



# 2017 Annual Data Report on Childhood Blood Lead Testing in Michigan

*Issued May 21, 2020*

Prepared by

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Michigan Department of Health and Human Services

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## Executive Summary

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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. The State of Michigan defines an elevated blood lead level (EBLL) as 5 micrograms per deciliter of blood ( $\mu\text{g}/\text{dL}$ ) or higher, as recommended by the CDC's Advisory Committee on Childhood Lead Poisoning Prevention (ACCLPP).<sup>1,2</sup> This report focuses on testing in 2017, with comparison to years 2003 through 2016.

Note: This report does not present an analysis of blood lead data for children in Flint beyond that which is presented for the state as a whole and for individual counties, selected communities, and ZIP codes. For more information about Flint, see [Michigan.gov/Flintwater](http://Michigan.gov/Flintwater).

## Key Findings

- In 2017, 150,068 children younger than 6 years old had a blood lead test. This represents 22% of the population in this age group.
  - 3.1% (4,711) of these children had an EBLL.
  - 55% (2,610) of elevated results were from confirmatory 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 7.4% having an EBLL (1,632 of 22,165 tested).
- Highland Park had the highest EBLL percent of any selected community, at 17% (54 children).
- The top 3 counties with the highest numbers of children under 6 with an EBLL were:
  1. Kent County (425 children);
  2. Wayne County excluding Detroit (365 children); and
  3. Oakland County (204 children).
- The top 3 counties with the highest proportion of tested children under 6 years with an EBLL were:
  1. Branch County (6.1%, 31 children);
  2. Cass County (5.8%, 34 children); and
  3. Jackson County (5.8%, 151 children).

## Recommendations and Next Steps

Continue work with local health departments and other agencies to:

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

## Definitions

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**Abatement** - Work done to remove or cover lead paint in a home. Abatement includes replacing windows and covering lead paint surfaces with a sealer (“encapsulation”) among others. It is either permanent or meant to last a long time.

**Anemia** - Having less 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.

**Assessment** - A test or check.

**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 lets us know 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 stick.”

**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. Elevated means high or raised. Elevated blood lead level is sometimes written as EBLL. See the [Meaning of an Elevated Result](#) in the Technical Appendix for more information.

**Inspection** - An official test or check of a home. The inspector will test the inside and outside of a home for lead.

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

**Lead Dust** - Tiny bits 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.

**Micrograms per deciliter (µg/dL)** - The amount of lead in the blood. For example: A blood lead level of 14 µg/dL means that there were 14 micrograms of lead per deciliter of blood.

**Nursing Case Management (NCM)** - Helping families of children with elevated lead levels. Case management is done by a nurse, generally from a local health department. It may include helping someone get their home inspected for lead or go back to the doctor for another blood lead test.

**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.

Definitions were modified from [CDC's Lead Poisoning Words to Know from A to Z](#)<sup>3</sup>

## Report Abbreviations

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BLL: Blood Lead Level

CDC: Centers for Disease Control and Prevention

CLPPP: Childhood Lead Poisoning Prevention Program

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

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

MCIR: Michigan Care Improvement 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

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### 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 MCL 333.5474 (<http://legislature.mi.gov/doc.aspx?mcl-333-5474>). 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 Advisory Committee on Childhood Lead Poisoning Prevention, there is no safe level of lead in the blood.<sup>1</sup>

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.<sup>4,5</sup> They are also smaller, so the same amount of lead will have more impact in a child than in an adult.<sup>6</sup> 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.<sup>1,4,6-8</sup> In children, exposure to lead has been linked to:

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

### Lead Sources

Lead enters the body through breathing in, eating, or drinking lead. The most common source of lead is from deteriorating lead paint in homes built before the lead paint ban in 1978.<sup>1,6,9-12</sup> Deteriorating paint may be peeling, chipping, blistering, flaking, worn, chalking, cracking, or otherwise becoming separated from the painted surface. This creates hazardous 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.<sup>6,10,12</sup>



Since the Flint water crisis, there has been increased concern about lead in drinking water. The focus of this report is on Michigan as a whole; for information about the water crisis, visit the State of Michigan's Flint water response website ([Michigan.gov/Flintwater](http://Michigan.gov/Flintwater)).

Besides deteriorating paint and leaded plumbing and pipes, there are other visible and invisible sources of lead in and around the home,<sup>4, 9-12</sup> including:

- Soil (dirt) on properties near high-traffic streets and highways, from leaded gasoline exhaust
- Soil on former industrial sites like mines or smelters (brownfields)
- Other plumbing fixtures, and solder
- Pottery with glazes containing lead
- Hobby supplies, including lead buckshot, fishing weights, and lead cane 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<sup>1,4-6, 13</sup>

The chances children contact lead are higher for those living in older homes and in poverty; it is also more common in the children of some ethnic and racial groups.<sup>4,6,13,14</sup> Michigan's urban areas tend to have aging homes, aging plumbing, and substandard living conditions, potentially increasing the risk of lead exposure for those that 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). A BLL is considered elevated (EBLL) per Michigan's standards when the BLL is equal to or exceeds 5 ug/dL. Tests are performed on capillary blood samples (from a finger stick) or venous blood samples (from a blood draw). Capillary tests are often used because they are easier to do. However, elevated capillary test results are often false positives, meaning the BLL appears to be elevated when it actually is not elevated. In a recent study, 60% of capillary tests indicating an EBLL were false positives.<sup>15</sup> A confirmatory venous blood retest should be used to verify elevated levels from capillary blood tests.

All blood lead test results must be submitted to the MDHHS CLPPP within five working days after test completion (see Michigan's Public Health Code MCL 333.20531, at <http://legislature.mi.gov/doc.aspx?mcl-333-20531>). CLPPP monitors these results and produces reports for the public.

### *Targeted Testing*

Children under age 6 are the primary focus of testing because they are most likely to experience negative health effects from lead. Children enrolled in Michigan Medicaid programs are required to be tested for lead by age 3.<sup>16</sup> Testing is also required for Michigan children enrolled in the WIC program (see MCL 280.400.111, at <http://legislature.mi.gov/doc.aspx?mcl-400-111>). For other children under 6 years old, CLPPP provides information to help providers and families determine a child's lead risk, including a lead risk screening questionnaire and other resources.<sup>2</sup>

MDHHS recommends blood lead testing for all children at risk of lead exposure as determined through the administration of Michigan's lead risk screening questionnaire and as defined on page 2 of the "Blood Lead Level Quick Reference for Primary Care Providers." \* The extent of administration of Michigan's lead risk screening questionnaire by health care providers and its accuracy in identifying children with EBLLs have not been assessed. The most accurate way to determine the true number and proportion of children with

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\* [https://www.michigan.gov/documents/lead/ProviderQuickReference\\_Sept2015\\_501803\\_7.pdf](https://www.michigan.gov/documents/lead/ProviderQuickReference_Sept2015_501803_7.pdf)



elevated lead levels would be to test *all* children in the State of Michigan through a universal testing program.<sup>17</sup>

## Methods

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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 and result data in this report are drawn from the CLPPP blood lead surveillance database called MiCLPS (Michigan Childhood Lead Poisoning Prevention Surveillance). 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 population estimates were downloaded from the December 2017 MDHHS Medicaid Green Book of Key Program Statistics ([https://www.michigan.gov/mdhhs/0,5885,7-339-73970\\_61179\\_10830---,00.html](https://www.michigan.gov/mdhhs/0,5885,7-339-73970_61179_10830---,00.html)).

### Testing Years

The focus of this report is on blood lead test results from 2017; other years are included for comparison. Blood lead test results are available as early as 1998; however, laboratory reporting of test results was inconsistent until 2003. Therefore, only years 2003 through 2017 are included in this report.

Data are current as of September 17, 2018.

### 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. A test result is included if the blood collection date for the lead test was before the child's 6th birthday.

Reference tables for the population of children 1 to 2 years old enrolled in Medicaid are presented in a supplement to this report (coming soon to [www.michigan.gov/documents/lead/2017\\_MiCLPPP\\_Medicaid\\_Supplemental\\_691426\\_7.pdf](http://www.michigan.gov/documents/lead/2017_MiCLPPP_Medicaid_Supplemental_691426_7.pdf)).

To report the number of children who were tested in a year (instead of the number of tests overall), it is necessary to deduplicate test results so that only one test is counted for each child. If a child had multiple tests within a calendar year, the highest BLL obtained from the most accurate test, a venous test, was kept. If no venous test was performed, the highest BLL obtained from a capillary test was kept. If the only test results were of unspecified sample type, then the highest of these results was kept.

### Geographic Areas

The child's residential address is reported by the parent, guardian, or physician when the test is ordered. After CLPPP receives this information, the reported address is corrected for spelling and other errors. Results in this report are presented for 3 types of geographies: (1) the state of Michigan, (2) counties, where Detroit is treated as a separate "county" compared to the rest of Wayne county (listed as "Wayne, Detroit" and "Wayne, Ex. Detroit" in the tables), and (3) nine selected communities. 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, Detroit, Flint, Grand Rapids,

Hamtramck, Highland Park, Jackson, Lansing, and Muskegon. (Information at the ZIP code level is presented in an on-line supplement to this report [coming soon to [www.michigan.gov/documents/lead/2017\\_MICLPPP\\_Zipcode\\_Supplemental\\_691427\\_7.pdf](http://www.michigan.gov/documents/lead/2017_MICLPPP_Zipcode_Supplemental_691427_7.pdf)]).

### *Risk Factors for Lead Exposure: Housing and Poverty*

Two indicators of older housing are included in this report: the 2017 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).<sup>1, 6, 8, 13, 14</sup> See [Housing Stock and Population Estimates](#) in the Technical Appendix for more information.

A Medicaid child is one that had at least one blood lead test that was paid for by any Medicaid program in the year. Medicaid status is included in the analysis as a proxy for poverty, a risk factor for lead exposure. It is also included because Medicaid requires testing of all Medicaid-enrolled children under age 6.

## Analysis

### *Elevated Blood Lead Levels*

Any level of lead measured in the blood demonstrates that a child has been exposed to lead. Educational materials are provided to the guardians of the child with information to minimize risk of continued exposure in the future regardless of level detected. However, MDHHS and the Centers for Disease Control and Prevention (CDC) consider 5 micrograms per deciliter ( $\mu\text{g}/\text{dL}$ ) or more lead in the blood to be an elevated blood lead level (EBLL).<sup>1, 4-6</sup> This blood lead level initiates 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, a confirmatory venous test be administered, identification and removal of lead sources, periodic retests to monitor the child's blood lead level, and provide follow-up medical treatment as needed.<sup>2, 6</sup> For more about how this reference value was determined, see the [Meaning of an Elevated Result](#) section in the Technical Appendix.

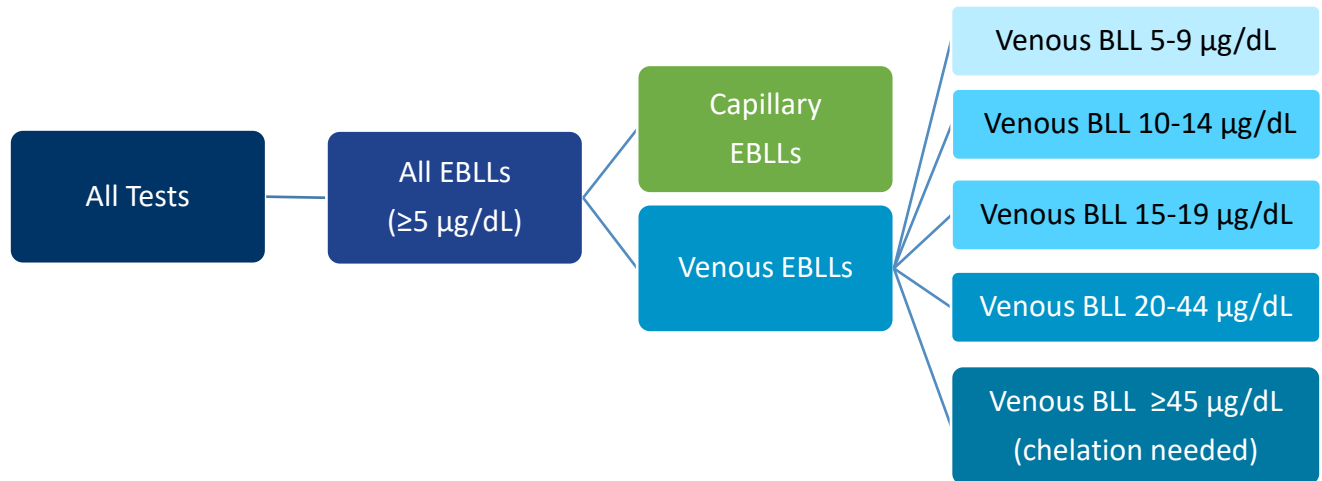
### *Measures*

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 for more information).
- **Elevated Blood Lead Levels:** Among children under 6 years old who have had a blood lead test, the number and percentage with an EBLL ( $\geq 5 \mu\text{g}/\text{dL}$ ). 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.
- **Venous Testing Proportion:** Among children under 6 years old who have had an EBLL, the count 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.
- **High Blood Lead Levels:** Among children under 6 years old who have had a blood lead test, the count 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. 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.<sup>2</sup>

- Reference Tables ([Appendix 4](#) only): Counts by sample type and BLL category, including number of children with at least one test, number of EBLLs based on a capillary blood sample, number of EBLLs based on a venous blood sample, and number of EBLLs regardless of sample type. For *venous* blood samples, counts of EBLLs are broken down into five categories (Figure B). These tables are included in [Appendix 4](#) for reference and will not be discussed in the main text.

**Figure B: Categories of Blood Lead Test Results Presented in the CLPPP Annual Report Reference Tables**



### Data Suppression

To prevent someone from being able to identify a child who had a blood lead test, counts between one (1) and five (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.

### 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 previous annual reports.

- 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 to maintain accuracy. For this reason, there may be slight differences in the numbers presented in this report compared to numbers presented in reports released previously.
- On July 1, 2018, CLPPP began using a more accurate method for calculating a child's age at the time of the blood lead test. This report was created using the new method for all test results. As a result, there may be slight differences in the numbers presented in this report compared to numbers presented in reports produced before July 1, 2018. See the [Change in Age Calculation](#) section in the Technical Appendix for more detailed information about this change.
- ZIP code-level tables and figures are posted in a supplemental report, found at [Michigan.gov/lead](https://Michigan.gov/lead) on the [Lead Data and Reports webpage](#).
- Reference tables for children 1-2 years old enrolled in Medicaid are posted in a supplemental report, found at [Michigan.gov/lead](https://Michigan.gov/lead), on the [Lead Data and Reports webpage](#).

## Blood Lead Surveillance Results in 2017

### Blood Lead Testing Coverage

#### *Michigan Overall*

#### Year-by-Year Comparisons

In 2017, there were 150,068 Michigan children under 6 years old who had a blood lead test, representing 22% of the population in that age group ([Figure 1, Table 1](#)). Testing rates have increased since 2003, when only 13% (99,963 children) were tested. The testing rate rose up to 21% in 2010 and remained steady through 2015. Between 2010 and 2015, the number of tests decreased, but so did the size of Michigan's population in this age group.

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 (157,184) and percent (23%) of the population under 6 tested for lead in Michigan since the beginning of the CLPPP surveillance program. The testing rate in 2017 (22%) was not as high as it was in 2016, but it was still higher than the plateau between 2010 and 2015.

**Table 1. Yearly Blood Lead Testing Coverage for Michigan Children Under 6 Years Old, 2003 - 2017**

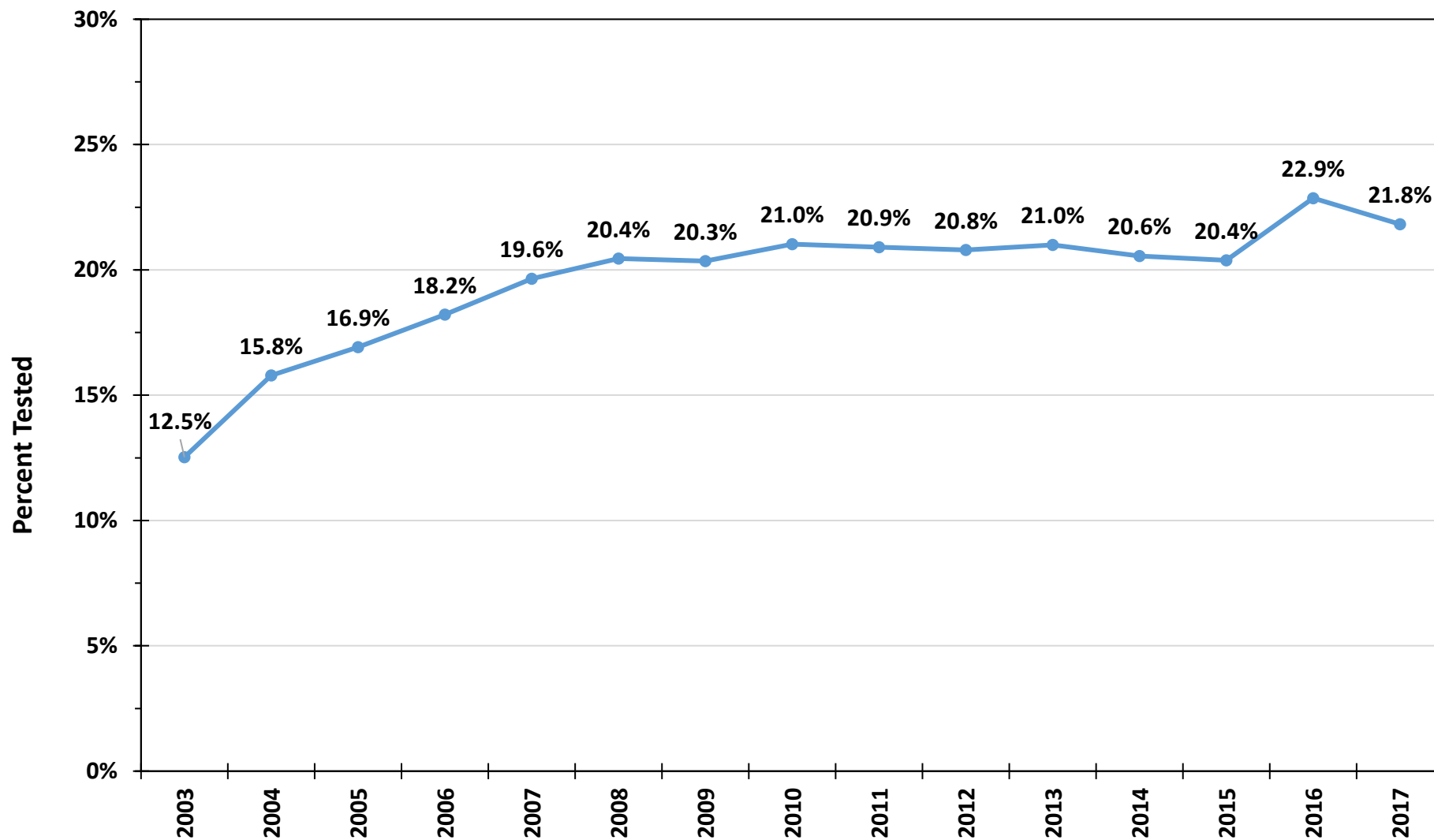
Year	Population*	# Tested	% Tested <sup>†</sup>	Year	Population*	# Tested	% Tested <sup>†</sup>
2003	797,847	99,963	12.5	2011	728,409	152,267	20.9
2004	793,480	125,265	15.8	2012	716,637	148,991	20.8
2005	785,850	132,934	16.9	2013	707,903	148,639	21.0
2006	776,156	141,398	18.2	2014	701,063	144,099	20.6
2007	762,649	149,829	19.6	2015	694,168	141,509	20.4
2008	749,205	153,203	20.4	2016	690,245	157,813	22.9
2009	759,362	154,525	20.3	2017	687,562	150,068	21.8
2010	741,970	155,980	21.0				

\* 2009 - 2015: [American Community Survey 5-year population estimates](#), Table B09001

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

<sup>†</sup> 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 – 2017



Population data from:

2009 - 2015: [American Community Survey 5-year population estimates](#), Table B09001

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

Blood lead testing data from MDHHS, as of Sep 17, 2018

## Comparisons by Child Characteristics

- Over one-half (53%) of 1-year-olds in Michigan were tested for lead in 2017 ([Table 2](#)). Just over a quarter (28%) of 2-year-olds were tested for lead and all other ages were tested less.
- The testing rate for children enrolled in Medicaid was nearly twice the rate in non-Medicaid children (29% vs 15%, respectively). Over half of children enrolled in Medicaid who were 1 to 2 years old were tested for blood lead. This makes sense, due to the requirement that children enrolled in Medicaid be tested before their third birthday.<sup>16</sup>
- Testing coverage was the same for males and females (21%).

**Table 2. Blood Lead Testing Coverage for Michigan Children Under 6 Years Old by Characteristic, 2017**

Characteristic	Population	# Tested	% Tested †
Age < 1	111,691*	16,774	15.0
Age 1	113,765*	60,611	53.3
Age 2	115,784*	32,561	28.1
Age 3	116,480*	15,973	13.7
Age 4	115,562*	16,897	14.6
Age 5	115,778*	7,252	6.3
Medicaid	342,508**	99,216	29.0
Non-Medicaid	346,552†	50,852	14.7
Medicaid Age 1 to 2	111,946**	58,619	52.4
Female	336,568*	71,855	21.3
Male	352,492*	75,393	21.4
Sex Not Reported	Not Applicable	2,820	Not Applicable
<b>Total</b>	<b>689,060*</b>	<b>150,068</b>	<b>21.8</b>

\* 2017 [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.

\*\* December 2017 Medicaid Green Book Population estimates, Table 70

† Michigan population estimate minus the Medicaid population estimate

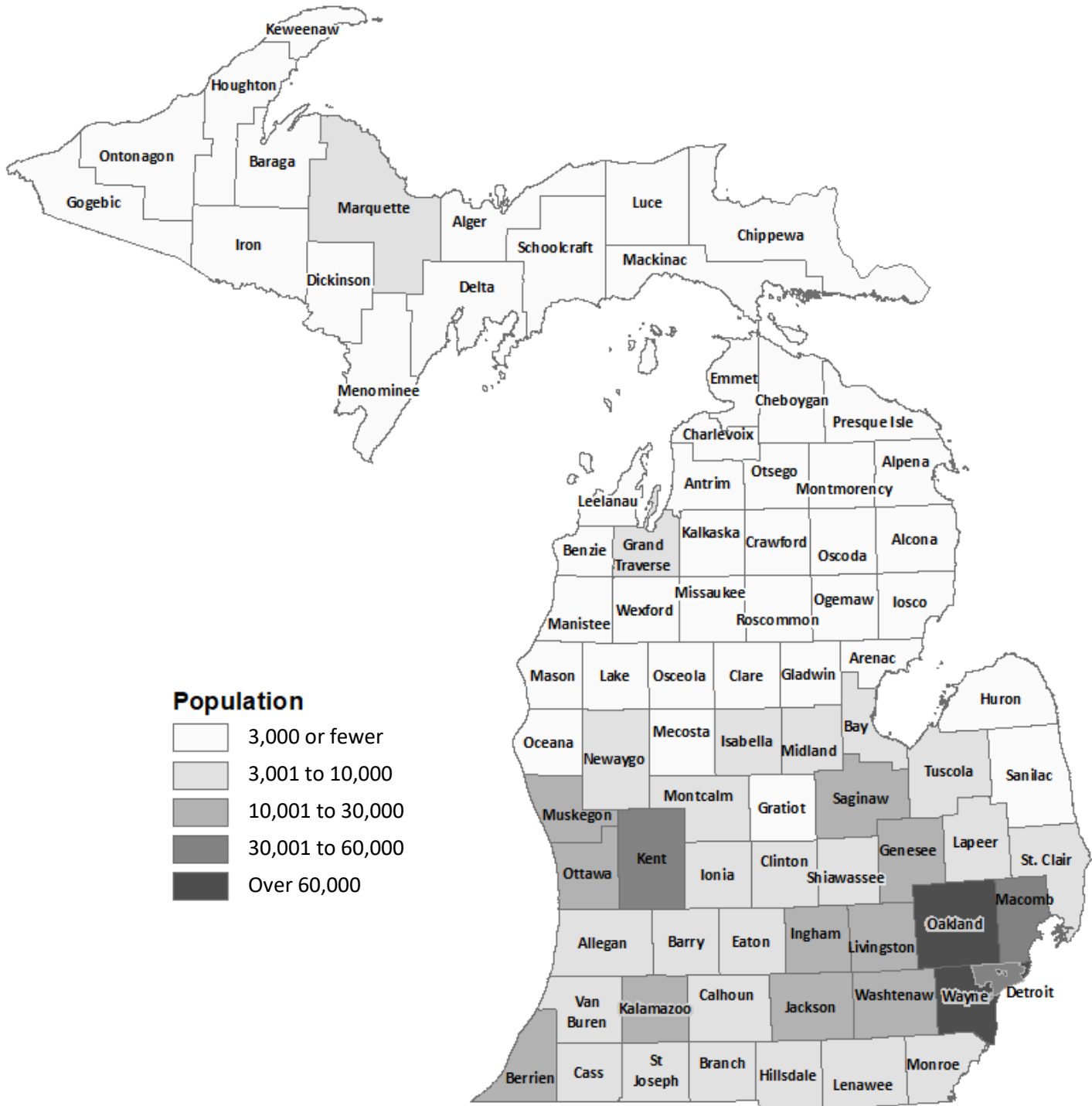
‡ Percent is among the population (% Tested = (# Tested / Population) x 100)

## Michigan Counties

All of Michigan's 83 counties as well as the city of Detroit had children under 6 who were tested for blood lead in 2017. Counties with highest populations of these children were also the areas where the highest numbers were tested ([Figure 2](#), [Figure 3](#), [Table 3](#)). The counties that tested the highest proportion ([Figure 4](#), [Table 3](#)) of their children under 6 years old included:

- Among counties with a population over 10,000: Wayne, Detroit (37%, 22,165 children), Wayne County without Detroit (25%, 19,589 children), Saginaw (24%, 3,427 children), and Ingham (24%, 4,649 children).
- Among counties with populations less than 10,000: Ontonagon (37%, 57 children), Shiawassee (33%, 1,341 children), and Arenac (32%, 255 children).

Figure 2. Population of Michigan Children Under 6 Years Old by County, 2017

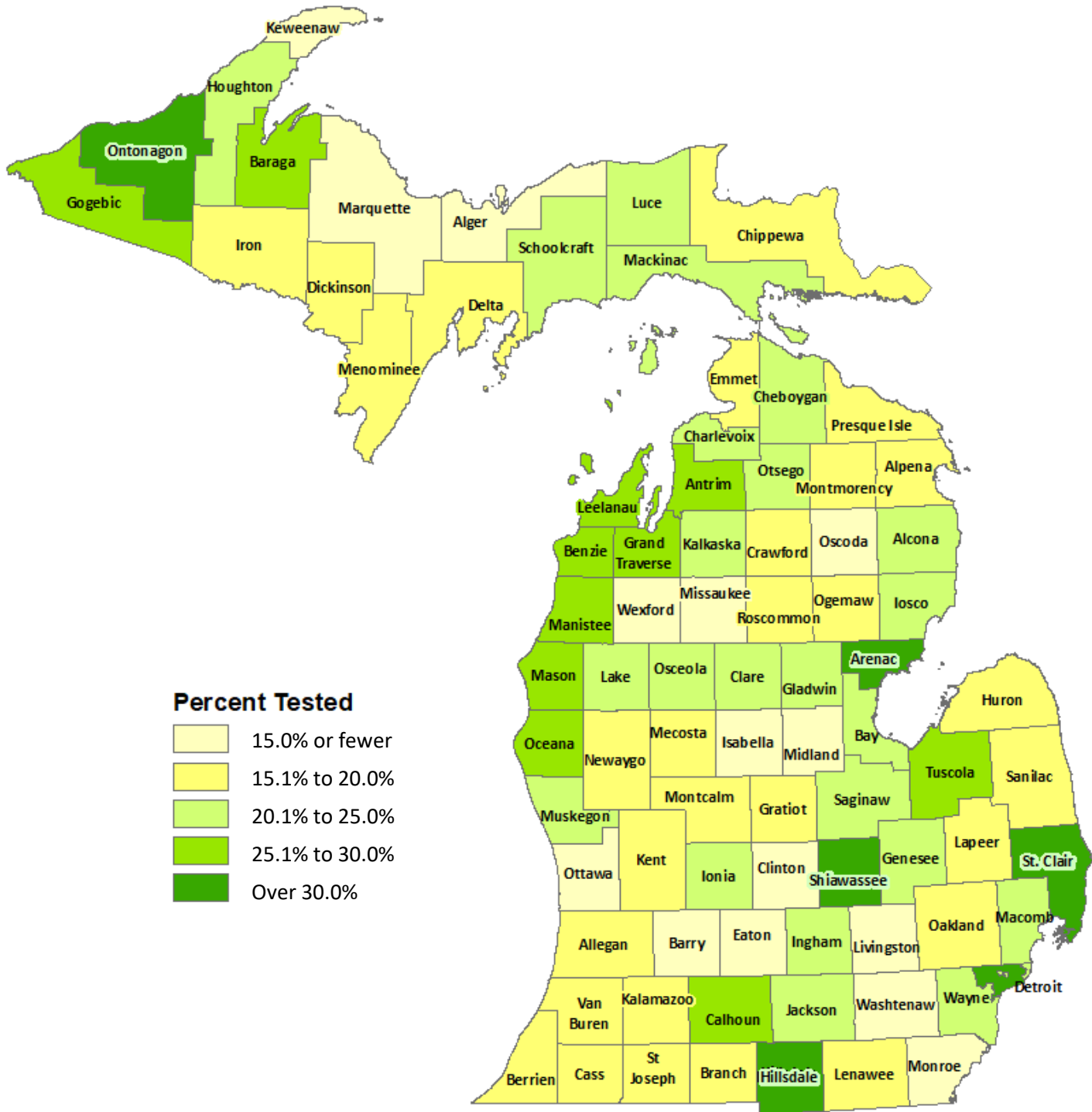


Population data from 2017 [American Community Survey 5-Year Population Estimates](#), Table B09001





Figure 4. Percent of Michigan Children Under 6 Years Old Tested for Blood Lead by County, 2017



Population data from 2017 [American Community Survey 5-Year Population Estimates](#), Table B09001

Michigan blood lead testing data from MDHHS, as of Sep 17, 2018

Table 3: County Blood Lead Testing Coverage for Michigan Children Under 6 Years Old, 2017

County	Population*	# Tested	% Tested <sup>†</sup>	County	Population*	# Tested	% Tested <sup>†</sup>
<b>MICHIGAN</b>	<b>687,562</b>	<b>150,068</b>	<b>21.8</b>	LAKE	584	132	22.6
ALCONA	401	84	20.9	LAPEER	5,504	975	17.7
ALGER	433	62	14.3	LEELANAU	1,038	290	27.9
ALLEGAN	8,456	1,536	18.2	LENAWEE	6,380	1,232	19.3
ALPENA	1,557	301	19.3	LIVINGSTON	11,815	1,026	8.7
ANTRIM	1,178	307	26.1	LUCE	334	81	24.3
ARENAC	807	255	31.6	MACKINAC	521	109	20.9
BARAGA	497	127	25.6	MACOMB	56,839	12,292	21.6
BARRY	3,970	488	12.3	MANISTEE	1,164	332	28.5
BAY	6,365	1,387	21.8	MARQUETTE	4,001	521	13.0
BENZIE	938	267	28.5	MASON	1,772	459	25.9
BERRIEN	11,214	2,153	19.2	MECOSTA	2,535	492	19.4
BRANCH	3,205	506	15.8	MENOMINEE	1,321	249	18.8
CALHOUN	9,972	2,910	29.2	MIDLAND	5,411	398	7.4
CASS	3,093	586	18.9	MISSAUKEE	1,101	127	11.5
CHARLEVOIX	1,480	302	20.4	MONROE	9,898	1359	13.7
CHEBOYGAN	1,285	260	20.2	MONTCALM	4,302	796	18.5
CHIPPEWA	2,167	364	16.8	MONTMORENCY	408	76	18.6
CLARE	1,970	463	23.5	MUSKEGON	12,795	2,670	20.9
CLINTON	5,125	693	13.5	NEWAYGO	3,389	526	15.5
CRAWFORD	687	128	18.6	OAKLAND	82,104	15,785	19.2
DELTA	2,221	398	17.9	OCEANA	1,857	476	25.6
DICKINSON	1,578	279	17.7	OGEMAW	1,209	232	19.2
EATON	7,616	1,131	14.9	ONTONAGON	155	57	36.8
EMMET	1,827	306	16.7	OSCEOLA	1,508	363	24.1
GENESEE	29,479	6,729	22.8	OSCODA	481	67	13.9
GLADWIN	1,532	308	20.1	OTSEGO	1,591	324	20.4
GOGEBIC	694	174	25.1	OTTAWA	21,315	3,132	14.7
GD TRAVERSE	5,812	1,504	25.9	PRESQUE ISLE	561	101	18.0
GRATIOT	2,414	408	16.9	ROSCOMMON	982	195	19.9
HILLSDALE	3,089	930	30.1	SAGINAW	13,423	3,247	24.2
HOUGHTON	2,316	516	22.3	SAINT CLAIR	9,874	3,032	30.7
HURON	1,869	366	19.6	SAINT JOSEPH	4,907	879	17.9
INGHAM	19,295	4,649	24.1	SANILAC	2,719	430	15.8
IONIA	4,361	1,034	23.7	SCHOOLCRAFT	492	100	20.3
IOSCO	1,316	280	21.3	SHIAWASSEE	4,055	1,341	33.1
IRON	638	111	17.4	TUSCOLA	3,290	897	27.3
ISABELLA	4,003	569	14.2	VAN BUREN	5,469	952	17.4
JACKSON	11,167	2,603	23.3	WASHTENAW	21,646	3,045	14.1
KALAMAZOO	18,703	3,510	18.8	WAYNE, DETROIT	59,381	22,165	37.3
KALKASKA	1,091	234	21.4	WAYNE, EX DETROIT	78,328	19,589	25.0
KENT	52,779	9,945	18.8	WEXFORD	2,363	333	14.1
KEWEENAW	140	21	15.0	<b>MICHIGAN</b>	<b>687,562</b>	<b>150,068</b>	<b>21.8</b>

\* Population data from 2017 [American Community Survey 5-year population estimates](#), table B09001 (numbers of children living in households)

<sup>†</sup> 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 elected communities compared to Michigan overall ([Table 4](#)). The highest rates were in Jackson (58%, 1,995 children), Hamtramck (46%, 1,140 children), and Detroit (37%, 22,165 children).

**Table 4: Selected Community Blood Lead Testing Coverage for Michigan Children Under 6 Years Old, 2017**

Community	Population*	# Tested	% Tested†
ADRIAN	1,735	601	34.6
DETROIT	59,381	22,165	37.3
FLINT	10,864	3,485	32.1
GRAND RAPIDS	19,025	6,441	33.9
HAMTRAMCK	2,457	1,140	46.4
HIGHLAND PARK	942	321	34.1
JACKSON	3,419	1,995	58.4
LANSING	10,299	3,693	35.9
MUSKEGON	6,109	1,848	30.3
<b>MICHIGAN</b>	<b>687,562</b>	<b>150,068</b>	<b>21.8</b>

\* Population data from 2017 [American Community Survey 5-year population estimates](#), table B09001 (numbers of children living in households)

† 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 prevalence of EBLLs among children tested has declined over the years ([Table 5](#), [Figure 5](#)), from 20% in 2003 to 3.1% in 2017 (a 16.9% reduction). Over the last five years, however, there has been little change in the prevalence (3.9% to 3.1%). While some of the decrease is likely due to the success of programs to reduce lead exposure, there are many other factors that may have contributed to this decline, making year-to-year comparisons difficult to interpret:

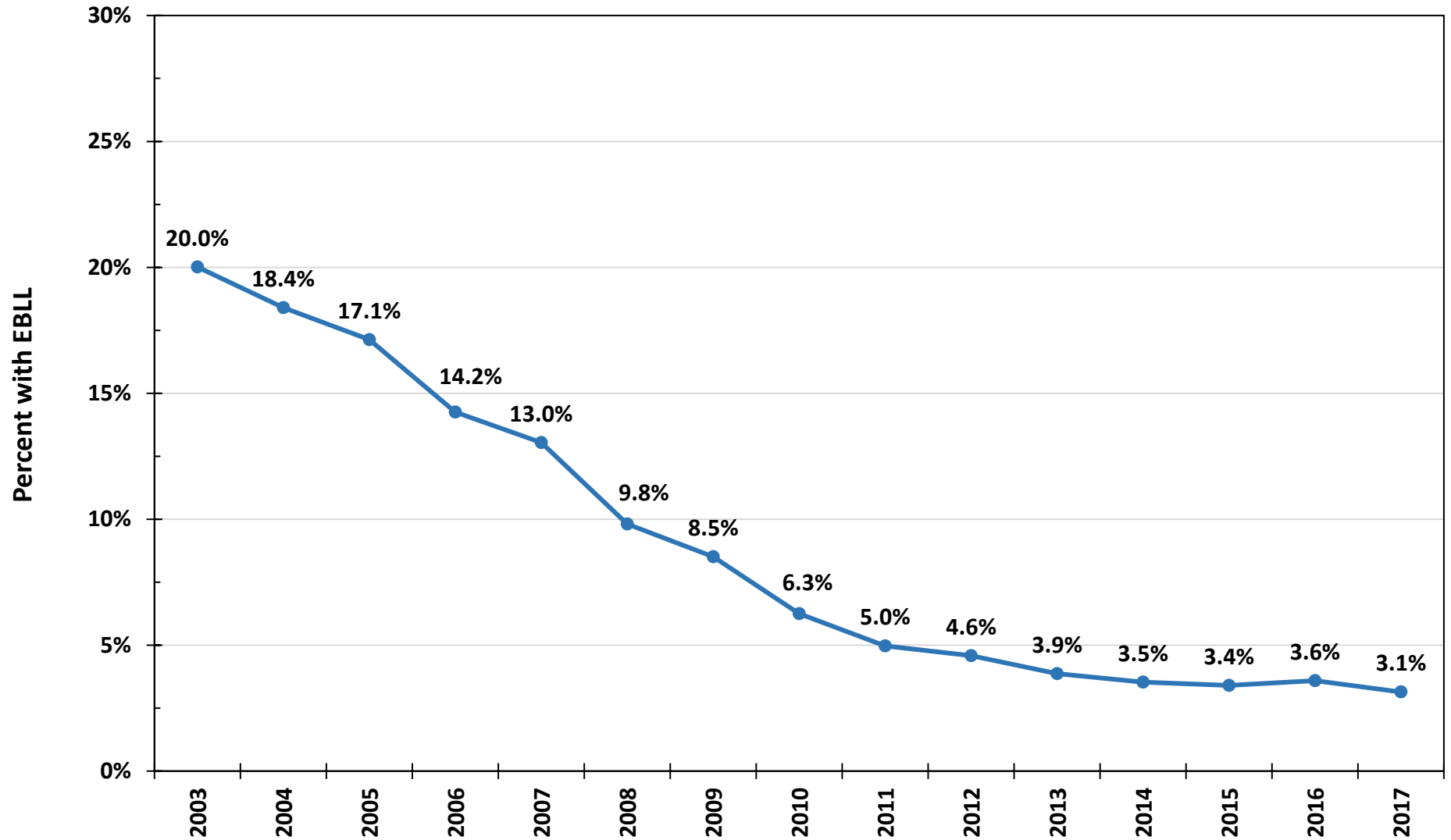
- There have been changes in blood lead testing rules and practices (see [blood lead testing history in the Technical Appendix](#)). Most notably, the testing rate among all children under age 6 rose after Michigan passed additional requirements for Medicaid testing in 2004; the rate increased from 12% in 2003 to 19% in 2007 ([Figure 1](#)). The rate plateaued, staying around 20-21% until 2016, when there was increased blood lead testing across the entire state. This means that the population tested in one year is likely different from another and given the children tested may have different underlying risk for lead exposure, comparison of numbers should be undertaken with caution.
- There have been changes in confirmatory testing practices (see [confirmatory venous testing in the Technical Appendix](#)) and the proportion of EBLLs from venous tests has increased since 2014 ([Table 10](#)). Capillary tests tend to overestimate blood lead levels. Therefore, if there is a higher proportion of tests that are venous tests, the EBLL rate percent will likely be lower.

Table 5. Annual Elevated Blood Lead Levels (EBLLs,  $\geq 5$   $\mu\text{g}/\text{dL}$ ) Among Tested Michigan Children Under 6 Years Old, 2003-2017

Year	# Tested	# EBLL	% EBLL <sup>†</sup>	Year	# Tested	# EBLL	% EBLL <sup>†</sup>
2003	99,963	20,006	20.0%	2011	152,267	7,568	5.0%
2004	125,265	23,049	18.4%	2012	148,991	6,830	4.6%
2005	132,934	22,769	17.1%	2013	148,639	5,743	3.9%
2006	141,398	20,149	14.2%	2014	144,099	5,089	3.5%
2007	149,829	19,537	13.0%	2015	141,509	4,815	3.4%
2008	153,203	15,030	9.8%	2016	157,813	5,668	3.6%
2009	154,525	13,153	8.5%	2017	150,068	4,711	3.1%
2010	155,980	9,753	6.3%				

<sup>†</sup> Percent is among those tested ( $\% \text{ EBLL} = (\# \text{ EBLL} / \# \text{ Tested}) \times 100$ )

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 -2017



Blood lead testing data from MDHHS, as of Sep 17, 2018

## Comparisons by Child Characteristics

- Children who were 3 years old had the highest percentage with an EBLL ([Table 6](#)). However, this difference may be explained by lower testing rates in this age group. For all years of age except in children less than 1 year old, a higher percent tested corresponded to a lower percent with an EBLL, an expected trend because of targeted testing practices.
- The EBLL percent was twice as high (3.8%) in Medicaid children compared to non-Medicaid children (1.9%). This is likely a true difference because (1) the rate of testing among Medicaid children was higher than for non-Medicaid children, and (2) those enrolled in Medicaid are more likely to be exposed to lead.<sup>18</sup>
- The EBLL percent was not substantially different between males (3.3%) and females (3.0%).

**Table 6. Elevated Blood Lead Levels (EBLLs,  $\geq 5$   $\mu\text{g}/\text{dL}$ ) Among Tested Michigan Children Under 6 Years Old by Characteristic, 2017**

Characteristic	# Tested	# EBLL	% EBLL <sup>†</sup>
Age < 1	16,774	317	1.9
Age 1	60,611	1,626	2.7
Age 2	32,561	1,232	3.8
Age 3	15,973	700	4.4
Age 4	16,897	566	3.3
Age 5	7,252	270	3.7
Medicaid	99,216	3,732	3.8
Non-Medicaid	50,852	979	1.9
Medicaid Age 1 to 2	58,619	2,220	3.8
Female	71,855	2,136	3.0
Male	75,393	2,495	3.3
Sex Not Reported	2,820	80	2.8
<b>Total</b>	<b>150,068</b>	<b>4,711</b>	<b>3.1</b>

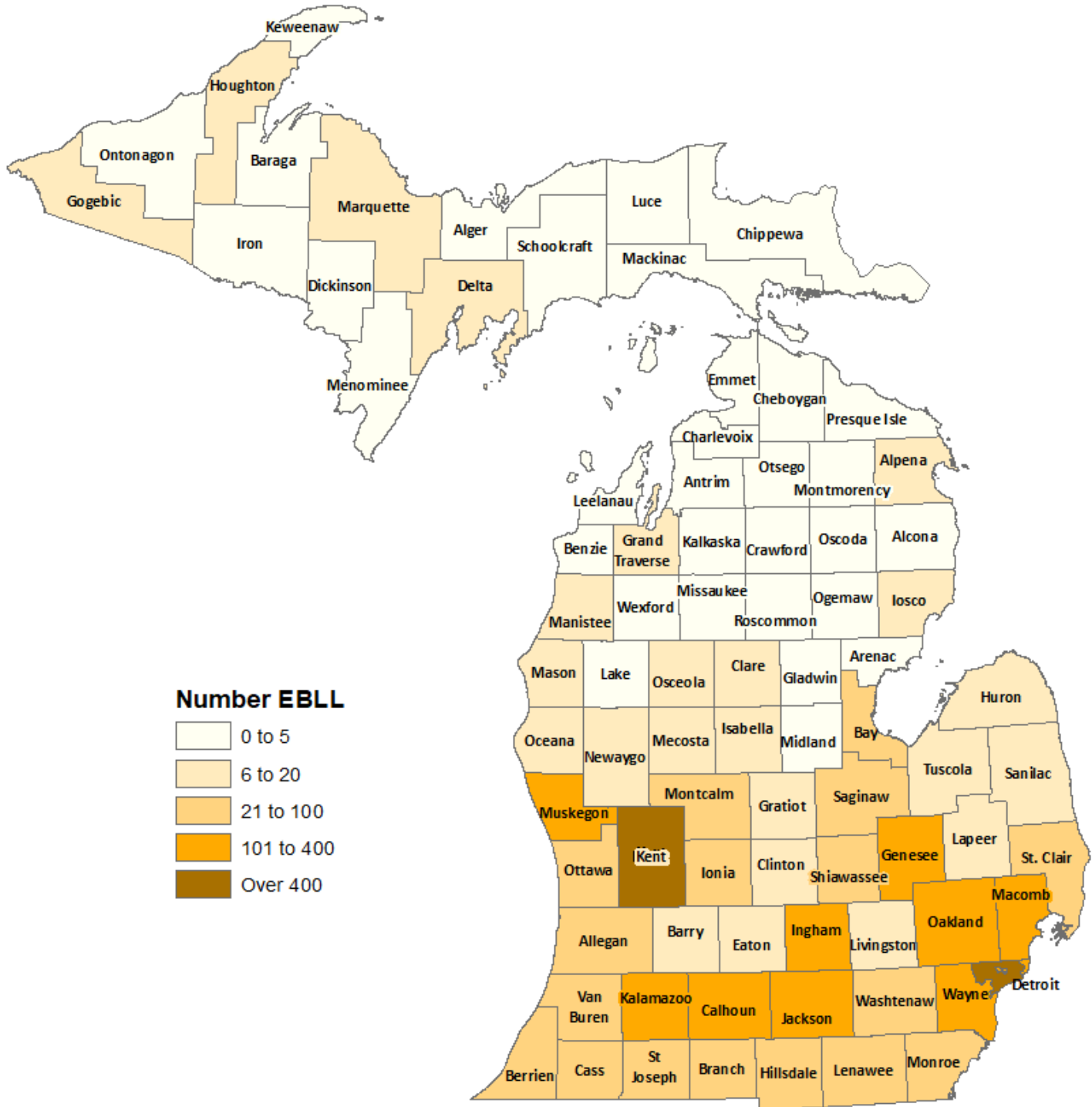
<sup>†</sup> Percent is among those tested (% EBLL = (# EBLL / # Tested)  $\times$  100)

## Michigan Counties

A total of 58 counties had an EBLL proportion less than 3.1%, which is the state of Michigan's overall percent. Among these, 30 counties were below 1.5% EBLL ([Figure 6](#), [Figure 7](#), [Table 7](#)).

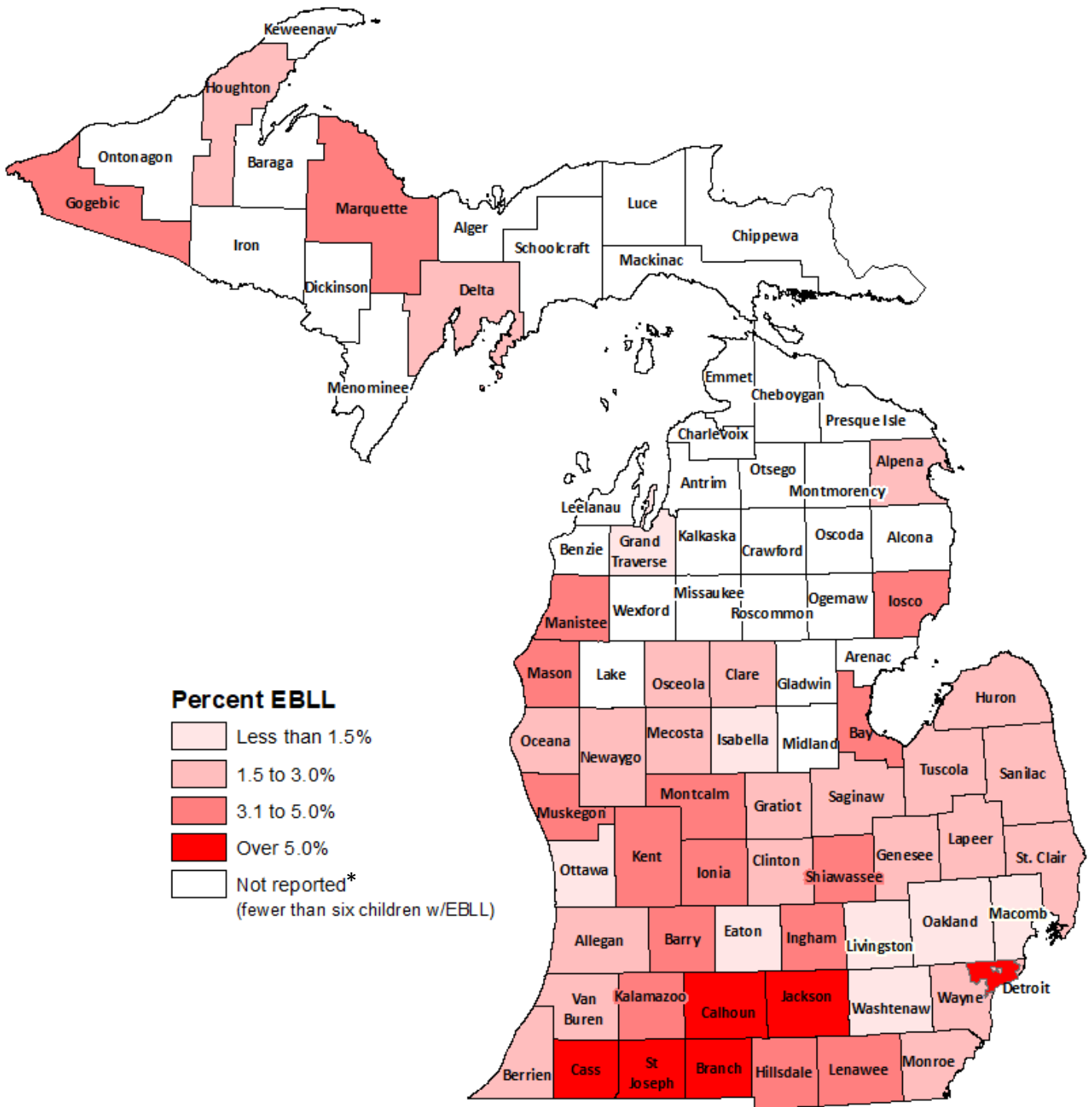
- Those with the highest numbers of children with an EBLL were the city of Detroit (1,632 children), Kent (425 children), and Wayne County excluding Detroit (365 children).
- Those with the highest percent with an EBLL among all tested were the city of Detroit (7.4%, 1,632 children), Branch (6.1%, 31 children), Cass (5.8%, 34 children), and Jackson (5.8%, 151 children).

Figure 6. Number of Tested Michigan Children Under 6 Years Old with Elevated Blood Lead Levels ( $\geq 5 \mu\text{g}/\text{dL}$ , EBLL) by County, 2017



Michigan blood lead testing data from MDHHS, as of Sep 17, 2018

Figure 7. Percent of Tested Michigan Children Under 6 Years Old with Elevated Blood Lead Levels ( $\geq 5 \mu\text{g}/\text{dL}$ , EBLL) by County, 2017



Michigan blood lead testing data from MDHHS, as of Sep 17, 2018

\*Percentages based on counts between one (1) and five (5) are not reported in order to protect the privacy of people who had a blood lead test.



Table 7: County Elevated Blood Lead Levels (EBLLs,  $\geq 5$   $\mu\text{g}/\text{dL}$ ) Among Tested Children Under 6 Years Old, 2017

County	# Tested <sup>†</sup>	# EBLL	% EBLL <sup>†</sup>	County	# Tested	# EBLL	% EBLL <sup>†</sup>
<b>MICHIGAN</b>	<b>150,068</b>	<b>4,711</b>	<b>3.1</b>	LAKE	132	0	0.0
ALCONA	84	*	-	LAPEER	975	20	2.1
ALGER	62	0	0.0	LEELANAU	290	*	-
ALLEGAN	1,536	29	1.9	LENAWEE	1,232	48	3.9
ALPENA	301	8	2.7	LIVINGSTON	1,026	10	1.0
ANTRIM	307	*	-	LUCE	81	*	-
ARENAC	255	*	-	MACKINAC	109	*	-
BARAGA	127	0	0.0	MACOMB	12,292	120	1.0
BARRY	488	17	3.5	MANISTEE	332	11	3.3
BAY	1,387	50	3.6	MARQUETTE	521	18	3.5
BENZIE	267	*	-	MASON	459	15	3.3
BERRIEN	2,153	62	2.9	MECOSTA	492	8	1.6
BRANCH	506	31	6.1	MENOMINEE	249	*	-
CALHOUN	2,910	157	5.4	MIDLAND	398	*	-
CASS	586	34	5.8	MISSAUKEE	127	*	-
CHARLEVOIX	302	*	-	MONROE	1,359	35	2.6
CHEBOYGAN	260	*	-	MONTCALM	796	26	3.3
CHIPPEWA	364	*	-	MONTMORENCY	76	0	0.0
CLARE	463	12	2.6	MUSKEGON	2,670	133	5.0
CLINTON	693	17	2.5	NEWAYGO	526	9	1.7
CRAWFORD	128	*	-	OAKLAND	15,785	204	1.3
DELTA	398	7	1.8	OCEANA	476	7	1.5
DICKINSON	279	*	-	OGEMAW	232	*	-
EATON	1,131	16	1.4	ONTONAGON	57	0	0.0
EMMET	306	*	-	OSCEOLA	363	7	1.9
GENESEE	6,729	124	1.8	OSCODA	67	*	-
GLADWIN	308	*	-	OTSEGO	324	*	-
GOGEBIC	174	7	4.0	OTTAWA	3,132	37	1.2
GD TRAVERSE	1,504	16	1.1	PRESQUE ISLE	101	*	-
GRATIOT	408	6	1.5	ROSCOMMON	195	*	-
HILLSDALE	930	45	4.8	SAGINAW	3,247	93	2.9
HOUGHTON	516	13	2.5	SAINT CLAIR	3,032	91	3.0
HURON	366	7	1.9	SAINT JOSEPH	879	45	5.1
INGHAM	4,649	150	3.2	SANILAC	430	7	1.6
IONIA	1,034	48	4.6	SCHOOLCRAFT	100	*	-
IOSCO	280	9	3.2	SHIAWASSEE	1,341	46	3.4
IRON	111	*	-	TUSCOLA	897	17	1.9
ISABELLA	569	8	1.4	VAN BUREN	952	24	2.5
JACKSON	2,603	151	5.8	WASHTENAW	3,045	35	1.1
KALAMAZOO	3,510	127	3.6	WAYNE, DETROIT	22,165	1,632	7.4
KALKASKA	234	*	-	WAYNE, EX DETROIT	19,589	365	1.9
KENT	9,945	425	4.3	WEXFORD	333	*	-
KEWEENAW	21	*	-	<b>MICHIGAN</b>	<b>150,068</b>	<b>4,711</b>	<b>3.1</b>

\* Counts between one (1) and five (5) are suppressed (not reported) and replaced with an asterisk (\*) in the table above to protect the privacy of people who had a blood lead test. Other counts are also not reported if they can be used to calculate the suppressed counts.

<sup>†</sup> Percent is among those tested (% EBLL = (# EBLL / # Tested)  $\times$  100)

## Selected Communities

Eight of the nine selected communities had higher proportions of EBLLs than the state proportion of 3.1% in 2017 ([Table 8](#)).

- The highest numbers of children with an EBLL were in Detroit (1,632 children), Grand Rapids (370 children), and Jackson (140 children).
- The greatest proportions of tested children with an EBLL were in Highland Park (16.8%, 54 children), Detroit (7.4%, 1,632 children), and Jackson (7.0%, 140 children).

Similar to the state overall, EBLL percentages have decreased since 2014 in the majority of selected communities ([Figure 8](#), [Table 9](#)). However, comparisons between years in these selected communities are subject to the same limitations listed for statewide year-to-year comparisons (see [Limitations of Year-to-Year Comparisons](#)). Between 2016 and 2017, for children under 6 years old:

- The percent with an EBLL increased the most in Highland Park (up 2.8%), Lansing (up 0.5%), and Flint (up 0.3%).
- The percent with an EBLL decreased the most in Hamtramck (down 3.1%), Adrian (down 2.7%), and Grand Rapids (down 2.3%).
- Lesser decreases in EBLL proportion were seen in Detroit (down 1.3%), Jackson (down 1.3%), and Muskegon (down 1.1%).

**Table 8. Selected Community Elevated Blood Lead Levels (EBLLs,  $\geq 5$   $\mu\text{g}/\text{dL}$ ) Among Tested Michigan Children Under 6 Years Old, 2017**

Community	# Tested	# EBLL	% EBLL <sup>†</sup>
ADRIAN	601	31	5.2
DETROIT	22,165	1,632	7.4
FLINT	3,485	95	2.7
GRAND RAPIDS	6,441	370	5.7
HAMTRAMCK	1,140	57	5.0
HIGHLAND PARK	321	54	16.8
JACKSON	1,995	140	7.0
LANSING	3,693	135	3.7
MUSKEGON	1,848	122	6.6
<b>MICHIGAN</b>	<b>150,068</b>	<b>4,711</b>	<b>3.1</b>

\* Population data from 2017 [American Community Survey 5-year population estimates](#), table B09001 (numbers of children living in households)

<sup>†</sup> Percent is among those tested ( $\% \text{ EBLL} = (\# \text{ EBLL} / \# \text{ Tested}) \times 100$ ).

Figure 8. Percent of Children Under 6 Years Old with Elevated Blood Lead Levels ( $\geq 5 \mu\text{g/dL}$ ) in Selected Communities, 2014-2017

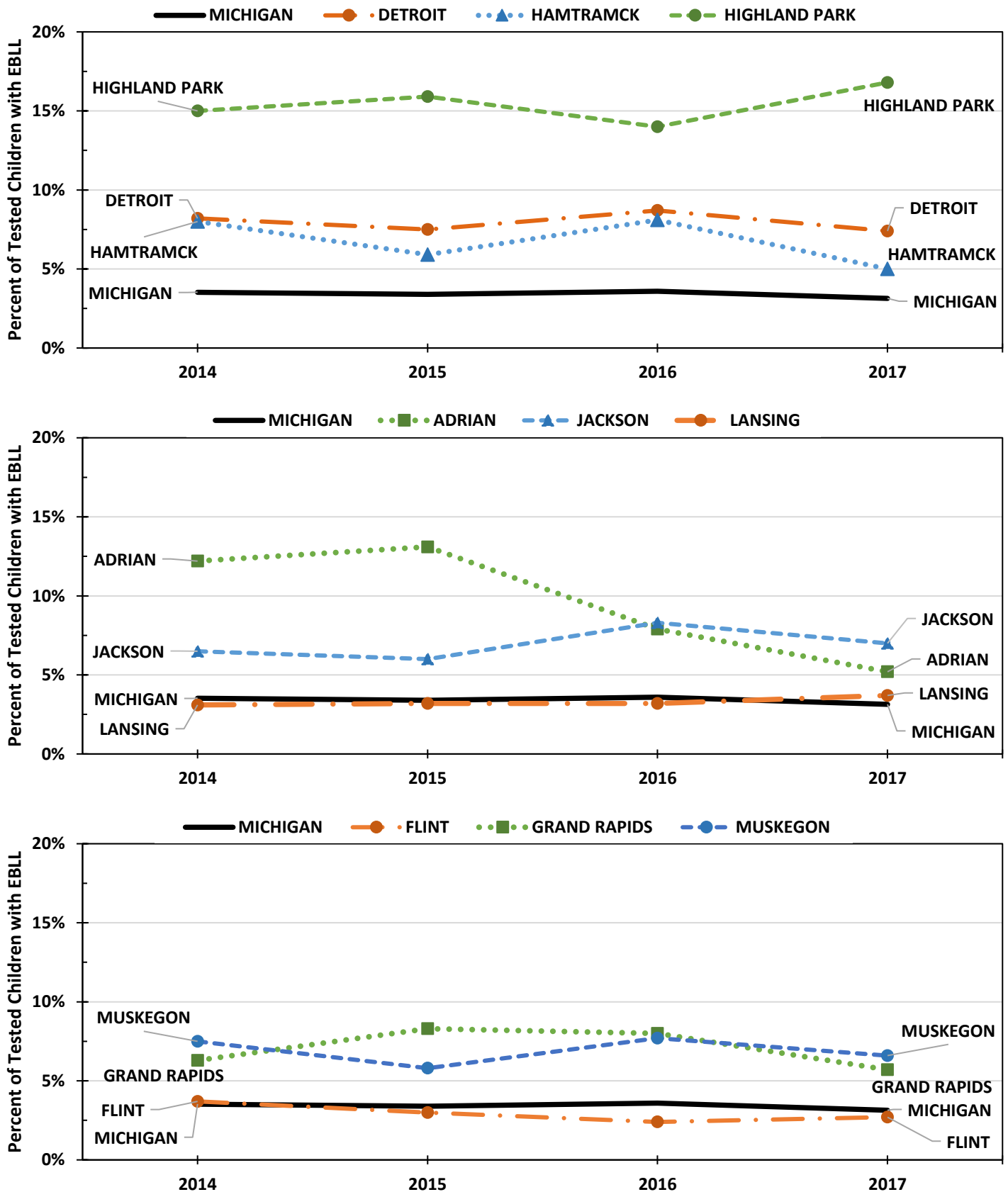


Table 9. Blood Lead Levels for Children Under 6 Years Old in Selected Communities, 2014-2017

Community	# Tested 2014	# EBLI 2014	% EBLI <sup>†</sup> 2014	# Tested 2015	# EBLI 2015	% EBLI <sup>†</sup> 2015	# Tested 2016	# EBLI 2016	% EBLI <sup>†</sup> 2016	# Tested 2017	# EBLI 2017	% EBLI <sup>†</sup> 2017
ADRIAN	641	78	12.2	518	68	13.1	554	44	7.9	601	31	5.2
DETROIT	23,289	1,912	8.2	21,604	1,629	7.5	23,617	2,057	8.7	22,165	1,632	7.4
FLINT	3,500	129	3.7	3,797	113	3.0	7,365	176	2.4	3,485	95	2.7
GRAND RAPIDS	6,376	399	6.3	6,303	524	8.3	6,633	531	8.0	6,441	370	5.7
HAMTRAMCK	1,028	82	8.0	961	57	5.9	1,181	96	8.1	1,140	57	5.0
HIGHLAND PARK	307	46	15.0	314	50	15.9	336	47	14.0	321	54	16.8
JACKSON	2,093	135	6.5	2,288	137	6.0	2,215	183	8.3	1,995	140	7.0
LANSING	3,899	121	3.1	3,686	117	3.2	3,734	120	3.2	3,693	135	3.7
MUSKEGON	1,970	148	7.5	1,873	109	5.8	1,809	139	7.7	1,848	122	6.6
<b>MICHIGAN</b>	<b>144,099</b>	<b>5,089</b>	<b>3.5</b>	<b>141,509</b>	<b>4,815</b>	<b>3.4</b>	<b>157,813</b>	<b>5,668</b>	<b>3.6</b>	<b>150,068</b>	<b>4,711</b>	<b>3.1</b>

<sup>†</sup> Percent is among all tested children under 6 years old (% Tested = (# EBLI / # All Children Tested) × 100).

## Venous Testing Proportion

### Michigan Overall

Capillary tests are useful for screening, but they are less accurate than venous tests. This is why the CDC and MDHHS CLPPP recommend that any elevated capillary blood lead test be followed by a venous blood test to confirm that a child truly has an EBLL. Historically, both of these blood lead tests were done in clinical laboratories.

The proportion of EBLLs from venous tests decreased from 2003 (66%) through 2013 (48%) ([Table 10](#)). In 2006, the Food and Drug Administration (FDA) approved point-of-care lead testing, using machines like the LeadCare™ analyzer. This allowed capillary blood lead tests to be done in any clinic,<sup>14</sup> where a blood draw for a confirmatory venous test may not be readily available. Expanded capillary point-of-care testing *without* appropriate follow-up testing may have contributed to the decrease in the proportion of venous EBLL since 2006.

The blood lead level considered to be ‘elevated’ changed from 10 µg/dL to 5 µg/dL in 2012, meaning that venous follow-up 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 (48% to 53%). Additionally, CLPPP has been working with local health departments and healthcare providers for the last several years to increase follow-up testing. Recent efforts appear to have been successful, with the proportion of venous EBLL at 55% in 2017 - its highest level since 2006.

Table 10. Number of EBLL Tests (all Capillary and Venous) and Number and Proportion of EBLLs based on Venous Blood Lead Tests for Michigan Children Under 6 Years Old by Year, 2003–2017

Year	# All EBLL	# Venous EBLL	% Venous EBLL <sup>†</sup>	Year	# All EBLL	# Venous EBLL	% Venous EBLL <sup>†</sup>
2003	20,006	13,290	66.4	2011	7,568	4,005	52.9
2004	23,049	14,583	63.3	2012	6,830	3,309	48.4
2005	22,769	14,007	61.5	2013	5,743	2,743	47.8
2006	20,149	11,530	57.2	2014	5,089	2,719	53.4
2007	19,537	10,576	54.1	2015	4,815	2,502	52.0
2008	15,030	8,202	54.6	2016	5,668	2,913	51.4
2009	13,153	6,574	50.0	2017	4,711	2,610	55.4
2010	9,753	5,104	52.3				

<sup>†</sup> Percent is among those with EBLL (% Venous EBLL = (# Venous EBLL / # All EBLL) × 100)

### Michigan Counties

In 2017, for children under 6 years old ([Table 11](#)):

- The counties with the *lowest* proportion of EBLLs from venous tests were Monroe (29%); Montcalm (31%); and Bay, Branch, and Muskegon (all 32%).
- Those with the *highest* venous EBLL proportion were Van Buren (67%), Ottawa (65%), and Berrien (61%).

Table 11. Number and Proportion of EBLs from Venous Blood Lead Tests for Michigan Children Under 6 Years Old, 2017, by County.

County	# All EBL	# Venous EBL	% Venous EBL <sup>†</sup>	County	# All EBL	# Venous EBL	% Venous EBL <sup>†</sup>
<b>MICHIGAN</b>	<b>4,711</b>	<b>2,610</b>	<b>55.4</b>	LAKE	0	0	0.0
ALCONA	*	0	0.0	LAPEER	20	7	35.0
ALGER	0	0	0.0	LEELANAU	*	0	-
ALLEGAN	29	11	37.9	LENAWEE	48	27	56.3
ALPENA	8	*	-	LIVINGSTON	10	*	-
ANTRIM	*	*	-	LUCE	*	*	-
ARENAC	*	*	-	MACKINAC	*	0	0.0
BARAGA	0	0	0.0	MACOMB	120	41	34.2
BARRY	17	6	35.3	MANISTEE	11	*	-
BAY	50	16	32.0	MARQUETTE	18	*	-
BENZIE	*	0	0.0	MASON	15	*	-
BERRIEN	62	38	61.3	MECOSTA	8	*	-
BRANCH	31	10	32.3	MENOMINEE	*	*	-
CALHOUN	157	82	52.2	MIDLAND	*	*	-
CASS	34	18	52.9	MISSAUKEE	*	*	-
CHARLEVOIX	*	*	-	MONROE	35	10	28.6
CHEBOYGAN	*	0	0.0	MONTCALM	26	8	30.8
CHIPPEWA	*	*	-	MONTMORENCY	0	0	0.0
CLARE	12	*	-	MUSKEGON	133	43	32.3
CLINTON	17	6	35.3	NEWAYGO	9	*	-
CRAWFORD	*	*	-	OAKLAND	204	95	46.6
DELTA	7	*	-	OCEANA	7	*	-
DICKINSON	*	*	-	OGEMAW	*	*	-
EATON	16	7	43.8	ONTONAGON	0	0	0.0
EMMET	*	*	*	OSCEOLA	7	*	-
GENESEE	124	66	53.2	OSCODA	*	0	0.0
GLADWIN	*	*	-	OTSEGO	*	*	-
GOGEBIC	7	*	-	OTTAWA	37	24	64.9
GD TRAVERSE	16	*	-	PRESQUE ISLE	*	0	0.0
GRATIOT	6	*	-	ROSCOMMON	*	0	0.0
HILLSDALE	45	18	40.0	SAGINAW	93	43	46.2
HOUGHTON	13	7	53.8	SAINT CLAIR	91	43	47.3
HURON	7	*	-	SAINT JOSEPH	45	16	35.6
INGHAM	150	58	38.7	SANILAC	7	*	-
IONIA	48	19	39.6	SCHOOLCRAFT	*	*	-
IOSCO	9	*	-	SHIAWASSEE	46	15	32.6
IRON	*	*	-	TUSCOLA	17	*	-
ISABELLA	8	*	-	VAN BUREN	24	16	66.7
JACKSON	151	52	34.4	WASHTENAW	35	21	60.0
KALAMAZOO	127	56	44.1	WAYNE, DETROIT	1,632	1,195	73.2
KALKASKA	*	*	-	WAYNE, EX DETROIT	365	202	55.3
KENT	425	223	52.5	WEXFORD	*	*	-
KEWEENAW	*	*	-	<b>MICHIGAN</b>	<b>4,711</b>	<b>2,610</b>	<b>55.4</b>

\* Counts between one (1) and five (5) are suppressed (not reported) and replaced with asterisk (\*) in the table above to protect the privacy of people who had a blood lead test. Counts are also not reported if they can be used to calculate the suppressed counts.

<sup>†</sup> Percent is among those with EBLs (% Venous EBLs = (# Venous EBLs / # All EBLs) × 100).

## Select Communities

Four selected communities had higher proportions of EBLLs detected by venous tests than Michigan overall ([Table 12](#)).

- Communities with the *highest* proportions in 2017 were Highland Park (81%), Hamtramck (74%), and Detroit (73%).
- Communities with the *lowest* proportions in 2017 were Muskegon (34%) and Jackson (36%).

Table 12. Selected Communities: Number of EBLLs (all Capillary and Venous) and Number and Proportion of EBLLs from Venous Blood Lead Tests for Michigan Children Under 6 Years Old, 2017

Community	# All EBLL	# Venous EBLL	% Venous EBLL <sup>†</sup>
ADRIAN	31	17	54.8
DETROIT	1,632	1,195	73.2
FLINT	95	59	62.1
GRAND RAPIDS	370	201	54.3
HAMTRAMCK	57	42	73.7
HIGHLAND PARK	54	44	81.5
JACKSON	140	51	36.4
LANSING	135	57	42.2
MUSKEGON	122	41	33.6
<b>MICHIGAN</b>	<b>4,711</b>	<b>2,610</b>	<b>55.4</b>

<sup>†</sup> Percent is among those with EBLLs (% Venous EBLLs = (# Venous EBLLs / # All EBLLs) × 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 2017, there were 8 children in Michigan with venous BLLs ≥ 45 µg/dL ([Table 13](#)). These children were in Wayne, Kent, Genesee, and Cass counties; most of these children lived in the city of Detroit (data not shown for privacy).

Since 2003, the number of children under 6 that may require chelation has been 33 or fewer in each year. Furthermore, there have been 15 or fewer children with high lead levels per year since 2009.

**Table 13. Michigan Children Under 6 Years Old with Venous Blood Lead Levels Typically Requiring Chelation (≥45 µg/dL) by Year, 2003 – 2017**

Year	# Tested	# Venous ≥45 µg/dL	% Venous ≥45 µg/dL <sup>†</sup>	Year	# Tested	# Venous ≥45 µg/dL	% Venous ≥45 µg/dL <sup>†</sup>
2003	99,963	33	0.03	2011	152,267	14	0.01
2004	125,265	33	0.03	2012	148,991	9	0.01
2005	132,934	30	0.02	2013	148,639	13	0.01
2006	141,398	20	0.01	2014	144,099	8	0.01
2007	149,829	16	0.01	2015	141,509	9	0.01
2008	153,203	23	0.02	2016	157,813	7	< 0.01
2009	154,525	12	0.01	2017	150,068	8	0.01
2010	155,980	15	0.01				

<sup>†</sup> 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](mailto:MDHHS-CLPPP@Michigan.gov).

### Blood Lead in Michigan

The percentages of tested children with an EBLL and a high EBLL have decreased; this indicates progress. However, current EBLL percentages and the fact that *any* children needed chelation demonstrate 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.

Primary prevention – removing sources of lead in the child’s environment *before* they have an EBLL – is the most effective way to prevent elevated blood lead levels in children.<sup>1, 3, 6, 10</sup> Due to limited resources, Michigan’s health departments focus on secondary prevention, meaning that services are provided only after a child is found to have an EBLL.

### *Areas with the Highest Burden*

Compared to other areas in Michigan, Detroit continued to bear the greatest burden of lead in 2017. Detroit had the highest absolute number of children with an EBLL, one of the highest proportions of children with an EBLL, and the highest number of children who needed chelation. This is likely because Detroit has many children living in poverty and older housing, which increases their risk of lead exposure. Other selected communities also have



higher proportions of children with elevated levels compared to Michigan overall, particularly the cities of Highland Park and Jackson. 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 MCL 333.20531](#)), many tests are reported months and sometimes years after they were done. This lag in reporting is the main reason that the CLPPP annual report is not released earlier.
- Many labs submit test results to CLPPP in a way that requires manual processing. This increases processing time and is prone to errors. Transitioning more labs to electronic messaging will increase data quality and decrease processing times.

#### Data Limitations

- When a child has more than one blood lead test, a computer algorithm uses information like name and date of birth to link each test result to the same child. However, the algorithm is not perfect. Errors in spelling of names, dates of birth, and other information may cause the linkage to fail, making it appear that the tests were for more than one child. In this way, some children may be counted more than once per year.
- Laboratories across Michigan do not report race and ethnicity information in a consistent way, so it is unavailable for this report. This is an area that CLPPP is working to improve, so that this information can be provided in the future.
- This report and previous reports used the address reported by the parent and included on the test result sent by the laboratory, which is usually a mailing address. It was not verified by geocoding and does not represent municipalities that are not part of a mailing address (like townships).

#### Interpretation of Results

- Michigan does not have mandatory blood lead testing, except for testing of Medicaid and WIC children. 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 *proportion* of all Michigan children with an EBLL is likely 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 and ethnicity, or Medicaid status) and may have been exposed to different risk factors (like poverty and living in older housing), than children who were not tested.
    - For example: 66% of *tested* children under 6 years old were enrolled in Medicaid, while 50% of *all* Michigan children under 6 years old are enrolled in Medicaid.<sup>19</sup>

- Interpretation of EBLL percentages between groups is difficult because of the difference in testing rates and underlying risks of lead exposure.
- Capillary blood lead tests are known to produce false positives,<sup>15</sup> where a test result indicates that the lead level is higher than it truly is. Since 45% of EBLLs are from these types of tests, the true numbers and percentages of children with an EBLL are likely lower than reported.
- Comparisons of EBLL percentages between years should be interpreted with caution for the reasons listed previously (see [Limitations of Year-to-Year Comparisons](#)).
- CLPPP reports on the number of Medicaid children ages 1 to 2 years old tested in that year. Medicaid reports on the accumulative total of children who are or have been tested before their third birthday in that year. These measurements are NOT the same. Therefore, these proportions should not be used to determine how well Michigan physicians are complying with this 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. 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 constantly updated to reflect new information. Analysis methods are continually being improved. This means that 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.

## 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 stress the importance of the confirmatory venous blood tests.
- Routinely assisting local health departments in obtaining Medicaid reimbursement covering the cost of in-home nursing case management for Medicaid children with venous confirmed EBLLs. This should lead to 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 (reduce number with an EBLL).
- Support services for children with an EBLL to identify and remove sources of lead, mitigate negative effects of exposure.
- Increase the proportion of children with capillary EBLLs receiving a subsequent confirmatory venous test.

## *Improvements to the CLPPP Surveillance Database*

In November 2017, CLPPP began using MiCLPS, an enhanced, web-based surveillance data application. Significant features and improvements are listed below.

- Expanded search and reporting capacity, including some data quality assessments.
- Automatic address geocoding: most addresses will now be automatically validated (checked to make sure they are correct) and matched to census tracts. With geocoding, CLPPP will be able to prepare more accurate maps and link results to census information, like age of housing in an area.
- 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 additional data cleanup. As of December 31, 2017, 3 laboratories were reporting blood lead test results in this way.
- Capture of test results below the limit of detection laboratories now report test results below the limit of detection with a special notation (for example, a test result of < 3 indicates that there were *less than* 3.0 µg/dL of lead in the sample). CLPPP can now differentiate between results below limits of detection and measurable test results.
- Capture of unrounded test results: the current data collection system now allows capture of the unrounded test result and Michigan laboratories are now reporting unrounded results.

Results in the 2018 annual report will reflect these improvements since there will be a full year of data collection with these enhancements.

## *Improving Analysis and Reporting*

CLPPP has started on several initiatives to improve accuracy and timeliness of reporting. Goals include:

- Helping more laboratories adopt optimal 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.
  - Number of test results that did not meet state-mandated reporting requirements (meaning that key information was missing, incomplete, or incorrect).
- Providing local health departments with regular updates of confirmatory testing rates, to inform new and existing interventions to increase confirmatory testing.
- Forming a data users group. This group of representatives from local health departments and other partners will aid CLPPP in determining what information is most important to produce, in what order, and best way to present it. The goal is that future CLPPP reports will be more useful and easier to understand.
- 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

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### Where can I find more information about lead?

Good resources on the web include:

- <https://www.michigan.gov/lead/>, <https://www.michigan.gov/leadsafe,> or <https://www.michigan.gov/mileadsafe>
- <https://www.cdc.gov/nceh/lead/default.htm>
- <https://www.epa.gov/lead>

### 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 (LHDs) of any child who has an EBLL. The LHDs follow up with the child and their caregivers, providing any or all of the following services:

- Providing 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 safe removal of lead in the home; WIC, for help with the child's nutrition; and other services.

CLPPP supports LHD NCM activities by staffing a nurse consultant for training, expertise, and consultations; providing a web-based application to track nursing case management activities; and helping LHDs get funding for NCM visits through Medicaid.

Additionally, MDHHS CLPPP works to increase lead awareness and testing through education and prevention grants offered to local health departments for special projects.

### 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 determine the proportion of all children who have an EBLL because not all children are tested for blood lead.

For example, it is accurate to say that “Among those tested for lead, 7.4% of Detroit children under 6 years old had an elevated blood lead level.”, or “7.4% of Detroit children under 6 years old who were tested for lead had elevated levels.” It is **NOT accurate** to say that “7.4% 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 44 µg/dL, and ≥45 µg/dL. These categories were chosen to meet the needs of local health departments across Michigan. A child qualifies for services regardless of which category they fall into. However, they may be pursued more aggressively and 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 be very aggressive in providing 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 some data (replaces it with an asterisk (\*) in the tables) to maintain the privacy of people who had a blood lead test. The idea is that if there are fewer than 6 people tested in an area (zip code, city, or county), it might be possible to identify the person or people tested and their result(s). Suppressing counts less than 6 is a common practice for similar types of reports. CLPPP will release unsuppressed counts to local health departments upon request.

## Why are the counts for 2016 (or earlier years) different from the 2016 (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?

Most of the information that people need is in the annual reports or supplemental documents, available on the web at [Michigan.gov/lead](https://www.michigan.gov/lead), on the [Lead Data and Reports webpage](#). However, if other information is needed, please [email MDHHS-CLPPP@michigan.gov](mailto:MDHHS-CLPPP@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 (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?

Feel free to send an email directly to CLPPP at [MDHHS-CLPPP@michigan.gov](mailto:MDHHS-CLPPP@michigan.gov).

## Appendix 2: Technical Information about Data Analysis

### Data Elements

Table 14. Contents of MiCLPS, the Michigan CLPPP Surveillance Database

Type of Data	Description
Patient Information	Name, Residential Address, Date of Birth, Sex, Race*, Ethnicity*, 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

\*Many laboratories do not consistently or correctly report this information. Therefore, it is considered unreliable.

### Data Flow and Data Quality

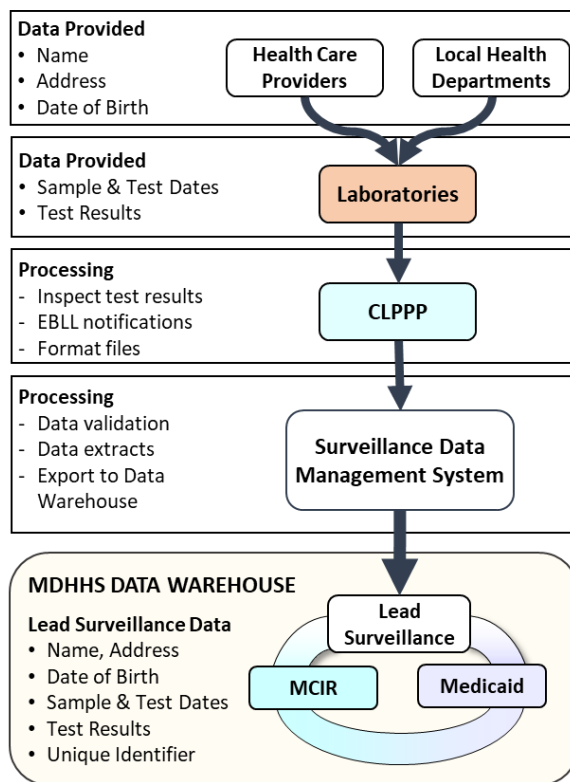
Results and other information flow from the patient to CLPPP and partners as illustrated in Figure C. Typically, information about the patient and blood samples are collected at a doctor's office or health department. Then, the blood is tested on-site by a portable blood lead analyzer or sent to a laboratory. All blood lead test results must be submitted to the MDHHS CLPPP (see [Michigan's Public Health Code MCL 333.20531](#)) within five working days after test completion.

CLPPP receives data from laboratories in a variety of formats, including HL7 messages and Excel spreadsheets. They are then uploaded each week to CLPPP's database, called MiCLPS (Michigan Childhood Lead Poisoning Surveillance). A unique identifier is assigned to each test, called the serial number. Priority datapoints are manually reviewed and submitting laboratories/ordering physicians are contacted to fix errors. 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 also automatically validated and geocoded by a computer algorithm, when possible.

After the first phase of data cleanup is completed, 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, Michigan Care Improvement Registry). This allows health care providers to see their patient's lead level when the child's immunization 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

Figure C. Blood Lead Data Flow



corrects errors with the help of the submitting laboratories. Further data cleanup is done at the time of analysis and report creation.

## Housing Stock and Population Estimates

The U.S. Census American Community Survey (ACS) produces estimates of socioeconomic and housing characteristics, which are available through online tools like the American Factfinder (<https://factfinder.census.gov/>). The new Census Factfinder (<https://data.census.gov/>) will replace the American Factfinder in the spring of 2020. These estimates describe the average characteristics of an area (such as a state, county, or city) over a specific period of time. This analysis used 5-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 2017 5-year estimate is based on data collected from January 2013 to December 2017. It can also be written as a 2013-2017 5-year estimate. For more information, see the ACS General Handbook at <https://www.census.gov/content/dam/Census/library/publications/2008/acs/ACSGeneralHandbook.pdf>

Population by year of age are based on estimates using data from the 2010 decennial census. Population estimates by year of age from 2011 to date are available from the U.S. Census by the American Factfinder or the new Census Factfinder. 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 (NVSS) website at [https://www.cdc.gov/nchs/nvss/bridged\\_race.htm](https://www.cdc.gov/nchs/nvss/bridged_race.htm).

Source tables used in this analysis were:

- Housing age in 2017: The 2013-2017 ACS 5-year estimate for 2017, table B25034 (Year Structure was Built)
- Yearly population estimates for children under 6 years old in 2009 – 2015: ACS 5-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 2017: U.S. Census 2010 table PEPSYASEX (Annual Estimates of the Resident Population by Single Year of Age and Sex for the United States, States, and Puerto Rico Commonwealth)

## Change in Age Calculation

On July 1, 2018, CLPPP began using a new way to calculate a child's age when tested. Age is now calculated the way most people think of age - a person's age increases on their birthday. For example: A child is 1 year old until the day of their second birthday. Then, they are 2 years old.

Prior to this report, age was calculated by finding the number of days since their date of birth and dividing by the number of days in a year (365.25 days, to account for the leap year). For example: A child was born on 1/1/2006 and received a blood lead test on 1/1/2007. Using the old method, the child would be 365 days / 365.25 days in one year = 0.99 years old, which is not yet 1 year old. Using the new method, the child would be 1 year old.

This report was created using the new age calculation. As a result of the change, there may be slight differences in numbers from this report compared to numbers from reports made before July 1, 2018.

## Software

Summary-level data was generated using SAS 9.4 and Microsoft Excel 2010.

## More about Deduplication

Children often receive more than one test per year. In order 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, the highest BLL obtained from the most accurate test, a venous test, was kept. If no venous test was performed, the highest BLL obtained from a capillary test was kept. If the only test results were of unspecified 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. Since this test was elevated, their doctor ordered a confirmatory venous test, which came back at 5 µg/dL. After receiving case management services, a follow-up venous test was done 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 an Elevated Result

An EBLL is a blood lead test result  $\geq 5$  µg/dL, the reference value currently recommended by the CDC. This value is based on the 97.5<sup>th</sup> 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).<sup>1</sup> This means that only 2.5% of surveyed children had blood lead levels greater than or equal to 5 µg/dL.

## More about Rounding and the Limit of Reporting

The CLPPP surveillance database has followed the requirements specified by [Administrative Rule R 325.9082](#), which states that blood lead test results are to be reported as whole numbers, rounded to the nearest whole number, with no method of identifying test results that are below the limit of reporting. Starting in November 2017, the CLPPP database was changed to collect non-rounded results and indications that a result is below the limit of reporting (limit of detection). (Note these Rules are being amended to reflect current practice as described here). Examples are provided to illustrate the impact of these changes:

- Before the change, a child with BLL of 4.5 µg/dL was reported to CLPPP as a rounded value of 5 µg/dL. This child would then be at the action level for services. The result is now stored in the database as the actual value of 4.5 µg/dL. To keep the same level of service as in the past, CLPPP now conventionally rounds the values for reporting. For example, CLPPP considers a value of 4.5 µg/dL to be an elevated result, but a value of 4.4 µg/dL is a non-elevated result.
- A laboratory reported that the test result was below 3 µg/dL, which was the method's limit of detection. The result was stored in the surveillance database as a result of 3 µg/dL. This means that the CLPPP database did not 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 for identification of results below the limit of reporting (limit of detection).



## History of Blood Lead Testing and Requirements

- Since 1989, the U.S. Centers for Medicare and Medicaid Services (CMS) has required lead testing for all children enrolled in Medicaid. At the time, CMS did not allow states to modify this requirement.<sup>18, 21</sup>
- From 1978 to 1997, the CDC recommended universal testing for all children under 6 years old.<sup>22</sup>
- 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.<sup>18, 21</sup>
- In 2004, Michigan passed legislation requiring that 80% of Medicaid children be screened by 2007, further enforcing compliance with the federal testing requirement (see [MCL 400.111k](#)).
- In 2006, the Food and Drug Administration approved point-of-care capillary blood lead testing, expanding capillary blood lead testing.<sup>23</sup>
- In 2012, the blood lead level considered to be 'elevated' changed from 10 µg/dL to 5 µg/dL,<sup>1</sup> meaning that 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: References

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## Appendix 4: Reference Data Tables

Table Appx 1A. Blood Lead Testing and Levels for Children Under 6 Years Old by County and Sample Type, 2017, Data Suppressed\*

County	% Pre-1950 Homes <sup>†</sup>	% Pre-1980 Homes <sup>†</sup>	Population Children <6 <sup>†</sup>	# Tested	% Tested <sup>A</sup>	# EBLL (≥5 µg/dL)	% EBLL <sup>B</sup>	# Capillary <sup>‡</sup> EBLL	% Capillary <sup>‡</sup> EBLL <sup>B</sup>	# Venous EBLL	% Venous EBLL <sup>B</sup>
ALCONA	13.6	66.5	401	84	20.9	*	-	*	-	0	0.0
ALGER	20.8	60.5	433	62	14.3	0	0.0	0	0.0	0	0.0
ALLEGAN	22.7	51.8	8,456	1,536	18.2	29	1.9	18	1.2	11	0.7
ALPENA	23.5	72.9	1,557	301	19.3	8	2.7	*	-	*	-
ANTRIM	16.5	52.9	1,178	307	26.1	*	-	*	-	*	-
ARENAC	16.0	58.8	807	255	31.6	*	-	*	-	*	-
BARAGA	25.1	67.0	497	127	25.6	0	0.0	0	0.0	0	0.0
BARRY	24.5	57.4	3,970	488	12.3	17	3.5	11	2.3	6	1.2
BAY	32.6	76.8	6,365	1,387	21.8	50	3.6	34	2.5	16	1.2
BENZIE	18.8	47.2	938	267	28.5	*	-	*	-	0	0.0
BERRIEN	25.9	70.3	11,214	2,153	19.2	62	2.9	24	1.1	38	1.8
BRANCH	30.0	64.1	3,205	506	15.8	31	6.1	21	4.2	10	2.0
CALHOUN	32.3	75.0	9,972	2,910	29.2	157	5.4	75	2.6	82	2.8
CASS	22.6	62.1	3,093	586	18.9	34	5.8	16	2.7	18	3.1
CHARLEVOIX	20.9	56.3	1,480	302	20.4	*	-	0	0.0	*	-
CHEBOYGAN	20.1	56.1	1,285	260	20.2	*	-	*	-	0	0.0
CHIPPEWA	20.8	58.0	2,167	364	16.8	*	-	*	-	*	-

\* Counts between one (1) and five (5) are suppressed (not reported) and replaced with an asterisk (\*) in the table above to protect the privacy of people who had a blood lead test. Other counts are also not reported if they can be used to calculate the suppressed counts. Note that sum of venous and capillary tests may not match the total number of tests due to missing values from this suppression.

<sup>†</sup> US Census data from [American Community Survey tables](#) B09001 (numbers of children living in households) and B25034 (house age).

<sup>‡</sup> Tests with unknown sample type are assumed to be capillary tests.

<sup>A</sup> Percent is among population of children under 6 years old (% Tested = (# Children Tested / Population Children <6) × 100).

<sup>B</sup> Percent is among all tested children under 6 years old (% in EBLL category = (# in EBLL category / # All Children Tested) × 100).

Table Appx 1A. Blood Lead Testing and Levels for Children Under 6 Years Old by County and Sample Type, 2017, Data Suppressed\*

County	% Pre-1950 Homes <sup>†</sup>	% Pre-1980 Homes <sup>†</sup>	Population Children <6 <sup>†</sup>	# Tested	% Tested <sup>A</sup>	# EBLB (≥5 µg/dL)	% EBLB <sup>B</sup>	# Capillary <sup>‡</sup> EBLB	% Capillary <sup>‡</sup> EBLB <sup>B</sup>	# Venous EBLB	% Venous EBLB <sup>B</sup>
CLARE	10.9	59.8	1,970	463	23.5	12	2.6	*	-	*	-
CLINTON	18.9	49.4	5,125	693	13.5	17	2.5	11	1.6	6	0.9
CRAWFORD	10.6	56.2	687	128	18.6	*	-	*	-	*	-
DELTA	32.6	69.8	2,221	398	17.9	7	1.8	*	-	*	-
DICKINSON	36.4	72.0	1,578	279	17.7	*	-	*	-	*	-
EATON	19.2	58.3	7,616	1131	14.9	16	1.4	9	0.8	7	0.6
EMMET	19.6	47.9	1,827	306	16.7	*	-	*	-	*	-
GENESEE	19.0	70.5	29,479	6,729	22.8	124	1.8	58	0.9	66	1.0
GLADWIN	11.0	53.6	1,532	308	20.1	*	-	*	-	*	-
GOGEBIC	45.5	75.5	694	174	25.1	7	4.0	*	-	*	-
GD TRAVERSE	14.5	43.3	5,812	1,504	25.9	16	1.1	*	-	*	-
GRATIOT	33.6	69.5	2,414	408	16.9	6	1.5	*	-	*	-
HILLSDALE	32.8	65.1	3,089	930	30.1	45	4.8	27	2.9	18	1.9
HOUGHTON	47.2	73.7	2,316	516	22.3	13	2.5	6	1.2	7	1.4
HURON	26.7	67.1	1,869	366	19.6	7	1.9	*	-	*	-
INGHAM	24.2	68.3	19,295	4,649	24.1	150	3.2	92	2.0	58	1.2
IONIA	30.5	60.9	4,361	1,034	23.7	48	4.6	29	2.8	19	1.8
IOSCO	18.3	69.2	1,316	280	21.3	9	3.2	*	-	*	-
IRON	39.9	70.8	638	111	17.4	*	-	*	-	*	-
ISABELLA	14.7	47.8	4,003	569	14.2	8	1.4	*	-	*	-

\* Counts between one (1) and five (5) are suppressed (not reported) and replaced with an asterisk (\*) in the table above to protect the privacy of people who had a blood lead test. Other counts are also not reported if they can be used to calculate the suppressed counts. Note that sum of venous and capillary tests may not match the total number of tests due to missing values from this suppression.

<sup>†</sup> US Census data from [American Community Survey tables](#) B09001 (numbers of children living in households) and B25034 (house age).

<sup>‡</sup> Tests with unknown sample type are assumed to be capillary tests.

<sup>A</sup> Percent is among population of children under 6 years old (% Tested = (# Children Tested / Population Children <6) × 100).

<sup>B</sup> Percent is among all tested children under 6 years old (% in EBLB category = (# in EBLB category / # All Children Tested) × 100).

Table Appx 1A. Blood Lead Testing and Levels for Children Under 6 Years Old by County and Sample Type, 2017, Data Suppressed\*

County	% Pre-1950 Homes <sup>†</sup>	% Pre-1980 Homes <sup>†</sup>	Population Children <6 <sup>†</sup>	# Tested	% Tested <sup>A</sup>	# EBLL (≥5 µg/dL)	% EBLL <sup>B</sup>	# Capillary <sup>‡</sup> EBLL	% Capillary <sup>‡</sup> EBLL <sup>B</sup>	# Venous EBLL	% Venous EBLL <sup>B</sup>
JACKSON	29.3	67.3	11,167	2,603	23.3	151	5.8	99	3.8	52	2.0
KALAMAZOO	20.9	61.3	18,703	3,510	18.8	127	3.6	71	2.0	56	1.6
KALKASKA	11.5	51.1	1,091	234	21.4	*	-	0	0.0	*	-
KENT	22.7	59.7	52,779	9,945	18.8	425	4.3	202	2.0	223	2.2
KEWEENAW	45.5	69.4	140	21	15	*	-	0	0.0	*	-
LAKE	10.4	50.6	584	132	22.6	0	0.0	0	0.0	0	0.0
LAPEER	17.2	55.1	5,504	975	17.7	20	2.1	13	1.3	7	0.7
LEELANAU	15.3	44.8	1,038	290	27.9	*	-	*	-	0	0.0
LENAWEE	31.3	66.2	6,380	1,232	19.3	48	3.9	21	1.7	27	2.2
LIVINGSTON	10.3	42.0	11,815	1026	8.7	10	1.0	*	-	*	-
LUCE	19.1	58.7	334	81	24.3	*	-	*	-	*	-
MACKINAC	22.6	55.5	521	109	20.9	*	-	*	-	0	0.0
MACOMB	9.5	61.1	56,839	12,292	21.6	120	1.0	79	0.6	41	0.3
MANISTEE	27.2	63.6	1,164	332	28.5	11	3.3	*	-	*	-
MARQUETTE	27.8	73.6	4,001	521	13	18	3.5	*	-	*	-
MASON	25.0	58.1	1,772	459	25.9	15	3.3	*	-	*	-
MECOSTA	15.5	50.1	2,535	492	19.4	8	1.6	*	-	*	-
MENOMINEE	32.4	66.1	1,321	249	18.8	*	-	*	-	*	-
MIDLAND	12.8	60.4	5,411	398	7.4	*	-	*	-	*	-
MISSAUKEE	15.8	55.9	1,101	127	11.5	*	-	*	-	*	-

\* Counts between one (1) and five (5) are suppressed (not reported) and replaced with an asterisk (\*) in the table above to protect the privacy of people who had a blood lead test. Other counts are also not reported if they can be used to calculate the suppressed counts. Note that sum of venous and capillary tests may not match the total number of tests due to missing values from this suppression.

<sup>†</sup> US Census data from [American Community Survey tables](#) B09001 (numbers of children living in households) and B25034 (house age).

<sup>‡</sup> Tests with unknown sample type are assumed to be capillary tests.

<sup>A</sup> Percent is among population of children under 6 years old (% Tested = (# Children Tested / Population Children <6) × 100).

<sup>B</sup> Percent is among all tested children under 6 years old (% in EBLL category = (# in EBLL category / # All Children Tested) × 100).

Table Appx 1A. Blood Lead Testing and Levels for Children Under 6 Years Old by County and Sample Type, 2017, Data Suppressed\*

County	% Pre-1950 Homes <sup>†</sup>	% Pre-1980 Homes <sup>†</sup>	Population Children <6 <sup>†</sup>	# Tested	% Tested <sup>A</sup>	# EBLL (≥5 µg/dL)	% EBLL <sup>B</sup>	# Capillary <sup>‡</sup> EBLL	% Capillary <sup>‡</sup> EBLL <sup>B</sup>	# Venous EBLL	% Venous EBLL <sup>B</sup>
MONROE	23.2	61.7	9,898	1,359	13.7	35	2.6	25	1.8	10	0.7
MONTCALM	23.8	57.3	4,302	796	18.5	26	3.3	18	2.3	8	1.0
MONTMORENCY	11.1	65.4	408	76	18.6	0	0.0	0	0.0	0	0.0
MUSKEGON	27.9	67.9	12,795	2,670	20.9	133	5.0	90	3.4	43	1.6
NEWAYGO	16.8	51.0	3,389	526	15.5	9	1.7	*	-	*	-
OAKLAND	14.0	62.4	82,104	15,785	19.2	204	1.3	109	0.7	95	0.6
OCEANA	21.4	53.5	1,857	476	25.6	7	1.5	*	-	*	-
OGEMAW	14.4	59.2	1,209	232	19.2	*	-	*	-	*	-
ONTONAGON	37.1	74.6	155	57	36.8	0	0.0	0	0.0	0	0.0
OSCEOLA	16.5	56.0	1,508	363	24.1	7	1.9	*	-	*	-
OSCODA	12.4	66.0	481	67	13.9	*	-	*	-	0	0.0
OTSEGO	8.6	51.0	1,591	324	20.4	*	-	0	0.0	*	-
OTTAWA	13.9	45.5	21,315	3,132	14.7	37	1.2	13	0.4	24	0.8
PRESQUE ISLE	20.0	66.2	561	101	18	*	-	*	-	0	0.0
ROSCOMMON	9.9	61.8	982	195	19.9	*	-	*	-	0	0.0
SAGINAW	25.1	76.7	13,423	3,247	24.2	93	2.9	50	1.5	43	1.3
SAINT CLAIR	24.7	61.5	9,874	3,032	30.7	91	3.0	48	1.6	43	1.4
SAINT JOSEPH	27.9	68.6	4,907	879	17.9	45	5.1	29	3.3	16	1.8
SANILAC	28.4	64.7	2,719	430	15.8	7	1.6	*	-	*	-
SCHOOLCRAFT	22.1	57.5	492	100	20.3	*	-	0	0.0	*	-

\* Counts between one (1) and five (5) are suppressed (not reported) and replaced with an asterisk (\*) in the table above to protect the privacy of people who had a blood lead test. Other counts are also not reported if they can be used to calculate the suppressed counts. Note that sum of venous and capillary tests may not match the total number of tests due to missing values from this suppression.

<sup>†</sup> US Census data from [American Community Survey tables](#) B09001 (numbers of children living in households) and B25034 (house age).

<sup>‡</sup> Tests with unknown sample type are assumed to be capillary tests.

<sup>A</sup> Percent is among population of children under 6 years old (% Tested = (# Children Tested / Population Children <6) × 100).

<sup>B</sup> Percent is among all tested children under 6 years old (% in EBLL category = (# in EBLL category / # All Children Tested) × 100).

Table Appx 1A. Blood Lead Testing and Levels for Children Under 6 Years Old by County and Sample Type, 2017, Data Suppressed\*

County	% Pre-1950 Homes <sup>†</sup>	% Pre-1980 Homes <sup>†</sup>	Population Children <6 <sup>†</sup>	# Tested	% Tested <sup>A</sup>	# EBLL (≥5 µg/dL)	% EBLL <sup>B</sup>	# Capillary <sup>‡</sup> EBLL	% Capillary <sup>‡</sup> EBLL <sup>B</sup>	# Venous EBLL	% Venous EBLL <sup>B</sup>
SHIAWASSEE	29.3	70.7	4,055	1,341	33.1	46	3.4	31	2.3	15	1.1
TUSCOLA	27.9	69.8	3,290	897	27.3	17	1.9	*	-	*	-
VAN BUREN	25.5	59.9	5,469	952	17.4	24	2.5	8	0.8	16	1.7
WASHTENAW	16.4	55.9	21,646	3045	14.1	35	1.1	14	0.5	21	0.7
WAYNE											
DETROIT	58.3	91.7	59,381	22,165	37.3	1,632	7.4	437	2.0	1195	5.4
WAYNE											
EX DETROIT	20.7	76.1	78,328	19,589	25	365	1.9	163	0.8	202	1.0
WEXFORD	21.1	57.6	2,363	333	14.1	*	-	*	-	*	-
<b>MICHIGAN</b>	<b>22.9</b>	<b>65.5</b>	<b>687,562</b>	<b>150,068</b>	<b>21.8</b>	<b>4,711</b>	<b>3.1</b>	<b>2101</b>	<b>1.4</b>	<b>2610</b>	<b>1.7</b>

\* Counts between one (1) and five (5) are suppressed (not reported) and replaced with an asterisk (\*) in the table above to protect the privacy of people who had a blood lead test. Other counts are also not reported if they can be used to calculate the suppressed counts. Note that sum of venous and capillary tests may not match the total number of tests due to missing values from this suppression.

<sup>†</sup> US Census data from [American Community Survey tables](#) B09001 (numbers of children living in households) and B25034 (house age).

<sup>‡</sup> Tests with unknown sample type are assumed to be capillary tests.

<sup>A</sup> Percent is among population of children under 6 years old (% Tested = (# Children Tested / Population Children <6) × 100).

<sup>B</sup> Percent is among all tested children under 6 years old (% in EBLL category = (# in EBLL category / # All Children Tested) × 100).



Table Appx 1B. Venous Blood Lead Levels for Children Under 6 Years Old by County, 2017, Data Suppressed\*

County	# Tested	# Venous 5-9 µg/dL	% Venous 5-9 µg/dL <sup>A</sup>	# Venous 10-14 µg/dL	% Venous 10-14 µg/dL <sup>A</sup>	# Venous 15-19 µg/dL	% Venous 15-19 µg/dL <sup>A</sup>	# Venous 20-44 µg/dL	% Venous 20-44 µg/dL <sup>A</sup>	# Venous ≥45 µg/dL	% Venous ≥45 µg/dL <sup>A</sup>
ALCONA	84	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
ALGER	62	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
ALLEGAN	1,536	9	0.6	*	-	*	-	*	-	0	0.0
ALPENA	301	*	-	*	-	0	0.0	0	0.0	0	0.0
ANTRIM	307	*	-	0	0.0	0	0.0	0	0.0	0	0.0
ARENAC	255	0	0.0	*	-	0	0.0	0	0.0	0	0.0
BARAGA	127	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
BARRY	488	*	-	*	-	0	0.0	0	0.0	0	0.0
BAY	1,387	*	-	*	-	0	0.0	0	0.0	0	0.0
BENZIE	267	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
BERRIEN	2,153	24	1.1	10	0.5	*	-	*	-	0	0.0
BRANCH	506	6	1.2	*	-	*	-	*	-	0	0.0
CALHOUN	2,910	54	1.9	17	0.6	*	-	*	-	0	0.0
CASS	586	16	2.7	*	-	0	0.0	*	-	*	-
CHARLEVOIX	302	*	-	*	-	0	0.0	0	0.0	0	0.0
CHEBOYGAN	260	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
CHIPPEWA	364	*	-	0	0.0	*	-	0	0.0	0	0.0
CLARE	463	*	-	0	0.0	0	0.0	0	0.0	0	0.0
CLINTON	693	*	-	*	-	0	0.0	*	-	0	0.0
CRAWFORD	128	*	-	0	0.0	0	0.0	0	0.0	0	0.0
DELTA	398	*	-	0	0.0	0	0.0	0	0.0	0	0.0
DICKINSON	279	*	-	0	0.0	0	0.0	*	-	0	0.0

\* Counts between one (1) and five (5) are suppressed (not reported) and replaced with a \* in the table above to protect the privacy of people who had a blood lead test. Other counts are also not reported if they can be used to calculate the suppressed counts. Note that sum of venous tests in BLL categories may not match the total number of venous tests listed in Table 1A. due to missing values from this suppression.

<sup>A</sup> Percent is among all tested children under 6 years old (% Venous EBLL category = (# in Venous EBLL Category/# All Children Tested) × 100).

Table Appx 1B. Venous Blood Lead Levels for Children Under 6 Years Old by County, 2017, Data Suppressed\*

County	# Tested	# Venous 5-9 µg/dL	% Venous 5-9 µg/dL <sup>A</sup>	# Venous 10-14 µg/dL	% Venous 10-14 µg/dL <sup>A</sup>	# Venous 15-19 µg/dL	% Venous 15-19 µg/dL <sup>A</sup>	# Venous 20-44 µg/dL	% Venous 20-44 µg/dL <sup>A</sup>	# Venous ≥45 µg/dL	% Venous ≥45 µg/dL <sup>A</sup>
EATON	1,131	*	-	0	0.0	*	-	0	0.0	0	0.0
EMMET	306	*	-	0	0.0	0	0.0	0	0.0	0	0.0
GENESEE	6,729	48	0.7	11	0.2	*	-	*	-	*	-
GLADWIN	308	0	0.0	*	-	0	0.0	0	0.0	0	0.0
GOGEBIC	174	*	-	*	-	0	0.0	0	0.0	0	0.0
GD TRAVERSE	1,504	*	-	0	0.0	0	0.0	0	0.0	0	0.0
GRATIOT	408	*	-	0	0.0	0	0.0	0	0.0	0	0.0
HILLSDALE	930	13	1.4	*	-	*	-	0	0.0	0	0.0
HOUGHTON	516	*	-	*	-	0	0.0	0	0.0	0	0.0
HURON	366	*	-	0	0.0	0	0.0	0	0.0	0	0.0
INGHAM	4,649	45	1.0	8	0.2	*	-	*	-	0	0.0
IONIA	1,034	9	0.9	*	-	*	-	*	-	0	0.0
IOSCO	280	*	-	*	-	*	-	0	0.0	0	0.0
IRON	111	*	-	0	0.0	0	0.0	0	0.0	0	0.0
ISABELLA	569	*	-	*	-	0	0.0	0	0.0	0	0.0
JACKSON	2,603	42	1.6	*	-	*	-	0	0.0	0	0.0
KALAMAZOO	3,510	41	1.2	7	0.2	*	-	*	-	0	0.0
KALKASKA	234	*	-	0	0.0	0	0.0	0	0.0	0	0.0
KENT	9,945	160	1.6	43	0.4	11	0.1	*	-	*	-
KEWEENAW	21	0	0.0	*	-	0	0.0	0	0.0	0	0.0
LAKE	132	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
LAPEER	975	*	-	*	-	0	0.0	0	0.0	0	0.0
LEELANAU	290	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0

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<sup>A</sup> Percent is among all tested children under 6 years old (% Venous EBLL category = (# in Venous EBLL Category/# All Children Tested) × 100).

Table Appx 1B. Venous Blood Lead Levels for Children Under 6 Years Old by County, 2017, Data Suppressed\*

County	# Tested	# Venous 5-9 µg/dL	% Venous 5-9 µg/dL <sup>A</sup>	# Venous 10-14 µg/dL	% Venous 10-14 µg/dL <sup>A</sup>	# Venous 15-19 µg/dL	% Venous 15-19 µg/dL <sup>A</sup>	# Venous 20-44 µg/dL	% Venous 20-44 µg/dL <sup>A</sup>	# Venous ≥45 µg/dL	% Venous ≥45 µg/dL <sup>A</sup>
LENAWEE	1,232	*	-	*	-	0	0.0	0	0.0	0	0.0
LIVINGSTON	1,026	*	-	0	0.0	0	0.0	*	-	0	0.0
LUCE	81	*	-	*	-	0	0.0	0	0.0	0	0.0
MACKINAC	109	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
MACOMB	12,292	27	0.2	8	0.1	*	-	*	-	0	0.0
MANISTEE	332	*	-	0	0.0	0	0.0	0	0.0	0	0.0
MARQUETTE	521	7	1.3	*	-	*	-	0	0.0	0	0.0
MASON	459	*	-	*	-	*	-	0	0.0	0	0.0
MECOSTA	492	*	-	0	0.0	0	0.0	0	0.0	0	0.0
MENOMINEE	249	*	-	0	0.0	*	-	0	0.0	0	0.0
MIDLAND	398	*	-	0	0.0	0	0.0	0	0.0	0	0.0
MISSAUKEE	127	0	0.0	*	-	0	0.0	0	0.0	0	0.0
MONROE	1,359	6	0.4	*	-	*	-	*	-	0	0.0
MONTCALM	796	*	-	*	-	0	0.0	0	0.0	0	0.0
MONTMORENCY	76	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
MUSKEGON	2,670	27	1.0	9	0.3	*	-	*	-	0	0.0
NEWAYGO	526	*	-	*	-	0	0.0	0	0.0	0	0.0
OAKLAND	15,785	75	0.5	14	0.1	*	-	*	-	0	0.0
OCEANA	476	*	-	*	-	0	0.0	0	0.0	0	0.0
OGEMAW	232	*	-	0	0.0	0	0.0	0	0.0	0	0.0
ONTONAGON	57	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
OSCEOLA	363	*	-	*	-	0	0.0	0	0.0	0	0.0
OSCODA	67	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0

\* Counts between one (1) and five (5) are suppressed (not reported) and replaced with a \* in the table above to protect the privacy of people who had a blood lead test. Other counts are also not reported if they can be used to calculate the suppressed counts. Note that sum of venous tests in BLL categories may not match the total number of venous tests listed in Table 1A. due to missing values from this suppression.

<sup>A</sup> Percent is among all tested children under 6 years old (% Venous EBLL category = (# in Venous EBLL Category/# All Children Tested) × 100).

Table Appx 1B. Venous Blood Lead Levels for Children Under 6 Years Old by County, 2017, Data Suppressed\*

County	# Tested	# Venous 5-9 µg/dL	% Venous 5-9 µg/dL <sup>A</sup>	# Venous 10-14 µg/dL	% Venous 10-14 µg/dL <sup>A</sup>	# Venous 15-19 µg/dL	% Venous 15-19 µg/dL <sup>A</sup>	# Venous 20-44 µg/dL	% Venous 20-44 µg/dL <sup>A</sup>	# Venous ≥45 µg/dL	% Venous ≥45 µg/dL <sup>A</sup>
OTSEGO	324	0	0.0	*	-	0	0.0	0	0.0	0	0.0
OTTAWA	3,132	19	0.6	*	-	*	-	*	-	0	0.0
PRESQUE ISLE	101	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
ROSCOMMON	195	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
SAGINAW	3,247	27	0.8	9	0.3	*	-	*	-	0	0.0
SAINT CLAIR	3,032	31	1.0	9	0.3	*	-	*	-	0	0.0
SAINT JOSEPH	879	*	-	*	-	0	0.0	0	0.0	0	0.0
SANILAC	430	*	-	0	0.0	0	0.0	0	0.0	0	0.0
SCHOOLCRAFT	100	*	-	0	0.0	0	0.0	0	0.0	0	0.0
SHIAWASSEE	1,341	11	0.8	*	-	*	-	0	0.0	0	0.0
TUSCOLA	897	9	1.0	*	-	0	0.0	*	-	0	0.0
VAN BUREN	952	11	1.2	*	-	*	-	*	-	0	0.0
WASHTENAW	3,045	19	0.6	*	-	*	-	*	-	0	0.0
WAYNE DETROIT	22,165	879	4.0	192	0.9	62	0.3	*	-	*	-
WAYNE EX DETROIT	19,589	146	0.7	33	0.2	12	0.1	*	-	*	-
WEXFORD	333	0	0.0	0	0.0	*	-	*	-	0	0.0
<b>MICHIGAN</b>	<b>150,068</b>	<b>1,898</b>	<b>1.3</b>	<b>442</b>	<b>0.3</b>	<b>136</b>	<b>0.1</b>	<b>126</b>	<b>0.1</b>	<b>8</b>	<b>0.0</b>

\* Counts between one (1) and five (5) are suppressed (not reported) and replaced with a \* in the table above to protect the privacy of people who had a blood lead test. Other counts are also not reported if they can be used to calculate the suppressed counts. Note that sum of venous tests in BLL categories may not match the total number of venous tests listed in Table 1A. due to missing values from this suppression.

<sup>A</sup> Percent is among all tested children under 6 years old (% Venous EBLL category = (# in Venous EBLL Category/# All Children Tested) × 100).

Table Appx 2A. Blood Lead Testing and Levels for Children Under 6 Years Old in Selected Communities and by Sample Type, 2017

Community	% Pre-1950 Homes <sup>†</sup>	% Pre-1980 Homes <sup>†</sup>	Population Children < 6 <sup>†</sup>	# Tested	% Tested <sup>A</sup>	# EBLL (≥5 µg/dL)	% EBLL <sup>B</sup>	# Capillary <sup>‡</sup> EBLL	% Capillary <sup>‡</sup> EBLL <sup>B</sup>	# Venous EBLL	% Venous EBLL <sup>B</sup>
ADRIAN	32.4	69.3	1,735	601	34.6	31	5.2	14	2.3	17	2.8
DETROIT	58.3	91.7	59,381	22,165	37.3	1,632	7.4	437	2.0	1,195	5.4
FLINT	31.5	88.2	10,864	3,485	32.1	95	2.7	36	1.0	59	1.7
GRAND RAPIDS	43.2	79.3	19,025	6,441	33.9	370	5.7	169	2.6	201	3.1
HAMTRAMCK	71.5	92.8	2,457	1,140	46.4	57	5.0	15	1.3	42	3.7
HIGHLAND PARK	56.4	84.3	942	321	34.1	54	16.8	10	3.1	44	13.7
JACKSON	64.0	91.0	3,419	1,995	58.4	140	7.0	89	4.5	51	2.6
LANSING	33.0	83.1	10,299	3,693	35.9	135	3.7	78	2.1	57	1.5
MUSKEGON	44.6	82.9	6,109	1,848	30.3	122	6.6	81	4.4	41	2.2
<b>MICHIGAN</b>	<b>22.9</b>	<b>65.5</b>	<b>687,562</b>	<b>150,068</b>	<b>21.8</b>	<b>4,711</b>	<b>3.1</b>	<b>2,101</b>	<b>1.4</b>	<b>2,610</b>	<b>1.7</b>

\* Counts between one (1) and five (5) are suppressed (not reported) and replaced with a \* in the table above to protect the privacy of people who had a blood lead test. Other counts are also not reported if they can be used to calculate the suppressed counts. Note that sum of venous and capillary tests may not match the total number of tests due to missing values from this suppression. <sup>†</sup> US Census data from [American Community Survey](#) tables B09001 (numbers of children living in households) and B25034 (house age).

<sup>‡</sup> Tests with unknown sample type are assumed to be capillary tests.

<sup>A</sup> Percent is among population of children under 6 years old (% Tested = # Children Tested/Population Children <6 × 100%).

<sup>B</sup> Percent is among all tested children under 6 years old (% in EBLL category = # in EBLL category/# All Children Tested × 100%).

Table Appx 2B. Blood Lead Levels for Children Under 6 Years Old in Selected Communities, 2017, Data Suppressed\*

Community	# Tested	# Venous 5-9 µg/dL	% Venous 5-9 µg/dL <sup>A</sup>	# Venous 10-14 µg/dL	% Venous 10-14 µg/dL <sup>A</sup>	# Venous 15-19 µg/dL	% Venous 15-19 µg/dL <sup>A</sup>	# Venous 20-44 µg/dL	% Venous 20-44 µg/dL <sup>A</sup>	# Venous ≥45 µg/dL	% Venous ≥45 µg/dL <sup>A</sup>
ADRIAN	601	*	-	*	-	0	0.0	0	0.0	0	0.0
DETROIT	22,165	879	4.0	192	0.9	62	0.3	*	-	*	-
FLINT	3,485	42	1.2	10	0.3	*	-	*	-	*	-
GRAND RAPIDS	6,441	144	2.2	39	0.6	10	0.2	*	-	*	-
HAMTRAMCK	1,140	34	3.0	*	-	*	-	*	-	0	0.0
HIGHLAND PARK	321	27	8.4	9	2.8	*	-	*	-	0	0.0
JACKSON	1,995	41	2.1	*	-	*	-	0	0.0	0	0.0
LANSING	3,693	45	1.2	6	0.2	*	-	*	-	0	0.0
MUSKEGON	1,848	25	1.4	9	0.5	*	-	*	-	0	0.0
<b>MICHIGAN</b>	<b>150,068</b>	<b>1,898</b>	<b>1.3</b>	<b>442</b>	<b>0.3</b>	<b>136</b>	<b>0.1</b>	<b>126</b>	<b>0.1</b>	<b>8</b>	<b>0.0</b>

\* Counts between one (1) and five (5) are suppressed (not reported) and replaced with a \* in the table above to protect the privacy of people who had a blood lead test. Other counts are also not reported if they can be used to calculate the suppressed counts. Note that sum of venous tests in BLL categories may not match the total number of venous tests listed in Table 2A. due to missing values from this suppression.

<sup>A</sup> Percent is among all tested children under 6 years old (% Venous EBLL category = (# in Venous EBLL Category/# All Children Tested) × 100).