.6	38	0.8
IONIA	12	43.6	4,285	942	22.0	29	3.1	16	1.7	13	1.4
IOSCO	25.3	70	1,363	283	20.8	*	-	*	-	*	-
IRON	21	53.7	518	114	22.0	*	-	*	-	0	0.0
ISABELLA	10.2	48	4,009	857	21.4	15	1.8	*	-	*	-

Data are current as of February 3, 2022.

^a US Census data from [American Community Survey](#) Tables B09001 (Population of Children) and B25034 (Year (house) Structure was Built).

^b Includes tests with unknown sample type.

^c Percent is among population of children less than six years old (% Tested= (# All Tested/Population) x 100).

^d Counts between 1 and 5 are [suppressed](#) and replaced with an asterisk (*). Percentages for suppressed counts are not calculated and appear as (-).

^e Percent is among all tested children less than 6 years old (% Tested= (# in EBLL category/# Tested) x 100).

^f Percent is among those with EBLL (% Capillary EBLL= (# Capillary EBLL / # All EBLL) x 100).

^g Percent is among those with EBLL (% Venous EBLL= (# Venous EBLL / # All EBLL) x 100).

Table A2. County Blood Lead Testing and Levels for Children Under 6 Years Old by Sample Type, 2019

County	% Pre-1950 Homes ^a	% Pre-1980 Homes ^a	Population < 6 ^a	# Tested ^b	% Tested ^c	# EBLL ^d	% EBLL ^e	# Capillary EBLL	% Capillary EBLL ^f	# Venous EBLL	% Venous EBLL ^g
JACKSON	21.1	52.6	10,838	2,780	25.7	155	5.6	127	4.6	28	1.0
KALAMAZOO	19	57.1	18,972	3,028	16.0	81	2.7	30	1.0	51	1.7
KALKASKA	11.2	59.2	1,082	288	26.6	*	-	*	-	*	-
KENT	17.3	53	52,460	9,345	17.8	222	2.4	66	0.7	156	1.7
KEWEENAW	10.3	30.7	101	15	14.9	*	-	0	0.0	*	-
LAKE	9.4	63.8	603	125	20.7	*	-	*	-	*	-
LAPEER	10.5	52.8	5,406	960	17.8	11	1.1	*	-	*	-
LEELANAU	8.9	47.1	1,027	244	23.8	*	-	*	-	0	0.0
LENAWEE	18.5	48.1	6,283	969	15.4	44	4.5	18	1.9	26	2.7
LIVINGSTON	8.3	45.1	11,832	1,194	10.1	6	0.5	*	-	*	-
LUCE	16.6	60.9	323	83	25.7	*	-	0	0.0	*	-
MACKINAC	17	53.6	466	130	27.9	*	-	*	-	*	-
MACOMB	21.8	66.8	57,232	13,063	22.8	101	0.8	54	0.4	47	0.4
MANISTEE	15.3	55.2	1,165	331	28.4	11	3.3	*	-	*	-
MARQUETTE	18.5	59.7	3,858	436	11.3	*	-	0	0.0	*	-
MASON	17.3	53.4	1,816	550	30.3	21	3.8	12	2.2	9	1.6
MECOSTA	9.8	54.1	2,481	527	21.2	10	1.9	*	-	*	-
MENOMINEE	21.6	54.9	1,286	160	12.4	*	-	*	-	0	0.0
MIDLAND	18.6	63.1	5,661	559	9.9	9	1.6	*	-	*	-

Data are current as of February 3, 2022.

^a US Census data from [American Community Survey](#) Tables B09001 (Population of Children) and B25034 (Year (house) Structure was Built).

^b Includes tests with unknown sample type.

^c Percent is among population of children less than six years old (% Tested= (# All Tested/Population) x 100).

^d Counts between 1 and 5 are [suppressed](#) and replaced with an asterisk (*). Percentages for suppressed counts are not calculated and appear as (-).

^e Percent is among all tested children less than 6 years old (% Tested= (# in EBLL category/# Tested) x 100).

^f Percent is among those with EBLL (% Capillary EBLL= (# Capillary EBLL / # All EBLL) x 100).

^g Percent is among those with EBLL (% Venous EBLL= (# Venous EBLL / # All EBLL) x 100).

Table A2. County Blood Lead Testing and Levels for Children Under 6 Years Old by Sample Type, 2019

County	% Pre-1950 Homes ^a	% Pre-1980 Homes ^a	Population < 6 ^a	# Tested ^b	% Tested ^c	# EBLL ^d	% EBLL ^e	# Capillary EBLL	% Capillary EBLL ^f	# Venous EBLL	% Venous EBLL ^g
MISSAUKEE	14.7	58.8	1,177	140	11.9	*	-	*	-	0	0.0
MONROE	20.4	52.6	9,477	1,365	14.4	27	2.0	15	1.1	12	0.9
MONTCALM	15.6	49.9	4,253	887	20.9	28	3.2	20	2.3	8	0.9
MONTMORENCY	19.4	75.6	361	89	24.7	0	0.0	0	0.0	0	0.0
MUSKEGON	25.5	58.9	12,557	3,250	25.9	191	5.9	126	3.9	65	2.0
NEWAYGO	13.8	54.9	3,368	749	22.2	10	1.3	*	-	*	-
OAKLAND	22.1	66.2	81,687	16,791	20.6	208	1.2	112	0.7	96	0.6
OCEANA	12.3	50.8	1,875	539	28.7	16	3.0	*	-	*	-
OGEMAW	15.7	62.5	1,184	201	17.0	*	-	*	-	*	-
ONTONAGON	20.2	52.9	164	43	26.2	*	-	0	0.0	*	-
OSCEOLA	11.3	62.1	1,534	369	24.1	8	2.2	*	-	*	-
OSCODA	20.2	72.7	490	99	20.2	*	-	*	-	0	0.0
OTSEGO	10.3	60.9	1,532	304	19.8	0	0.0	0	0.0	0	0.0
OTTAWA	11.8	48.5	21,534	3,056	14.2	41	1.3	20	0.7	21	0.7
PRESQUE ISLE	22.4	65.6	568	125	22.0	*	-	0	0.0	*	-
ROSCOMMON	17.5	70.9	998	222	22.2	*	-	*	-	0	0.0
SAGINAW	23.3	65.1	13,061	2,914	22.3	103	3.5	62	2.1	41	1.4
SAINT CLAIR	20.1	53.9	9,499	2,641	27.8	80	3.0	59	2.2	21	0.8
SAINT JOSEPH	18.9	55.7	4,702	984	20.9	45	4.6	20	2.0	25	2.5

Data are current as of February 3, 2022.

^a US Census data from [American Community Survey](#) Tables B09001 (Population of Children) and B25034 (Year (house) Structure was Built).

^b Includes tests with unknown sample type.

^c Percent is among population of children less than six years old (% Tested= (# All Tested/Population) x 100).

^d Counts between 1 and 5 are [suppressed](#) and replaced with an asterisk (*). Percentages for suppressed counts are not calculated and appear as (-).

^e Percent is among all tested children less than 6 years old (% Tested= (# in EBLL category/# Tested) x 100).

^f Percent is among those with EBLL (% Capillary EBLL= (# Capillary EBLL / # All EBLL) x 100).

^g Percent is among those with EBLL (% Venous EBLL= (# Venous EBLL / # All EBLL) x 100).

Table A2. County Blood Lead Testing and Levels for Children Under 6 Years Old by Sample Type, 2019

County	% Pre-1950 Homes ^a	% Pre-1980 Homes ^a	Population < 6 ^a	# Tested ^b	% Tested ^c	# EBLLe ^d	% EBLLe ^e	# Capillary EBLLe	% Capillary EBLLe ^f	# Venous EBLLe	% Venous EBLLe ^g
SANILAC	19.4	54	2,684	391	14.6	*	-	*	-	*	-
SCHOOLCRAFT	14.3	54.9	393	106	27.0	*	-	*	-	*	-
SHIAWASSEE	19.3	56.3	4,066	1,160	28.5	38	3.3	21	1.8	17	1.5
TUSCOLA	17.8	57	3,446	825	23.9	*	-	*	-	*	-
VAN BUREN	16.2	52.7	5,440	876	16.1	17	1.9	8	0.9	9	1.0
WASHTENAW	14.2	54.3	21,138	2,973	14.1	34	1.1	12	0.4	22	0.7
WAYNE, DETROIT	46.2	60	58,458	19,270	33.0	1,297	6.7	370	1.9	927	4.8
WAYNE, EXCL. DETROIT	35.9	71.8	79,906	18,306	22.9	304	1.7	109	0.6	195	1.1
WEXFORD	13.8	51.9	2,412	364	15.1	6	1.6	*	-	*	-
MICHIGAN	22.5	59.7	683,842	143,224	20.9	3,907	2.7	1,740	1.2	2,167	1.5

Data are current as of February 3, 2022.

^a US Census data from [American Community Survey](#) Tables B09001 (Population of Children) and B25034 (Year (house) Structure was Built).

^b Includes tests with unknown sample type.

^c Percent is among population of children less than six years old (% Tested= (# All Tested/Population) x 100).

^d Counts between 1 and 5 are [suppressed](#) and replaced with an asterisk (*). Percentages for suppressed counts are not calculated and appear as (-).

^e Percent is among all tested children less than 6 years old (% Tested= (# in EBLLe category/# Tested) x 100).

^f Percent is among those with EBLLe (% Capillary EBLLe= (# Capillary EBLLe / # All EBLLe) x 100).

^g Percent is among those with EBLLe (% Venous EBLLe= (# Venous EBLLe / # All EBLLe) x 100).

Table A3. Blood Lead Testing and Levels for Children Under 6 Years Old in Selected Communities and by Sample Type, 2019

Community	% Pre-1950 Homes ^a	% Pre-1980 Homes ^a	Population < 6 ^a	# Tested	% Tested ^b	# EBLL	% EBLL ^c	# Capillary ^d EBLL	% Capillary ^d EBLL ^e	# Venous EBLL	% Venous EBLL ^f
ADRIAN	24.3	52.4	1,781	439	24.6	27	6.2	15	3.4	12	2.7
CITY OF DETROIT	46.2	60	58,458	19,270	33.0	1,297	6.7	370	1.9	927	4.8
FLINT	41.3	70.9	10,557	3,129	29.6	79	2.5	37	1.2	42	1.3
GRAND RAPIDS	25.3	51	18,335	5,891	32.1	187	3.2	48	0.8	139	2.4
HAMTRAMCK	25.8	39.4	2,398	1,134	47.3	58	5.1	16	1.4	42	3.7
HIGHLAND PARK	23.3	47.9	806	331	41.1	41	12.4	6	1.8	35	10.6
JACKSON	22.6	39.5	2,848	2,090	73.4	132	6.3	108	5.2	24	1.1
LANSING	27.6	65.2	9,783	3,711	37.9	138	3.7	104	2.8	34	0.9
MUSKEGON	32.9	57.4	5,592	2,500	44.7	174	7.0	113	4.5	61	2.4
MICHIGAN	22.5	59.7	683,842	143,224	20.9	3,907	2.7	1,740	1.2	2,167	1.5

Data are current as of February 3, 2022.

^a US Census data from American Community Survey tables B09001 (numbers of children living in households) and B25034 (house age).

^b Percent is among population of children less than 6 years old (% Tested= # All Blood Samples Tested/Population * 100).

^c Percent is among all tested children less than 6 years old (% Tested= # in EBLL category/# Tested * 100).

^d Includes tests with unknown sample type.

^e Percent is among those with EBLL (% Capillary EBLL= (# Capillary EBLL / # All EBLL) x 100).

^f Percent is among those with EBLL (% Venous EBLL= (# Venous EBLL / # All EBLL) x 100).

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