

**2007**

---

Annual Report on  
Blood Lead Levels on  
Adults and Children in Michigan





# **2007 Annual Report on Blood Lead Levels on Adults and Children in Michigan**

A Joint Report

of

Michigan State University  
Department of Medicine  
117 West Fee Hall  
East Lansing, Michigan 48824-1316  
(517) 353-1846

Kenneth D. Rosenman, M.D., Professor of Medicine  
Amy S. Sims, B.S., ABLES Program Coordinator

and

the Michigan Department of Labor and Economic Growth  
Michigan Occupational Safety and Health Administration  
P.O. Box 30643  
Lansing, Michigan 48909-8143  
(517) 322-1817

Douglas J. Kalinowski, Director  
Michigan Occupational Safety and Health Administration

and

Michigan Department of Community Health  
Division of Family and Community Health  
Childhood Lead Poisoning Prevention Program  
109 West Michigan Avenue  
P.O. Box 30195  
Lansing, Michigan 48909  
(517) 335-8885

Brenda Fink, A.C.S.W., Program Director  
Nancy Peeler, Ed.M., Program Supervisor  
Jane Nickert, R.N., M.S.N., M.S.B.A., Program Coordinator  
Robert L. Scott, Ph.D., Program Data Manager

December 31, 2008



---

## **PART I: Childhood Lead Poisoning Prevention program (CLPPP) TABLE OF CONTENTS**

	<u>page</u>
EXECUTIVE SUMMARY .....	1
Introduction.....	2
Seven Priority Recommendations.....	3
Progress .....	4
2007 Data.....	5
Efforts Toward Elimination in 2007.....	19
MDCH Healthy Homes Section.....	23
Michigan Legislature .....	23
Local Health Departments .....	23
Other Local Agencies –some highlights from around the State .....	24
CASES OF INTEREST IN 2007.....	24
Moving toward 2010.....	25

### **FIGURES**

1 Number of Children with Lead Poisoning in 2006.....	2
2 Blood Lead Testing in Michigan, 1998 – 2007 Children less than Six Years of Age.....	4
3 Elevated Blood Lead Levels in Michigan 1998 – 2007, Children less than Six .....	4
4 Percent of Children 1 & 2 years of age Tested for Lead Poisoning 2007 .....	7
5 Children less than Six years of age with Confirmed Elevated Blood Lead Levels 2007..	8
6 Childhood Lead Poisoning in Michigan .....	25

### **TABLES**

1 Data Facts, ZIP Codes Ranked by % EBLB 2007 Children less than six years of age.....	5
2 Census Block Groups Ranked by %ELBB 2007 Children less than six years of age.....	6
3 Childhood Lead Poisoning Data Facts All Counties in Michigan 2007 Children less than six years of age.....	9 & 10
4 Childhood Lead Poisoning Data Facts All Counties in Michigan 2007 Children one and two years of age .....	11 & 12
5 Blood Lead Testing Among Children who are Insured by Medicaid, Calendar Year 2007 All MI Counties .....	13 & 14
6 Percent of Children with at Least One Blood Lead Test before their Third Bday .....	15
7 Blood Lead Testing Among Children who are enrolled in WIC, 2007.....	16 & 17
8 Fourteen Target Communities in Michigan 2007, Children less than Six Years of Age ..	18
9 Fourteen Target Communities in Michigan 2007, Children One and Two Years of Age..	18
10 Childhood Lead Poisoning Data Facts – Calendar Year 2007 Children Who Should be tested .....	19
11 Laboratories Analyzing and Reporting Blood Lead Specimens to MDCH CLPPP .....	21

**PART II: Adult Blood Lead Epidemiology and Surveillance (ABLES)  
 TABLE OF CONTENTS**

	<u>page</u>
SUMMARY .....	26
Background .....	27
Michigan Adult Blood Registry .....	27
Reporting Regulations and Mechanism .....	27
Laboratories .....	28
Data Management .....	28
Case Follow-up .....	28
MICHIGAN OSHA (MIOSHA) REQUIREMENTS FOR MEDICAL MONITORING AND MEDICAL REMOVAL.....	28
Dissemination of Surveillance Data.....	29
Results.....	29
BLOOD LEAD LEVELS REPORTED IN 2007 .....	29
Number of Reports and Individuals.....	29
Distribution of Blood Lead Levels .....	29
GENDER AND AGE DISTRIBUTION .....	30
All Blood Lead Levels.....	30
Blood Lead Levels greater than 10 µg/dL .....	30
RACE DISTRIBUTION.....	30
All Blood Lead Levels.....	30
Blood Lead Levels Greater than 10 µg/dL .....	30
GEOGRAPHIC DISTRIBUTION.....	30
SOURCE OF EXPOSURE.....	31
Summary of Industrial Hygiene Inspections.....	32
CASE NARRATIVES .....	33
Interviews of Adults with Blood Lead Levels 10 µg/dL or Greater.....	33
DISCUSSION .....	34
REFERENCES .....	37

**FIGURES**

1 Number of Adults Tested for Blood Lead, Michigan 1998-2007.....	38
2 Number of Adults with Blood Lead Level (BLL) Ranges Exposed to Lead at WORK .....	39
3 Number of Adults with BLL Ranges Exposed to Lead NOT AT WORK .....	40
4 Distribution of Adults Tested for Lead in Michigan by County of Residence 2007 .....	41
5 Distribution of Adults with BLL ≥ 10 µg/dL by County of Residence.....	42
6 Distribution of Adults with BLL ≥ 25 µg/dL by County of Residence.....	43
7 Percentage of Adults with BLL ≥ 10 µg/dL by County of Residence.....	44
8 Percentage of Adults with BLL ≥ 25 µg/dL by County of Residence.....	45
9 Annual Incidence of BLL ≥ 10 µg/dL Among Women by County.....	46
10 Annual Incidence of BLL ≥ 10 µg/dL Among Men by County of Residence .....	47
11 Geographic Distribution of Non-Construction Companies Reporting Adults with BLL .. Greater than 25 µg/dL.....	48
12 Number of Individuals with BLL ≥ 10 µg/dL by Industry .....	49

13	Percent of Individuals with BLL $\geq$ 10 $\mu\text{g}/\text{dL}$ Trend of Working Conditions.....	50
14	Percent of Individuals with BLL $\geq$ 10 $\mu\text{g}/\text{dL}$ Trend of Personal Habits .....	51
15	Percent of Individuals with BLL $\geq$ 10 $\mu\text{g}/\text{dL}$ Trend of Children being tested .....	52

## **TABLES**

1	Distribution of Highest Blood Lead Levels (BLLs) Among Adults and Source of Exposure in Michigan 2007 .....	53
2	Distribution of Gender Among Adults Tested for Blood Lead in Michigan: 2007.....	54
3	Distribution of Age Among Adults Tested for Blood Lead in Michigan: 2007.....	55
4	Distribution of Race Among Adults Tested for Blood Lead in Michigan :2007.....	56
5	Number and Percent of All Adults Tested in Each County and with All BLL $\geq$ 10 $\mu\text{g}/\text{dL}$ and 25 $\mu\text{g}/\text{dL}$ by County of Residences in Michigan: 2007 .....	57 & 58
6	Annual Incidence of BLLs Among Women $\geq$ 10 $\mu\text{g}/\text{dL}$ by County of Residence: 2007 ....	59
7	Annual Incidence of BLLs Among Men $\geq$ 10 $\mu\text{g}/\text{dL}$ by County of Residence: 2007.....	60
8	Source of Exposure Among Adults with BLL $\geq$ 10 $\mu\text{g}/\text{dL}$ in Michigan : 2007 .....	61
9	Industries Where Individuals with BLL $\geq$ 10 $\mu\text{g}/\text{dL}$ were Exposed to Lead in MI 2007.....	62
10	Demographic Characteristics of Interviewed MI Adults with BLL $\geq$ 10 $\mu\text{g}/\text{dL}$ .....	63
11	Highest Education Level of MI Adults with BLL $\geq$ 10 $\mu\text{g}/\text{dL}$ Interviewed 1997-2007.....	64
12	Symptoms of MI Adults with BLL $\geq$ 10 $\mu\text{g}/\text{dL}$ Interviewed 1997-2007 .....	65
13	Lead Related Health Conditions of Interviewed MI Adults with BLL $\geq$ 10 $\mu\text{g}/\text{dL}$ .....	66
14	Industries of MI Adults by Highest Reported BLL $\geq$ 10 $\mu\text{g}/\text{dL}$ Interviewed 1997-2007...	67
15	Number of Years Worked of Interviewed MI Workers with BLL $\geq$ 10 $\mu\text{g}/\text{dL}$ .....	68
16	Working Conditions Reported by MI Adults BLL $\geq$ 10 $\mu\text{g}/\text{dL}$ .....	69
17	Number of Households with Children under the Age of Six Potentially Exposed to Take-Home Lead from MI Adults .....	70

## **APPENDICES**

A	Department of Community Health Legislation and Policy Development Blood Lead Analysis Reporting .....	71
B	OSHA Approved Blood Lead Laboratories in Michigan.....	75
C	Summary of Michigan's Lead Standards.....	76
D	MMWR: Lead Exposure Among Females of Childbearing Age – US, 2004.....	79
E	Narratives of Nine Individuals with a Blood Lead Level $\geq$ 50 $\mu\text{g}/\text{dL}$ in 2007 .....	84





## 2007 ANNUAL REPORT ON BLOOD LEAD LEVELS ON ADULTS AND CHILDREN IN MICHIGAN

### -- Part I: Childhood Lead Poisoning Prevention

#### Executive Summary

There has been considerable progress made in recent years toward the 2010 goal of elimination of childhood lead poisoning in Michigan:

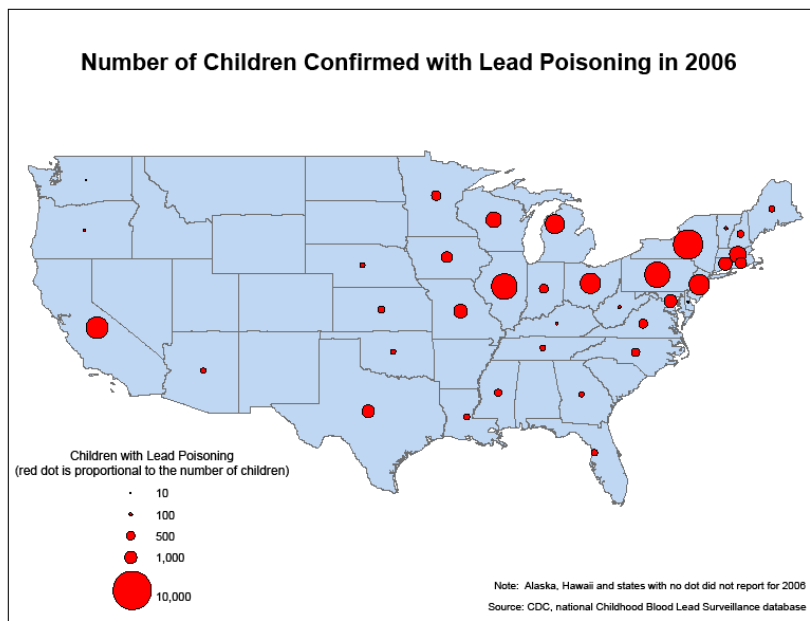
- From 2003 to 2007, the number of young children tested for lead poisoning increased by nearly 50% -- 149,445 children under the age of six in 2007.
- From 2003 to 2007, the number of young children confirmed with elevated blood lead levels ( $\geq 10$  micrograms per deciliter) decreased by more than 35%, even though far more children were tested -- 2,031 children under the age of six in 2007, for a state-wide rate of 1.4%.
- Required testing of one and two year old children insured by Medicaid has increased dramatically, from 19% tested in 1999, to 49% in 2007.

The job is far from over, however:

- The Chief of the CDC's Lead Branch has suggested that a rate of 0.2% would constitute "elimination." Assuming a steady increase in testing, the number of children with lead poisoning would have to fall below 400 to reach a statewide rate of 0.2% in 2010.
- 14 communities have been targeted in recent years for prevention efforts: Battle Creek, Benton Harbor, Dearborn, Detroit, Flint, Grand Rapids, Hamtramck, Highland Park, Jackson, Kalamazoo, Lansing, Muskegon/Muskegon Heights, Pontiac & Saginaw. These communities have the highest rates of childhood lead poisoning in the state, and accounted in 2007 for 79% of all children with elevated levels (see pp. 17-18).
- Highland Park had the highest rate of lead poisoning in 2007: 10.4% of children tested were confirmed with elevated blood lead levels.
- At the ZIP Code level, 48214 in Detroit had the highest rate: 11.1%
- Drilling down to the census block group level (a smaller unit of area, essentially a neighborhood, with a population averaging 1,500), the highest rate was 37.0%--i.e., 17 children with lead poisoning out of 46 children tested. Twenty-six other block groups, from eight different cities in Michigan, had rates of 20% or higher.
- The only way to clearly identify children with lead poisoning is with a blood test. Testing rates vary greatly, however, from one area to another. By county, the highest rates of testing among one and two year olds in 2007 were in Schoolcraft, Ontonagon & Ogemaw counties—all over 60%. The lowest rates were in the 'teens, however—Midland, Grand Traverse, Livingston, Washtenaw & Leelanau counties.

## 2007 ANNUAL REPORT ON BLOOD LEAD LEVELS ON ADULTS AND CHILDREN IN MICHIGAN – Part I: Childhood Lead Poisoning Prevention

It's the old "good news/bad news" story. The good news is that childhood lead poisoning has been drastically reduced since the middle of the 20<sup>th</sup> century. Average blood lead levels now are a small fraction of what they were then. The bad news, though, is that lead poisoning still affects hundreds of thousands of children nationwide. In Michigan alone, 2,031 children under the age of six were confirmed with lead poisoning in 2007, and 17,465 more children had blood tests that indicated some exposure to lead. And because not every child has been tested, we can assume that thousands more are affected but not identified. As of 2006, Michigan ranks 7<sup>th</sup> in the nation for number and for percentage of children confirmed with lead poisoning.



While there are no definitive data from mid-century, childhood lead poisoning in Michigan probably peaked in the 1950's through the 1970's. Increased automobile traffic using leaded gasoline, together with the deterioration of leaded paint applied years or decades before, resulted in several childhood deaths from lead poisoning each year, and

encephalopathy was not uncommon in the state's emergency rooms. These children were treated case by case, but without any concerted campaign to prevent other poisonings. The Second National Health and Nutrition Survey (NHANES II), a population-based national survey, indicated that 88.2% of children nationwide had blood lead levels of 10 ug/dL or higher in the late 1970s. By the late 1980s, NHANES III indicated that the prevalence of those levels had dropped precipitously to 8.9%, due apparently to the near elimination of lead in gasoline and in food and soft-drink cans. These changes left residential lead paint—banned in 1978 but still in place in homes built before then—as the major source of ongoing childhood lead poisoning.

In 1992, the Centers for Disease Control and Prevention (CDC) provided funding to Michigan and other states to create Childhood Lead Poisoning Prevention Programs (CLPPP), for education, surveillance and assurance of public health services to lead-poisoned children. The CDC developed protocols, including home visits by public health nurses and investigations by environmental health staff. By 1995, Michigan surveillance data indicated that 9.5% of state children tested and reported had elevated blood lead levels (EBLL). The EBLL rate for children in some areas was much higher, though: 25% in Detroit, and several counties had rates approaching 20%. In 1995 reporting was not yet mandatory, and testing was not (and never has been before or since) universal. That year 43,150 children under age six were reported as tested, just under 5% of all kids in that age group.

By the year 2000, with a more mature CLPPP, mandatory reporting of all blood lead levels, a state Lead Hazard Remediation Program (LHRP), and several functioning local lead programs, testing in Michigan had nearly doubled and the statewide EBLL rate had dropped to 5.4%. In each calendar year since then, more children have been tested and fewer have been found to be lead poisoned.

In 2003, the CDC assigned each funded state the task of developing and publishing a plan for the elimination of childhood lead poisoning in that state by 2010. By coincidence, in January 2003 the Detroit Free Press published a five-part front-page series on childhood lead poisoning in Detroit and Michigan. This high-profile coverage gained the attention of state and local politicians, advocacy groups, and news outlets around the state. As a result of this attention focused on the problem, Governor Jennifer Granholm convened the Task Force to Eliminate Childhood Lead Poisoning. In June 2004, the Task Force published a Final Report, fulfilling the CDC requirement and serving as a guiding document for prevention efforts statewide. The report included seven “Priority Recommendations” as well as dozens of other secondary recommendations. In the years since then, most of the priority recommendations and many of the others have been fully or partly implemented, but many others have gone unfulfilled through lack of funding, staff or political will.

The seven priority recommendations are these:

- *Create capacity to assist target communities in building coalitions and obtaining funding to address lead poisoning.* MDCH has brought in nationally-recognized consultants to several of Michigan’s highest risk communities, resulting in coalitions in Battle Creek, Benton Harbor, Detroit, Flint, Hamtramck, Highland Park, Kalamazoo, Lansing, Muskegon and Saginaw. Coalition activities around the state include sponsoring testing events for children and toys, distribution of lead information in neighborhood door-to-door events, networking with local partners, and initiating community lead forums for parents and professionals. Despite these successes, the coalitions have been limited in their activities as a result of lack of funding and lack of strategic plan development.
- *Assure case management for all children with EBLL at or above 20 ug/dL.* CLPPP’s nursing staff worked in collaboration with consultants from the National Center for Healthy Housing to revise the case management protocol and forms for local public health. CLPPP sponsored three case management trainings in 2007 for 64 nurses across the state, with four more trainings planned for 2008.
- *Establish a public health trust, to provide a stable source of funding for lead prevention efforts.* The Public Health Trust is not yet operational. Final approval from the Department of Labor and Economic Growth is pending.
- *Develop a lead-status housing registry.* The registry is functional and accessible to the public via the Web, at [www.michigan.gov/ismyhomeleadsafe](http://www.michigan.gov/ismyhomeleadsafe). It identifies lead hazards and abatement activities on rental properties statewide, and is one of only a handful of Web-based interactive housing registries in the nation. While the registry is currently restricted to rentals, legislation is being drafted to allow the inclusion of owner-occupied homes.
- *Develop and implement a public awareness campaign.* In 2005 a series of radio and TV spots hit the airwaves in key areas around Michigan, encouraging parents to have their children tested. The campaign also included posters and postcards with a similar message. The campaign was not funded to the extent intended by the Task Force, but certainly reached many parents throughout the state. A new campaign has been prepared for 2008, with a message directed at do-it-yourself remodelers.
- *Establish a commission to evaluate and coordinate lead resources and activities statewide.* Legislation was passed in 2004 establishing the Childhood Lead Poisoning Prevention and Control Commission, which met, held public hearings and provided a report with recommendations in 2007. The commission was recently re-established by legislation, and will be re-convened in 2008.
- *Expand the remediation and control of lead hazards in homes.* Some additional funding was made available beginning in 2005, resulting in the remediation of 22 homes in 2005, 29 homes in 2006, and

32 homes in 2007, with funding and remediation continuing in 2008. However, this activity has not been funded at the level recommended by the Task Force, thereby limiting the number of homes that could be addressed.

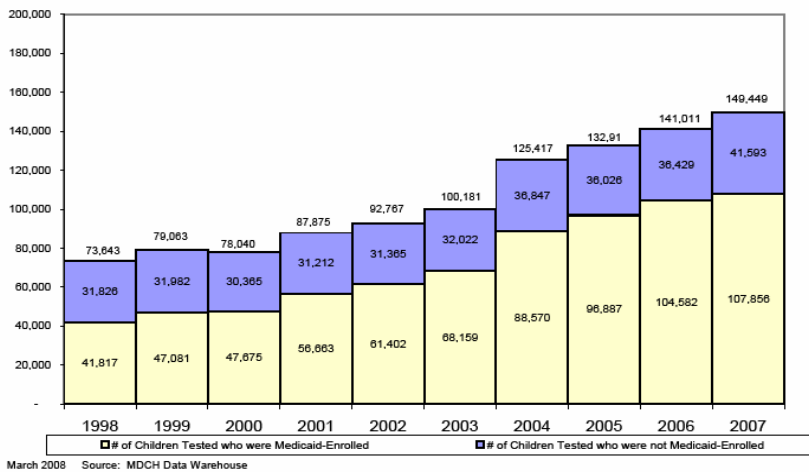
In short, most of these recommendations have been implemented have been effective in reducing lead poisoning—but restrictions in funding have limited the success in most cases.

Some other recommendations of the Task Force include creating penalties for rental property owners who rent properties with known lead hazards (which has since become Michigan law); creating tax incentives for properties owners to make them lead safe; requiring environmental testing of day-care facilities, pre-schools, schools and other settings for children; establishing and enforcing requirements for contractors to use lead-safe practices when working on pre-1978 homes (soon to become Federal law); expanding testing requirements; and increasing funding for lead activities through fees or taxes.

### Progress by the Numbers

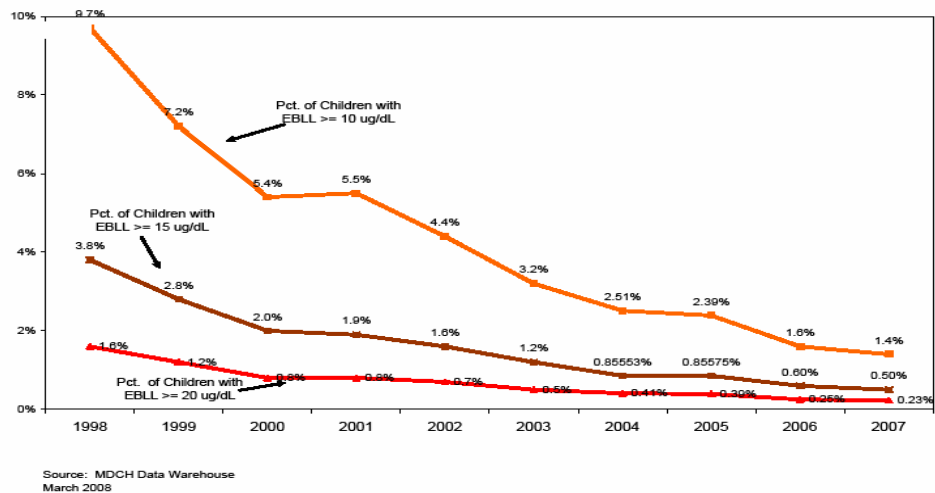
By the numbers, there has been considerable progress made since the convening of the Task Force and the publication of its Final Report for Elimination.

Blood Lead Testing in Michigan, 1998 - 2007  
 Children less than Six Years of Age



- In calendar year 2003, there were 100,181 children under age six tested. Four years later, in calendar year 2007, the number of children tested rose to 149,445—nearly a 50% increase.

Elevated Blood Lead Levels (EBLL) in Michigan 1998 - 2007  
 Children less than Six Years of Age



- In 2003 the number of children confirmed with EBLL was 3,141, or 3.2% of those tested. Four years later that number dropped to 2,031 (1.4% of those tested) —a decrease of more than 35%, even though far more children were tested.

This pattern—increased testing concurrent with decreased number and percentage of children with EBL—persists during this period for 1 and 2 years olds, Medicaid children only, and the various ranges of elevated levels (10 to 14 µg/dL, 15 to 19, 20 and up). Clearly, we’re making progress.

The job is far from over, however. Despite the lower numbers, Michigan has not yet *eliminated* childhood lead poisoning. Mary Jean Brown, Chief of the CDC’s Lead Branch, has suggested that elimination could be defined as reducing lead poisoning to the point where it is no longer a “public health problem.” This, she suggests, would occur when lead poisoning is no longer detectable by the nation’s definitive health survey, NHANES, which uses a nationally representative sample to evaluate the health status of people in the United States. She estimates that lead poisoning will become “invisible” to NHANES when the rate of children with EBL falls below 0.2% of those tested. Even if the number of children tested in Michigan were to increase annually by 10%, the number of children confirmed with EBL would have to fall below 400 to reach a statewide rate of 0.2% in 2010.

### 2007 Data

Meanwhile, the problem is not simply a matter of a statewide rate. In 2007, while Michigan’s rate of EBLs was 1.4%, smaller areas within the state showed much higher rates. Detroit, our most populous city, had a rate of 3.5%. Benton Harbor was at 5.3%, and Highland Park at 10.4%. One Detroit ZIP code was over 10%, while ZIPs from several cities around the state were over 5.0%.

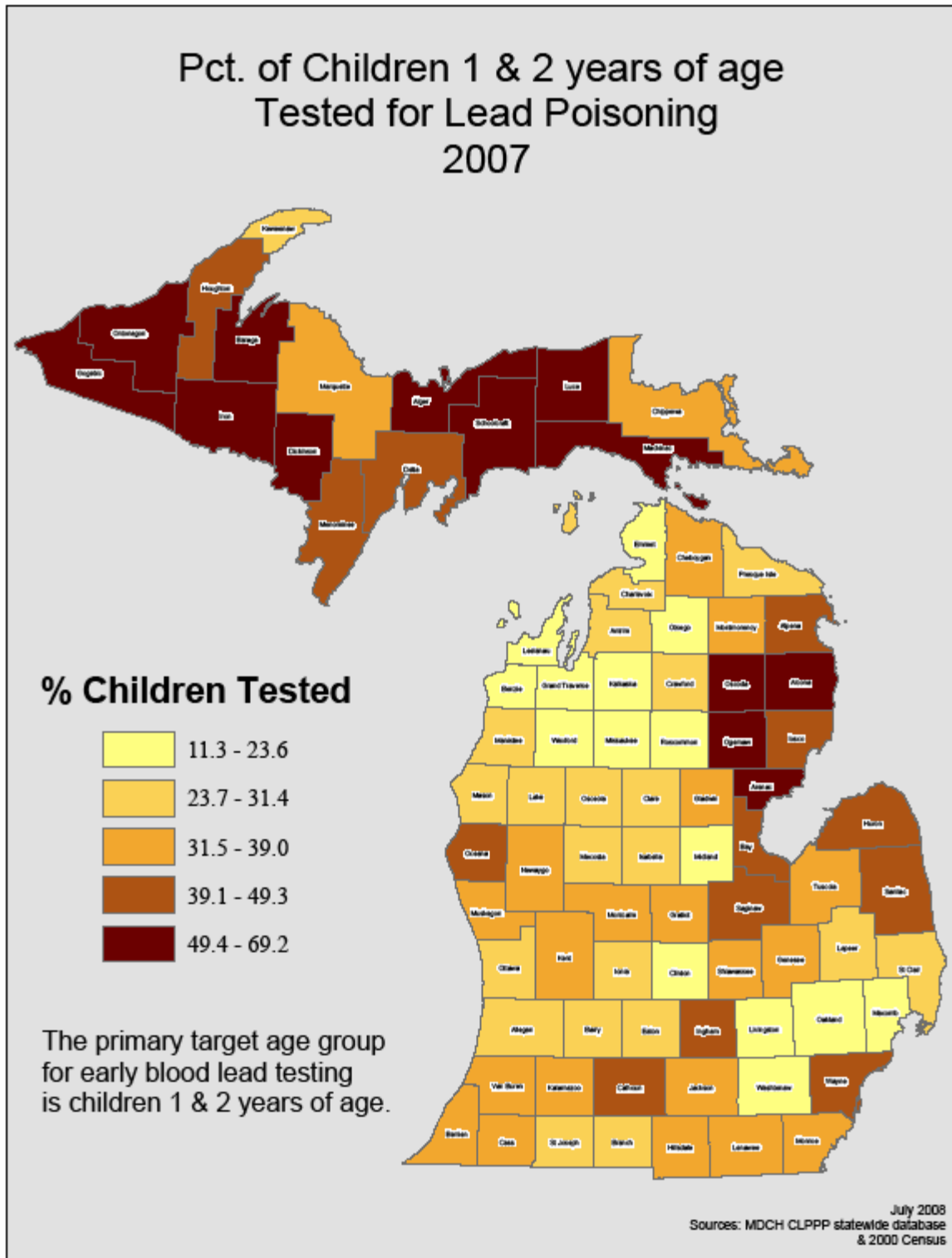
**Childhood Lead Poisoning Data Facts**  
**ZIP Codes Ranked by %EBLL (minimum 50 children tested)**  
**Calendar Year 2007**  
**Children less than Six Years of Age**

ZIP	%Pre-1950 Housing**	Children Under Age 6**	Children < Age 6, Tested for Lead in 2007		Children with Blood Lead Levels >= 5 ug/dL									
			Number of Children Tested	% Tested	% with BLL >= 5 ug/dL	% EBL (>= 10 ug/dL, venous only)	5 to 9 ug/dL (capillary, venous or unknown)	10-14 ug/dL (venous only)	15-19 ug/dL (venous only)	20-44 ug/dL (venous only)	45+ ug/dL (venous only)	Total EBL (≥ 10 ug/dL)	Capillary >= 10, not confirmed by venous	
48214	71.0	2653	1009	38.0	46.6	11.1	336	74	16	18	1	109	25	
48211	72.1	1140	402	35.3	44.5	7.8	144	21	3	7	0	31	4	
48203	61.4	4717	1308	27.7	40.4	7.4	405	65	22	7	1	95	28	
48206	78.1	3278	1040	31.7	45.3	7.1	364	40	17	13	1	71	36	
48215	55.5	1954	676	34.6	40.4	6.9	215	31	7	8	0	46	12	
48202	68.5	1721	630	36.6	34.0	6.9	162	30	8	4	1	43	9	
48213	62.5	4802	1631	34.0	38.2	6.5	492	66	24	14	0	104	27	
48807	74.4	221	50	22.6	32.0	6.1	12	2	0	1	0	3	1	
48204	67.2	4121	1354	32.9	36.7	6.1	395	44	21	16	0	81	21	
48226	49.4	148	50	33.8	16.0	6.0	5	2	1	0	0	3	0	
48208	64.7	1105	442	40.0	31.2	5.1	104	16	4	2	0	22	12	
49064	33.3	311	66	21.2	24.2	4.5	13	3	0	0	0	3	0	
49007	61.2	936	308	32.9	37.7	4.4	90	8	2	2	1	13	13	
48207	34.7	1759	691	39.3	27.1	4.4	150	16	10	4	0	30	7	
49503	66.1	3063	1104	36.0	23.9	4.0	212	27	6	11	0	44	8	

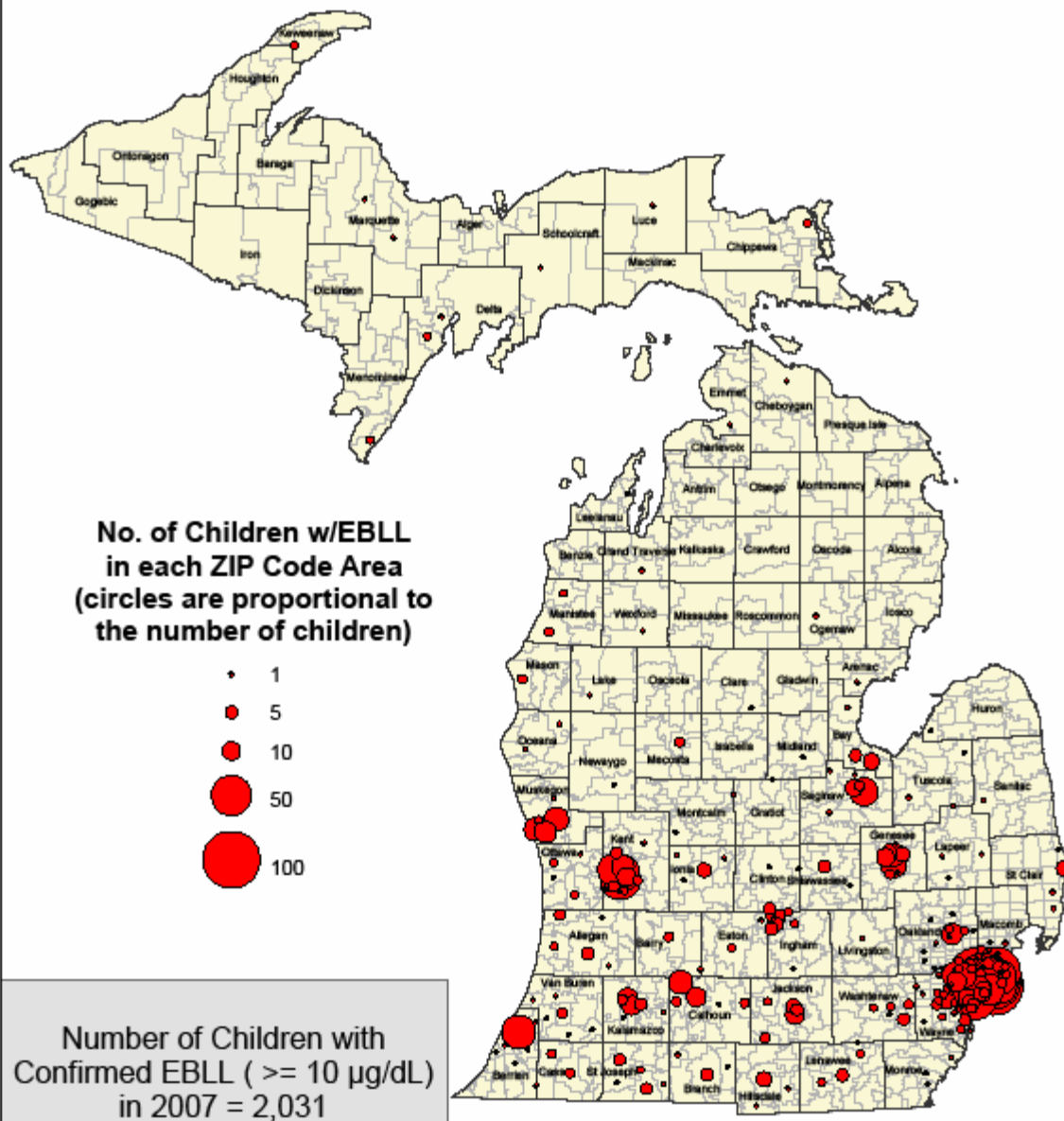
If we narrow the focus to the Census Block Group level, there are 27 different block groups, from Detroit, Flint, Grand Rapids, Highland Park and Muskegon, with EBLL rates at or over 20% (minimum 10 children tested). In these areas, lead poisoning is still a big problem, far from elimination; but the areas are small enough that prevention efforts could be concentrated in them, making success achievable.

**Childhood Lead Poisoning Prevention - Census Block Groups Ranked by %EBLL (minimum 10 children tested)  
 Children less than six years of age, Tested in Calendar Year 2007**

Census Block Group	City	Median Household Income*	# of Pre-1950 Housing Units*	%Pre-1950 Housing*	Children < Age 6, Tested for Lead				
					Number of Children Tested	% with Elevated Blood Lead Levels (>= 10 ug/dL venous only)	5 to 9 ug/dL (capillary, venous or unknown)	10-19 ug/dL (venous only)	20+ ug/dL (venous only)
261635152003	Detroit	20,521	343	72.4	46	37.0	13	14	3
260490014001	Flint	18,906	129	67.2	17	35.3	3	5	1
261635384001	Detroit	93,488	259	85.8	13	30.8	0	3	1
261635206002	Detroit	8,025	385	57.3	11	27.3	2	3	0
261635147002	Detroit	21,875	215	90.0	30	26.7	13	7	1
261635184003	Detroit	22,969	177	65.6	23	26.1	10	6	0
261635151001	Detroit	17,865	227	74.4	32	25.0	13	7	1
261635185003	Detroit	16,793	217	86.8	20	25.0	4	1	4
261635531001	Highland Park	26,071	200	65.1	20	25.0	6	4	1
261635334006	Detroit	24,096	463	92.8	29	24.1	8	7	0
261635319002	Detroit	12,344	280	85.9	21	23.8	8	4	1
261635188001	Detroit	14,922	165	76.4	17	23.5	6	3	1
261635064001	Detroit	41,042	111	69.4	13	23.1	4	3	0
261635145001	Detroit	24,519	141	100.0	13	23.1	5	3	0
261635215003	Detroit	30,500	166	78.3	13	23.1	5	3	0
261635103001	Detroit	33,661	134	69.8	22	22.7	6	5	0
261635150003	Detroit	24,750	258	81.6	36	22.2	16	7	1
261635037003	Detroit	14,618	69	39.4	23	21.7	10	4	1
261079609001	Mecosta	30,750	121	26.4	14	21.4	1	0	3
261635222002	Detroit	15,521	191	77.0	19	21.1	6	3	1
261635538002	Highland Park	11,282	427	83.4	44	20.5	14	9	0
260050311003	Allegan	30,431	71	25.5	10	20.0	0	2	0
260810032004	Grand Rapids	34,375	166	65.1	15	20.0	5	3	0
261210006021	Muskegon	18,250	303	53.5	50	20.0	9	7	3
261635004004	Detroit	15,500	80	72.1	20	20.0	9	3	1
261635104002	Detroit	18,633	233	69.3	40	20.0	14	3	5
261635324002	Detroit	11,012	300	84.3	35	20.0	4	7	0



## Children less than Six years of age with Confirmed Elevated Blood Lead Levels (EBLL) 2007





2007 ANNUAL REPORT ON BLOOD LEAD LEVELS OF ADULTS AND CHILDREN IN MICHIGAN  
 — Part I: Childhood Lead Poisoning Prevention Program

**Childhood Lead Poisoning Data Facts**  
**All Counties in Michigan**  
**Calendar Year 2007**  
**Children less than Six Years of Age**

County	%Pre-1950 Housing*	Children Under Age 6**	Children < Age 6, Tested for Lead during 2007		% with BLL >= 5 ug/dL	% with BLL 0-4 ug/dL, venous only**	Children with Low-Level Exposure 8 to 9 ug/dL, capillary, venous or unknown	Children with Confirmed Elevated Blood Lead Levels					Children with Elevated Capillary Tests, Not Confirmed by Venous				
			Number of Children Tested	% Tested				10-14 ug/dL (venous only)	15-19 ug/dL (venous only)	20-44 ug/dL (venous only)	≥45 ug/dL (venous only)	Total BLL ≥ 10 ug/dL	Capillary 10-14, not confirmed by venous	Capillary 15-19, not confirmed by venous	Capillary 20-44, not confirmed by venous	Capillary ≥45, not confirmed by venous	Total Elevated Capillary, not confirmed by venous
Alcona	21.0	430	134	31.2	15.7	0.0	20	0	0	0	0	0	1	0	0	0	1
Alger	32.6	444	106	23.9	6.6	0.0	5	0	0	0	0	0	2	0	0	0	2
Allegan	27.4	8,809	1,395	15.8	9.9	0.6	119	6	1	1	1	9	5	2	3	0	10
Alpena	28.6	1,769	404	22.8	10.6	0.0	39	0	0	0	0	0	3	0	1	0	4
Antrim	22.6	1,435	239	16.7	8.8	0.0	20	0	0	0	0	0	0	0	1	0	1
Arenac	20.6	979	244	24.9	11.9	0.4	26	1	0	0	0	1	1	0	1	0	2
Baraga	34.9	514	162	31.5	8.0	0.0	10	0	0	0	0	0	3	0	0	0	3
Barry	29.4	4,279	660	15.4	10.8	0.5	64	3	0	0	0	3	3	1	0	0	4
Bay	37.1	7,551	1,533	20.3	12.3	0.9	166	10	2	2	0	14	9	0	0	0	9
Benzie	27.3	1,185	181	15.3	7.7	0.0	14	0	0	0	0	0	0	0	0	0	0
Berrien	32.7	12,913	2,498	19.3	17.9	1.6	391	28	4	7	0	39	14	3	1	0	18
Branch	36.5	3,473	499	14.4	16.8	1.4	71	4	2	1	0	7	5	1	0	0	6
Calhoun	36.4	11,258	2,769	24.6	11.1	1.3	252	22	7	7	0	36	17	2	0	0	19
Cass	30.4	3,382	589	17.4	13.1	0.9	69	4	1	0	0	5	3	0	0	0	3
Charlevoix	25.7	1,786	256	14.3	7.4	0.0	18	0	0	0	0	0	0	1	0	0	1
Cheboygan	21.7	1,678	267	15.9	7.5	0.4	19	0	0	1	0	1	0	0	0	0	0
Chippewa	28.4	2,188	410	18.9	3.9	0.5	14	0	1	1	0	2	0	0	0	0	0
Clare	13.1	1,979	293	14.8	4.8	0.3	12	0	1	0	0	1	1	0	0	0	1
Clinton	28.7	4,752	563	11.8	3.9	0.4	20	2	0	0	0	2	0	0	0	0	0
Crawford	19.6	822	130	15.8	6.9	0.0	8	0	0	0	0	0	1	0	0	0	1
Delta	37.7	2,448	426	17.4	7.0	0.7	26	3	0	0	0	3	1	0	0	0	1
Dickinson	41.6	1,631	457	28.0	4.6	0.0	20	0	0	0	0	0	1	0	0	0	1
Eaton	23.4	7,502	1,204	16.0	5.7	0.3	61	3	0	1	0	4	3	1	0	0	4
Emmet	27.7	2,329	277	11.9	5.1	0.4	12	1	0	0	0	1	1	0	0	0	1
Genesee	22.8	37,070	7,771	21.0	8.4	0.7	568	37	10	10	1	58	20	2	1	0	23
Gladwin	13.7	1,636	315	19.3	4.4	0.0	11	0	0	0	0	0	3	0	0	0	3
Gogebic	54.1	783	198	26.0	6.6	0.0	13	0	0	0	0	0	0	0	0	0	0
Grand Traverse	17.8	5,658	565	10.0	6.9	0.2	37	0	0	1	0	1	0	0	1	0	1
Gratiot	39.8	2,826	463	16.4	10.8	0.2	48	1	0	0	0	1	1	0	0	0	1
Hillsdale	39.0	3,469	663	19.1	13.0	1.4	74	8	0	1	0	9	3	0	0	0	3
Houghton	54.8	2,282	615	27.0	3.4	0.3	16	2	0	0	0	2	1	2	0	0	3
Huron	33.5	2,057	566	28.5	16.9	0.2	94	1	0	0	0	1	3	0	1	0	4
Ingham	25.9	21,618	5,127	23.7	9.0	0.6	416	14	8	8	1	31	12	2	0	0	14
Ionia	37.9	4,851	805	16.6	10.7	1.1	73	8	1	0	0	9	3	0	1	0	4
Iosco	19.8	1,433	368	25.7	16.0	0.0	53	0	0	0	0	0	5	0	1	0	6
Iron	44.5	558	154	27.6	5.2	0.0	7	0	0	0	0	0	1	0	0	0	1
Isabella	19.2	3,983	591	14.8	3.2	0.2	18	0	1	0	0	1	0	0	0	0	0
Jackson	35.7	12,331	2,152	17.5	20.0	1.3	370	13	8	5	1	27	25	4	5	0	34
Kalamazoo	24.6	18,619	3,311	17.8	15.9	1.0	452	20	5	7	2	34	33	8	0	0	41
Kalkaska	15.2	1,315	185	14.1	13.5	0.0	25	0	0	0	0	0	0	0	0	0	0
Kent	26.8	55,828	9,710	17.4	14.2	1.7	1,151	102	35	29	0	166	43	10	4	0	57
Keweenaw	54.9	123	18	14.6	5.6	0.0	1	0	0	0	0	0	0	0	0	0	0
Lake	15.1	669	130	19.4	6.9	0.8	6	1	0	0	0	1	2	0	0	0	2
Lapeer	22.2	6,281	936	14.9	9.6	0.3	79	2	0	1	0	3	6	0	2	0	8

2007 ANNUAL REPORT ON BLOOD LEAD LEVELS OF ADULTS AND CHILDREN IN MICHIGAN  
 — Part I: Childhood Lead Poisoning Prevention Program

**Childhood Lead Poisoning Data Facts**  
**All Counties in Michigan**  
**Calendar Year 2007**  
**Children less than Six Years of Age**

County	%Pre-1950 Housing*	Children Under Age 6**	Children < Age 6, Tested for Lead during 2007				Children with Elevated Blood Lead Levels					Children with Elevated Capillary Tests, Not Confirmed by Venous				Total Elevated Capillary, not confirmed by venous	
			Number of Children Tested	% Tested	% with BLL $\geq 5$ ug/dL	% BLL $\geq 10$ ug/dL, venous only***	0-9 ug/dL (capillary, venous or unknown)	10-14 ug/dL (venous only)	15-19 ug/dL (venous only)	20-44 ug/dL (venous only)	≥45 ug/dL (venous only)	Total BLL $\geq 10$ ug/dL	Capillary 10-14, not confirmed by venous	Capillary 15-19, not confirmed by venous	Capillary 20-44, not confirmed by venous		Capillary $\geq 45$ , not confirmed by venous
Leelanau	22.0	1,157	133	11.5	4.5	0.8	5	0	1	0	0	1	0	0	0	0	0
Lenawee	38.6	7,456	1,267	17.0	12.9	0.8	138	7	2	1	0	10	11	1	3	0	15
Livingston	13.7	12,437	966	7.8	3.2	0.1	29	1	0	0	0	1	0	1	0	0	1
Luce	30.0	361	87	24.1	9.2	1.2	6	0	1	0	0	1	1	0	0	0	1
Mackinac	28.1	628	147	23.4	5.4	0.0	7	0	0	0	0	0	0	0	1	0	1
Macomb	10.9	61,493	7,864	12.8	5.0	0.2	364	9	3	4	0	16	13	0	3	0	16
Manistee	35.9	1,569	266	17.0	12.4	1.9	27	2	2	1	0	5	1	0	0	0	1
Marquette	32.6	3,597	600	16.7	7.8	0.3	43	0	2	0	0	2	0	0	2	0	2
Mason	31.1	1,832	264	14.4	13.6	1.1	31	1	2	0	0	3	1	0	1	0	2
Mecosta	22.0	2,725	428	15.7	5.1	0.7	19	0	0	3	0	3	0	0	0	0	0
Menominee	38.4	1,561	309	19.8	10.7	0.7	29	1	1	0	0	2	1	0	1	0	2
Midland	16.9	5,863	396	6.8	3.5	0.5	12	2	0	0	0	2	0	0	0	0	0
Missaukee	20.6	1,012	149	14.7	8.7	0.0	12	0	0	0	0	0	1	0	0	0	1
Monroe	28.3	10,550	1,559	14.8	7.7	0.2	114	3	0	0	0	3	3	0	0	0	3
Montcalm	28.1	4,895	896	18.3	11.9	0.1	99	1	0	0	0	1	6	0	1	0	7
Montmorency	18.4	515	104	20.2	10.6	0.0	11	0	0	0	0	0	0	0	0	0	0
Muskegon	29.8	14,248	3,441	24.2	10.0	1.5	280	34	9	10	0	53	9	3	0	0	12
Newaygo	22.7	3,716	705	19.0	7.8	0.1	50	0	1	0	0	1	2	1	1	0	4
Oakland	15.9	92,500	11,467	12.4	4.8	0.3	510	19	10	7	0	36	6	1	1	0	8
Oceana	26.8	2,230	595	26.7	8.2	0.3	46	1	1	0	0	2	1	0	0	0	1
Ogemaw	18.3	1,247	408	32.7	10.0	0.2	37	1	0	0	0	1	3	0	0	0	3
Ontonagon	43.4	333	89	26.7	10.1	0.0	7	0	0	0	0	0	1	0	1	0	2
Osceola	24.2	1,761	258	14.7	7.8	0.0	17	0	0	0	0	0	2	0	1	0	3
Oscoda	18.3	542	142	26.2	8.5	0.0	12	0	0	0	0	0	0	0	0	0	0
Otsego	12.6	1,695	260	15.3	2.7	0.0	6	0	0	0	0	0	0	0	1	0	1
Ottawa	18.0	21,138	2,687	12.7	6.0	0.4	146	6	4	0	0	10	4	1	0	0	5
Presque Isle	27.6	782	115	14.7	15.7	0.0	14	0	0	0	0	0	4	0	0	0	4
Roscommon	16.1	1,222	161	13.2	3.1	0.0	5	0	0	0	0	0	0	0	0	0	0
Saginaw	29.3	15,982	3,499	21.9	16.3	1.1	497	27	3	9	0	39	27	5	4	0	36
St Clair	29.6	12,484	1,653	13.2	11.3	0.6	156	6	1	3	0	10	16	1	4	0	21
St Joseph	34.8	5,539	867	15.7	16.5	1.4	130	8	2	2	0	12	1	0	0	0	1
Sanilac	34.7	3,178	740	23.3	9.7	0.1	68	1	0	0	0	1	1	2	0	0	3
Schoolcraft	33.1	461	125	27.1	20.0	0.8	24	1	0	0	0	1	0	0	0	0	0
Shiawassee	35.9	5,208	1,039	20.0	6.7	0.6	60	4	1	1	0	6	3	0	1	0	4
Tuscola	32.8	4,030	873	21.7	8.7	0.3	72	2	1	0	0	3	1	0	0	0	1
Van Buren	29.4	6,264	1,230	19.6	14.1	0.8	157	7	2	1	0	10	6	0	1	0	7
Washtenaw	19.3	24,941	2,471	9.9	3.2	0.5	66	9	3	1	0	13	0	0	0	0	0
Wayne ex Det	24.0	97,904	17,454	17.8	8.2	0.9	1,201	102	35	25	1	163	51	4	9	0	64
Wexford	26.2	2,315	362	15.6	5.0	0.3	17	0	0	1	0	1	0	0	0	0	0
Detroit, City of	56.0	75,502	33,010	43.7	26.0	3.5	7,054	744	220	173	10	1,147	254	77	38	1	370
MICHIGAN	27.0	781,759	149,445	19.1	13.0	1.4	16,566	1,295	394	325	17	2,031	665	136	97	1	899

\* U.S. Census Bureau, Census 2000. \*\*Source: 2005 population estimates, Kidscount.org (kidscount.org)

\*\*\* %BLL is calculated as follows: Number of Children with BLL divided by (Number of Children Tested minus Children who missed capillary tests, not confirmed by venous)

Note: Counts of children tested and blood lead levels are reported from Michigan Department of Community Health, Childhood Lead Poisoning Prevention Program statewide database.

March 26, 2008

2007 ANNUAL REPORT ON BLOOD LEAD LEVELS OF ADULTS AND CHILDREN IN MICHIGAN  
 — Part I: Childhood Lead Poisoning Prevention Program

**Childhood Lead Poisoning Data Facts**  
**All Counties in Michigan**  
**Calendar Year 2007**  
**Children One and Two Years of Age**

County	%Pre-1950 Housing*	Children Age 1 & 2, Tested for Lead during 2007				% with BLL >= 10 ug/dL	% BLL 5-10 ug/dL, venous (n/g)*	Children with Elevated Blood Lead Levels	Children with Elevated Blood Lead Levels					Children with Elevated Capillary Tests, Not Confirmed by Venous				
		Children Age 1 & 2**	Number of Children Tested	% Tested	% with BLL >= 10 ug/dL				% BLL 5-10 ug/dL, venous (n/g)*	5-9 ug/dL, capillary, venous (n/g)	10-14 ug/dL, (venous only)	15-19 ug/dL, (venous only)	20-44 ug/dL, (venous only)	≥45 ug/dL, (venous only)	Total BLL (n 10 ug/dL)	Capillary 10-14, not confirmed by venous	Capillary 15-19, not confirmed by venous	Capillary 20-44, not confirmed by venous
Alcona	21.0	142	85	59.9	15.3	0.0	12	0	0	0	0	0	1	0	0	0	1	
Alger	32.6	144	80	55.6	7.5	0.0	4	0	0	0	0	0	2	0	0	0	2	
Allegan	27.4	2,889	908	31.4	10.7	0.6	84	3	1	0	1	5	5	1	2	0	8	
Alpena	28.6	552	267	48.4	12.4	0.0	30	0	0	0	0	0	2	0	1	0	3	
Antrim	22.6	471	135	28.7	8.9	0.0	11	0	0	0	0	0	0	0	1	0	1	
Arenac	20.6	308	163	52.9	12.9	0.6	18	1	0	0	0	1	1	0	1	0	2	
Baraga	34.9	170	90	52.9	7.8	0.0	5	0	0	0	0	0	2	0	0	0	2	
Barry	29.4	1,384	430	31.1	10.9	0.7	40	3	0	0	0	3	3	1	0	0	4	
Bay	37.1	2,426	1,023	42.2	14.1	1.1	130	9	1	1	0	11	3	0	0	0	3	
Benzie	27.3	416	95	22.8	9.5	0.0	9	0	0	0	0	0	0	0	0	0	0	
Berrien	32.7	4,334	1,456	33.6	18.9	1.8	232	16	5	5	0	26	12	3	2	0	17	
Branch	36.5	1,180	322	27.3	18.6	1.9	51	3	2	1	0	6	2	1	0	0	3	
Calhoun	36.4	3,868	1,748	45.2	10.9	1.3	154	12	5	5	0	22	12	2	0	0	14	
Cass	30.4	1,052	380	36.1	13.7	0.8	48	2	1	0	0	3	1	0	0	0	1	
Charlevoix	25.7	581	169	29.1	7.1	0.0	11	0	0	0	0	0	0	1	0	0	1	
Cheboygan	21.7	544	184	33.8	8.2	0.0	15	0	0	0	0	0	0	0	0	0	0	
Chippewa	28.4	718	228	31.8	4.4	0.4	9	0	0	1	0	1	0	0	0	0	0	
Clare	13.1	638	170	26.6	7.1	0.6	10	0	1	0	0	1	1	0	0	0	1	
Clinton	28.7	1,574	338	21.5	5.3	0.6	16	2	0	0	0	2	0	0	0	0	0	
Crawford	19.6	272	69	25.4	10.1	0.0	6	0	0	0	0	0	1	0	0	0	1	
Delta	37.7	762	324	42.5	6.5	0.9	17	3	0	0	0	3	1	0	0	0	1	
Dickinson	41.6	539	314	58.3	5.4	0.0	16	0	0	0	0	0	1	0	0	0	1	
Eaton	23.4	2,456	767	31.2	6.9	0.4	47	2	0	1	0	3	2	0	1	0	3	
Emmet	27.7	768	180	23.4	6.1	0.6	9	1	0	0	0	1	1	0	0	0	1	
Genesee	22.8	12,433	4,611	37.1	8.8	0.7	358	23	4	5	1	33	14	2	1	0	17	
Gladwin	13.7	516	177	34.3	2.8	0.0	2	0	0	0	0	0	3	0	0	0	3	
Gogebic	54.1	243	136	56.0	8.1	0.0	11	0	0	0	0	0	0	0	0	0	0	
Grand Traverse	17.8	1,894	248	13.1	5.2	0.0	13	0	0	0	0	0	0	0	0	0	0	
Gratiot	39.8	898	287	32.0	12.5	0.3	35	1	0	0	0	1	0	0	0	0	0	
Hillsdale	39.0	1,093	353	32.3	15.9	0.9	52	3	0	0	0	3	1	0	0	0	1	
Houghton	54.8	773	381	49.3	4.2	0.5	11	2	0	0	0	2	1	2	0	0	3	
Huron	33.5	695	327	47.1	16.5	0.0	52	0	0	0	0	0	2	0	0	0	2	
Ingham	25.9	7,341	3,019	41.1	8.6	0.9	255	13	6	6	1	26	9	1	0	0	10	
Ionia	37.9	1,587	457	28.8	11.2	1.5	42	6	1	0	0	7	1	0	1	0	2	
Iosco	19.8	445	213	47.9	17.8	0.0	36	0	0	0	0	0	2	0	0	0	2	
Iron	44.5	181	94	51.9	6.4	0.0	5	0	0	0	0	0	1	0	0	0	1	
Isabella	19.2	1,310	348	26.6	3.4	0.0	12	0	0	0	0	0	0	0	0	0	0	
Jackson	35.7	4,172	1,484	35.6	21.0	1.3	269	8	7	3	1	19	20	1	2	0	23	
Kalamazoo	24.6	6,256	2,262	36.2	14.7	0.9	279	11	4	3	2	20	27	6	0	0	33	
Kalkaska	15.2	445	95	21.3	15.8	0.0	15	0	0	0	0	0	0	0	0	0	0	
Kent	26.8	18,612	6,971	37.5	14.6	1.7	856	73	24	20	0	117	31	10	2	0	43	
Keweenaw	54.9	38	11	28.9	9.1	0.0	1	0	0	0	0	0	0	0	0	0	0	
Lake	15.1	235	68	28.9	8.8	0.0	5	0	0	0	0	0	1	0	0	0	1	
Lapeer	22.2	2,023	597	29.5	8.9	0.3	46	1	0	1	0	2	5	0	0	0	5	

2007 ANNUAL REPORT ON BLOOD LEAD LEVELS OF ADULTS AND CHILDREN IN MICHIGAN  
 — Part I: Childhood Lead Poisoning Prevention Program

**Childhood Lead Poisoning Data Facts**  
**All Counties in Michigan**  
**Calendar Year 2007**  
**Children One and Two Years of Age**

County	%Pop-1990 Housing*	Children Age 1 & 2**	Children Age 1 & 2, Tested for Lead during 2007		Children with Elevated Blood Lead Levels			Children with Elevated Blood Lead Levels					Children with Elevated Capillary Tests, Not Confirmed by Venous				
			Number of Children Tested	% Tested	% with BLL >= 10 ug/dL	% BLL >= 15 ug/dL, venous only***	% BLL >= 20 ug/dL, venous only***	10-14 ug/dL (venous only)	15-19 ug/dL (venous only)	20-44 ug/dL (venous only)	≥45 ug/dL (venous only)	Total BLL (≥ 10 ug/dL)	Capillary 10-14, not confirmed by venous	Capillary 15-19, not confirmed by venous	Capillary 20-44, not confirmed by venous	Capillary ≥45, not confirmed by venous	Total Elevated Capillary, not confirmed by venous
Leelanau	22.0	395	72	18.2	6.9	1.4	4	0	1	0	0	1	0	0	0	0	0
Lenawee	38.6	2,497	796	31.9	14.8	1.0	99	6	1	1	0	8	7	2	2	0	11
Livingston	13.7	3,980	597	15.1	3.2	0.0	18	0	0	0	0	0	0	1	0	0	1
Luce	30.0	115	67	58.3	10.4	0.0	6	0	0	0	0	0	1	0	0	0	1
Mackinac	28.1	201	116	57.7	6.0	0.0	6	0	0	0	0	0	0	0	1	0	1
Macomb	10.9	20,388	4,646	22.8	5.6	0.2	240	4	3	4	0	11	9	0	1	0	10
Manistee	35.9	545	166	30.5	13.9	1.2	20	1	1	0	0	2	1	0	0	0	1
Marquette	32.6	1,220	398	32.6	7.8	0.3	29	0	1	0	0	1	0	0	1	0	1
Mason	31.1	597	170	28.5	14.1	1.2	20	0	2	0	0	2	1	0	1	0	2
Mecosta	22.0	852	243	28.5	6.2	0.8	13	0	0	2	0	2	0	0	0	0	0
Menominee	38.4	501	225	44.9	12.0	0.9	23	1	1	0	0	2	1	0	1	0	2
Midland	16.9	1,898	214	11.3	2.8	0.9	4	2	0	0	0	2	0	0	0	0	0
Missaukee	20.6	322	76	23.6	11.8	0.0	8	0	0	0	0	0	1	0	0	0	1
Monroe	28.3	3,471	1,127	32.5	7.7	0.2	82	2	0	0	0	2	2	1	0	0	3
Montcalm	28.1	1,631	560	34.3	11.8	0.2	61	1	0	0	0	1	3	0	1	0	4
Montmorency	18.4	180	65	36.1	12.3	0.0	8	0	0	0	0	0	0	0	0	0	0
Muskegon	29.8	4,685	1,826	39.0	10.2	1.7	145	15	7	8	0	30	8	4	0	0	12
Newaygo	22.7	1,216	452	37.2	8.8	0.2	37	0	1	0	0	1	1	0	1	0	2
Oakland	15.9	30,478	6,321	20.7	5.7	0.3	334	9	7	5	0	21	5	1	1	0	7
Oceana	26.8	747	323	43.2	7.1	0.3	22	1	0	0	0	1	0	0	0	0	0
Ogemaw	18.3	405	247	61.0	10.9	0.4	25	1	0	0	0	1	1	0	0	0	1
Ontonagon	43.4	110	75	68.2	8.0	0.0	6	0	0	0	0	0	0	0	0	0	0
Osceola	24.2	608	163	26.9	9.2	0.0	13	0	0	0	0	0	1	0	1	0	2
Oscoda	18.3	171	88	51.5	10.2	0.0	9	0	0	0	0	0	0	0	0	0	0
Otsego	12.6	570	125	21.9	3.2	0.0	3	0	0	0	0	0	0	0	1	0	1
Ottawa	18.0	6,857	1,720	25.1	6.3	0.3	98	3	3	0	0	6	4	0	0	0	4
Presque Isle	27.6	266	69	25.9	20.3	0.0	10	0	0	0	0	0	4	0	0	0	4
Roscommon	16.1	416	90	21.6	5.6	0.0	5	0	0	0	0	0	0	0	0	0	0
Saginaw	29.3	5,263	2,232	42.4	18.1	1.1	350	17	2	5	0	24	20	7	4	0	31
St Clair	29.6	4,174	1,085	26.0	12.8	0.9	112	6	1	3	0	10	13	1	3	0	17
St Joseph	34.8	1,860	583	31.3	16.8	1.4	89	5	1	2	0	8	1	0	0	0	1
Sanilac	34.7	1,013	425	42.0	11.1	0.0	46	0	0	0	0	0	1	0	0	0	1
Schoolcraft	33.1	133	92	69.2	21.7	1.1	19	1	0	0	0	1	0	0	0	0	0
Shiawassee	35.9	1,642	638	38.9	8.2	0.5	45	2	1	0	0	3	3	0	1	0	4
Tuscola	32.8	1,362	467	34.3	10.3	0.4	45	1	1	0	0	2	1	0	0	0	1
Van Buren	29.4	2,010	761	37.9	14.5	1.2	96	6	2	1	0	9	5	0	0	0	5
Washtenaw	19.3	8,422	1,426	16.9	3.9	0.5	49	6	1	0	0	7	0	0	0	0	0
Wayne ex Det	24.0	30,400	9,106	30.0	8.7	1.0	664	52	22	15	1	90	28	3	5	0	36
Wexford	26.2	762	177	23.2	6.8	0.0	12	0	0	0	0	0	0	0	0	0	0
Detroit, City of	56.0	27,058	14,345	53.0	30.0	4.4	3,471	374	132	106	3	615	150	50	19	1	220
MICHIGAN	27.0	258,777	84,438	32.6	13.6	1.4	9,685	714	253	204	10	1,181	443	101	58	1	603

\* U.S. Census Bureau, Census 2000. \*\* Source: 2005 population estimates, Kidoconnect.org (census.org)

\*\*\* %BLL is calculated as follows: Number of Children with BLL divided by (Number of Children Tested minus Children who tested capillary tests, not confirmed by venous)

Note: Counts of children tested and blood lead levels are reported from Michigan Department of Community Health, Childhood Lead Poisoning Prevention Program statewide database.

March 26, 2008

Lead poisoning continues to affect children insured by Medicaid disproportionately, and these children constitute a target population for testing and other lead poisoning prevention efforts. The Centers for Medicare and Medicaid Services (CMS) requires that all children insured by Medicaid be tested at 12 and 24 months of age. In Michigan, the annual percentage of (Medicaid) children tested at ages one and two has increased from 19% in 1999 to 49% in 2007.

**Childhood Lead Poisoning Data Facts**  
**All Counties in Michigan**  
**Calendar Year 2007**  
**Blood Lead Testing Among Children who are Insured by Medicaid**

County	Children age < 6 years, insured by Medicaid					Children age 1 & 2 years, insured by Medicaid				
	# of Children, age < 6 yrs, insured by Medicaid during 2007	# of Children Tested for Lead Poisoning in 2007	% Tested	# of Children Confirmed w/EBLL*	% EBLL	# of Children, age 1 & 2 yrs, insured by Medicaid during 2007	# of Children Tested for Lead Poisoning in 2007	% Tested	# of Children Confirmed w/EBLL*	% EBLL
Alcona	264	104	39.4	0	0.0	89	70	78.7	0	0.0
Alger	268	75	28.0	0	0.0	95	58	61.1	0	0.0
Allegan	4,241	1,004	23.7	8	0.8	1,466	665	45.4	4	0.6
Alpena	1,097	306	27.9	0	0.0	382	217	56.8	0	0.0
Antrim	980	222	22.7	0	0.0	332	125	37.7	0	0.0
Arenac	633	183	28.9	0	0.0	216	124	57.4	0	0.0
Baraga	320	110	34.4	0	0.0	123	68	55.3	0	0.0
Barry	1,922	504	26.2	3	0.6	641	328	51.2	3	0.9
Bay	3,956	1,124	28.4	10	0.9	1,345	761	56.6	8	1.1
Benzie	648	148	22.8	0	0.0	225	79	35.1	0	0.0
Berrien	7,476	2,132	28.5	37	1.7	2,666	1,270	47.6	25	2.0
Branch	2,027	388	19.1	6	1.5	710	263	37.0	5	1.9
Calhoun	6,681	1,891	28.3	33	1.7	2,268	1,131	49.9	19	1.7
Cass	2,054	473	23.0	5	1.1	686	312	45.5	3	1.0
Charlevoix	820	234	28.5	0	0.0	261	158	60.5	0	0.0
Cheboygan	1,108	252	22.7	1	0.4	367	175	47.7	0	0.0
Chippewa	1,407	339	24.1	1	0.3	465	198	42.6	0	0.0
Clare	1,337	240	18.0	1	0.4	461	149	32.3	1	0.7
Clinton	1,581	365	23.1	1	0.3	534	229	42.9	1	0.4
Crawford	527	100	19.0	0	0.0	169	54	32.0	0	0.0
Delta	1,363	340	24.9	3	0.9	455	266	58.5	3	1.1
Dickinson	974	370	38.0	0	0.0	337	262	77.7	0	0.0
Eaton	3,134	917	29.3	3	0.3	1,062	611	57.5	2	0.3
Emmet	1,338	247	18.5	1	0.4	452	163	36.1	1	0.6
Genesee	20,805	5,688	27.3	53	0.9	7,106	3,437	48.4	30	0.9
Gladwin	922	277	30.0	0	0.0	311	161	51.8	0	0.0
Gogebic	558	139	24.9	0	0.0	180	95	52.8	0	0.0
Grand Traverse	2,989	418	14.0	0	0.0	982	170	17.3	0	0.0
Gratiot	1,741	371	21.3	1	0.3	597	225	37.7	1	0.4
Hillsdale	1,923	450	23.4	7	1.6	646	277	42.9	3	1.1
Houghton	1,258	338	26.9	1	0.3	444	234	52.7	1	0.4
Huron	1,139	506	44.4	1	0.2	415	293	70.6	0	0.0
Ingham	10,573	3,984	37.7	29	0.7	3,698	2,361	63.8	24	1.0
Ionia	2,456	651	26.5	7	1.1	863	364	42.2	5	1.4
Iosco	1,005	317	31.5	0	0.0	330	192	58.2	0	0.0
Iron	404	144	35.6	0	0.0	135	90	66.7	0	0.0
Isabella	2,074	423	20.4	1	0.2	757	251	33.2	0	0.0
Jackson	6,547	1,767	27.0	22	1.2	2,257	1,252	55.5	14	1.1
Kalamazoo	8,923	2,431	27.2	31	1.3	3,105	1,609	51.8	17	1.1
Kalkaska	856	160	18.7	0	0.0	284	86	30.3	0	0.0
Kent	26,435	7,582	28.7	152	2.0	9,406	5,521	58.7	107	1.9
Keweenaw	56	9	16.1	0	0.0	13	4	30.8	0	0.0
Leite	480	112	23.3	1	0.9	170	56	32.9	0	0.0
Lapeer	2,814	653	23.2	3	0.5	927	447	48.2	2	0.4

**Childhood Lead Poisoning Data Facts**  
**All Counties in Michigan**  
**Calendar Year 2007**  
**Blood Lead Testing Among Children who are Insured by Medicaid**

County	Children age < 6 years, insured by Medicaid					Children age 1 & 2 years, insured by Medicaid				
	# of Children, age < 6 yrs, insured by Medicaid during 2007	# of Children Tested for Lead Poisoning in 2007	% Tested	# of Children Confirmed w/EBLL*	% EBLL	# of Children, age 1 & 2 yrs, insured by Medicaid during 2007	# of Children Tested for Lead Poisoning in 2007	% Tested	# of Children Confirmed w/EBLL*	% EBLL
Leelanau	375	98	26.1	0	0.0	138	52	37.7	0	0.0
Lenawee	3,647	931	25.5	8	0.9	1,277	606	47.5	6	1.0
Livingston	2,912	623	21.4	1	0.2	1,019	406	39.8	0	0.0
Luce	249	82	32.9	1	1.2	89	64	71.9	0	0.0
Mackinac	326	123	37.7	0	0.0	126	103	81.7	0	0.0
Macomb	21,913	4,844	22.1	10	0.2	7,636	2,826	37.0	6	0.2
Manistee	873	240	27.5	5	2.1	290	152	52.4	2	1.3
Marquette	1,834	453	24.7	2	0.4	640	309	48.3	1	0.3
Mason	1,178	229	19.4	3	1.3	413	154	37.3	2	1.3
Mecosta	1,579	306	19.4	3	1.0	552	175	31.7	2	1.1
Menominee	771	201	26.1	0	0.0	244	155	63.5	0	0.0
Midland	2,464	270	11.0	1	0.4	819	146	17.8	1	0.7
Missaukee	543	129	23.8	0	0.0	190	67	35.3	0	0.0
Monroe	4,187	916	21.9	2	0.2	1,418	663	46.8	1	0.2
Montcalm	2,712	710	26.2	1	0.1	968	444	45.9	1	0.2
Montmorency	325	89	27.4	0	0.0	111	57	51.4	0	0.0
Muskegon	8,595	2,431	28.3	51	2.1	2,970	1,254	42.2	30	2.4
Newaygo	2,180	501	23.0	1	0.2	783	324	41.4	1	0.3
Oakland	23,737	6,359	26.8	26	0.4	8,318	3,672	44.1	15	0.4
Oceana	1,689	482	28.5	2	0.4	603	275	45.6	1	0.4
Ogemaw	934	327	35.0	1	0.3	309	200	64.7	1	0.5
Ontonagon	196	76	38.8	0	0.0	82	65	79.3	0	0.0
Osceola	909	205	22.6	0	0.0	301	134	44.5	0	0.0
Oscoda	348	123	35.3	0	0.0	119	81	68.1	0	0.0
Otsego	1,025	222	21.7	0	0.0	365	117	32.1	0	0.0
Ottawa	7,410	1,585	21.4	8	0.5	2,569	1,038	40.4	5	0.5
Presque Isle	378	84	22.2	0	0.0	116	55	47.4	0	0.0
Roscommon	901	137	15.2	0	0.0	319	75	23.5	0	0.0
Saginaw	9,036	2,768	30.6	37	1.3	3,069	1,790	58.3	23	1.3
St Clair	5,875	1,215	20.7	7	0.6	1,942	825	42.5	7	0.8
St Joseph	3,315	661	19.9	11	1.7	1,173	438	37.3	8	1.8
Sanilac	1,751	621	35.5	1	0.2	573	358	62.5	0	0.0
Schoolcraft	316	113	35.8	1	0.9	102	83	81.4	1	1.2
Shiawassee	2,729	798	29.2	6	0.8	930	482	52.9	3	0.6
Tuscola	2,240	646	28.8	3	0.5	732	357	48.8	2	0.6
Van Buren	3,779	943	25.0	7	0.7	1,294	573	44.3	6	1.0
Washtenaw	7,796	1,561	20.0	9	0.6	2,778	896	32.3	6	0.7
Wayne ex Det	37,106	10,438	28.1	135	1.3	12,570	5,564	44.3	77	1.4
Westford	1,789	322	18.0	1	0.3	665	160	24.1	0	0.0
Detroit, City of	59,579	26,506	44.5	1,057	4.0	20,272	11,677	57.6	568	4.9
<b>MICHIGAN</b>	<b>369,615</b>	<b>107,856</b>	<b>29.2</b>	<b>1,823</b>	<b>1.7</b>	<b>127,317</b>	<b>61,743</b>	<b>48.5</b>	<b>1,055</b>	<b>1.7</b>

\*EBLL: Elevated Blood Lead Level (≥ 10µg/dL)  
 Source: MICH Data Warehouse

A Michigan law passed in 2004 imposes sanctions if providers are not substantially (80%) in compliance with the Federal requirement. Michigan's Medical Services Administration (MSA)—the Medicaid arm of MDCH—uses “percent of eligibles with at least one test on or before their 3<sup>rd</sup> birthday” as the measure for compliance. Measured in this way, the testing rate of children insured by Medicaid has increased from 48% in January 2005 to 70% at the end of 2007.

**. Percent of Children with at Least One Blood Lead Test on or before their Second Birthday**

Program	Dec-06	Jan-07	Feb-07	Mar-07	Apr-07	May-07	Jun-07	Jul-07	Aug-07	Sep-07	Oct-07	Nov-07	Dec-07
MC	60.0%	60.5%	60.8%	61.2%	61.4%	61.9%	62.2%	62.7%	63.2%	63.7%	64.2%	64.3%	64.7%
FFS	48.4%	49.3%	50.2%	50.5%	51.2%	52.0%	52.9%	52.7%	53.1%	52.6%	52.4%	52.8%	53.5%
Duals	59.8%	59.0%	59.6%	59.5%	59.8%	60.1%	61.4%	61.1%	61.8%	62.4%	62.6%	63.2%	64.3%
Total	57.9%	58.4%	58.8%	59.2%	59.6%	60.2%	60.7%	60.9%	61.4%	61.8%	62.1%	62.3%	62.7%

**. Percent of Children with at Least One Blood Lead Test on or before their Third Birthday**

Program	Dec-06	Jan-07	Feb-07	Mar-07	Apr-07	May-07	Jun-07	Jul-07	Aug-07	Sep-07	Oct-07	Nov-07	Dec-07
MC	66.2%	66.7%	67.5%	68.1%	68.4%	68.9%	69.5%	69.9%	70.6%	71.2%	71.8%	72.5%	72.8%
FFS	53.8%	54.8%	55.2%	54.6%	55.9%	57.0%	57.5%	58.5%	59.1%	59.0%	58.3%	58.6%	59.6%
Duals	64.3%	64.3%	64.7%	64.9%	64.8%	65.3%	65.2%	66.4%	67.0%	66.6%	66.7%	68.0%	67.8%
Total	63.9%	64.4%	65.1%	65.5%	66.2%	66.7%	67.3%	67.8%	68.4%	69.0%	69.2%	69.9%	70.3%

**. Percent of Children Ages One to Six with at Least One Blood Lead Test**

Program	Dec-06	Jan-07	Feb-07	Mar-07	Apr-07	May-07	Jun-07	Jul-07	Aug-07	Sep-07	Oct-07	Nov-07	Dec-07
MC	69.1%	69.3%	69.0%	69.8%	69.8%	70.2%	70.3%	71.2%	71.4%	71.9%	73.0%	72.9%	73.1%
FFS	56.8%	57.3%	57.1%	57.5%	58.2%	59.2%	59.4%	59.9%	60.3%	60.5%	60.7%	60.8%	61.2%
Duals	65.4%	65.4%	65.3%	66.0%	66.4%	66.8%	66.8%	67.6%	67.7%	68.4%	69.3%	69.4%	70.0%
Total	66.8%	67.0%	66.8%	67.4%	67.7%	68.2%	68.4%	69.1%	69.3%	69.9%	70.7%	70.7%	70.9%

Another target population for lead testing is children participating in the Special Supplemental Nutrition Program for Women, Infants and Children, commonly known as WIC. (This population overlaps substantially with the Medicaid population.) Michigan law requires that all children participating in the program be tested. WIC clinics in 44 counties around the state are now testing their one to three year olds for lead.

**Childhood Lead Poisoning Data Facts**  
**All Counties in Michigan**  
**Calendar Year 2007**  
**Blood Lead Testing Among Children who are enrolled in WIC**

County	# of Children, age 1 - 3 yrs, enrolled in WIC during CY2007	# of Children Tested for Lead Poisoning	% Tested	# of Children w/Confirmed EBLL*	% EBLL
Alcona	110	71	64.5	0	0.0
Alger	114	68	59.6	0	0.0
Allegan	1912	704	36.8	6	0.9
Alpena	411	205	49.9	0	0.0
Antrim	420	142	33.8	0	0.0
Arenac	335	149	44.5	0	0.0
Baraga	166	77	46.4	0	0.0
Barry	789	356	45.1	3	0.8
Bay	1780	841	47.2	8	1.0
Benzie	291	85	29.2	0	0.0
Berrien	2815	1296	46.0	23	1.8
Branch	883	259	29.3	5	1.9
Calhoun	2610	1126	43.1	17	1.5
Cass	795	322	40.5	2	0.6
Charlevoix	389	174	44.7	0	0.0
Cheboygan	455	207	45.5	0	0.0
Chippewa	604	230	38.1	2	0.9
Clare	625	175	28.0	1	0.6
Clinton	617	246	39.9	1	0.4
Crawford	211	60	28.4	0	0.0
Delta	575	272	47.3	3	1.1
Dickinson	465	305	65.6	0	0.0
Eaton	1128	708	62.8	2	0.3
Emmet	476	184	38.7	1	0.5
Genesee	6842	3,380	49.4	28	0.8
Gladwin	428	201	47.0	0	0.0
Gogebic	234	115	49.1	0	0.0
Grand Traverse	1172	206	17.6	1	0.5
Gratiot	757	261	34.5	1	0.4
Hillsdale	755	296	39.2	3	1.0
Houghton	562	262	46.6	1	0.4
Huron	494	337	68.2	1	0.3
Ingham	4134	3,038	73.5	24	0.8
Ionia	1067	480	45.0	8	1.7
Iosco	362	230	63.5	0	0.0
Iron	198	119	60.1	0	0.0
Isabella	879	269	30.6	0	0.0
Jackson	2680	1243	46.4	16	1.3
Kalamazoo	3706	1725	46.5	22	1.3
Kalkaska	301	95	31.6	0	0.0
Kent	10710	5,709	53.3	108	1.9
Keweenaw	12	6	50.0	0	0.0
Lake	203	58	28.6	0	0.0
Lapeer	943	381	40.4	2	0.5



**Childhood Lead Poisoning Data Facts**  
**All Counties in Michigan**  
**Calendar Year 2007**  
**Blood Lead Testing Among Children who are enrolled in WIC**

County	# of Children, age 1 - 3 yrs, enrolled in WIC during CY2007	# of Children Tested for Lead Poisoning	% Tested	# of Children w/Confirmed EBLL*	% EBLL
Leelanau	214	61	28.5	0	0.0
Lenawee	1155	613	53.1	5	0.8
Livingston	792	364	46.0	0	0.0
Luce	110	68	61.8	0	0.0
Mackinac	211	116	55.0	0	0.0
Macomb	6996	2538	36.3	5	0.2
Manistee	367	159	43.3	1	0.6
Marquette	783	328	41.9	2	0.6
Mason	498	167	33.5	3	1.8
Mecosta	602	190	31.6	3	1.6
Menominee	359	171	47.6	0	0.0
Midland	887	161	18.2	1	0.6
Missaukee	253	80	31.6	0	0.0
Monroe	1641	672	41.0	1	0.1
Montcalm	1168	506	43.3	1	0.2
Montmorency	161	62	38.5	0	0.0
Muskegon	3571	1467	41.1	29	2.0
Newaygo	1087	341	31.4	1	0.3
Oakland	8560	3,675	42.9	17	0.5
Oceana	816	339	41.5	2	0.6
Ogemaw	326	237	72.7	1	0.4
Ontonagon	98	72	73.5	0	0.0
Osceola	438	141	32.2	0	0.0
Oscoda	126	99	78.6	0	0.0
Otsego	411	142	34.5	0	0.0
Ottawa	3212	1046	32.6	4	0.4
Presque Isle	169	56	33.1	0	0.0
Roscommon	384	88	22.9	0	0.0
Saginaw	3799	2130	56.1	26	1.2
St Clair	2224	816	36.7	9	1.1
St Joseph	1,432	454	31.7	7	1.5
Sanilac	649	391	60.2	0	0.0
Schoolcraft	168	95	56.5	1	1.1
Shiawassee	1,072	528	49.3	3	0.6
Tuscola	898	422	47.0	2	0.5
Van Buren	1,720	629	36.6	8	1.3
Washtenaw	2,843	882	31.0	6	0.7
Wayne ex Det	13,101	5,865	44.8	74	1.3
Wexford	638	185	29.0	0	0.0
<b>Detroit, City of</b>	<b>21,130</b>	<b>13,290</b>	<b>62.9</b>	<b>563</b>	<b>4.2</b>
<b>MICHIGAN</b>	<b>140,484</b>	<b>66,319</b>	<b>47.2</b>	<b>1,064</b>	<b>1.6</b>

\*EBLL: elevated blood lead level -  $\geq 10 \mu\text{g/dL}$   
 Source: MDCH Data Warehouse

An even more predictive risk factor is geography: children living in one of Michigan's 14 designated "Target Communities" are more likely to be lead-poisoned than children living elsewhere in the state. (Again, this population overlaps substantially with the Medicaid population.) The lead poisoning rate among one & two year olds living in the Target Communities is more than double that of Michigan statewide, and almost double the rate of the Medicaid population statewide.

**Childhood Lead Poisoning Data Facts**  
**Fourteen Target Communities in Michigan**  
**Calendar Year 2007**  
**Children less than Six Years of Age**

Target Community	%Pre-1950 Housing*	%Pre-1978 Housing*	Children < Age 6, Tested for Lead during 2007		Children with Confirmed Elevated Blood Lead Levels					Children with Elevated Capillary Tests, Not Confirmed by Venous								
			Number of Children Tested	% Tested	% with BLL >= 5 ug/dL	% BLL >= 10 ug/dL, venous only**	5 to 9 ug/dL (capillary; venous or unknown)	10-14 ug/dL (venous only)	15-19 ug/dL (venous only)	20-44 ug/dL (venous only)	>45 ug/dL (venous only)	Total BLL >= 10 ug/dL	Capillary 10-14, not confirmed by venous	Capillary 15-19, not confirmed by venous	Capillary 20-44, not confirmed by venous	Capillary >= 45, not confirmed by venous	Total Elevated Capillary, not confirmed by venous	
Battle Creek	42.3	83.2	4,694	1,418	30.2	11.2	1.6	130	14	4	4	0	22	6	1	0	0	7
Benton Harbor	47.8	88.8	1,406	517	36.8	30.2	5.3	123	19	2	6	0	27	4	1	1	0	6
Dearborn	49.5	87.8	9,675	3,110	32.1	5.6	0.9	135	18	4	6	1	29	11	0	0	0	11
Detroit	56.0	95.2	75,502	33,010	43.7	26.0	3.5	7,054	744	220	173	10	1,147	254	77	38	1	370
Flint	40.9	93.7	11,152	2,950	26.5	13.6	1.8	337	35	9	9	0	53	9	2	0	0	11
Grand Rapids	48.9	84.9	19,954	4,976	24.9	22.1	3.0	909	91	31	27	0	149	32	7	3	0	42
Hamtramck	75.8	95.7	2,153	1,135	52.7	26.2	2.3	269	18	4	3	0	25	19	1	6	0	26
Highland Park	62.4	89.8	1,572	523	33.3	45.1	10.4	172	34	15	4	0	53	8	2	1	0	11
Jackson	65.9	92.6	3,920	921	23.5	30.5	2.2	234	11	6	3	0	20	20	4	3	0	27
Kalamazoo	40.0	81.5	4,867	1,392	28.6	26.3	2.1	304	15	5	7	2	29	26	7	0	0	33
Lansing	35.8	85.1	12,116	3,539	29.2	10.3	0.7	327	12	7	6	0	25	12	2	0	0	14
Muskegon/MuskHts	52.1	90.4	8,187	1,510	18.4	18.7	3.5	220	33	9	10	0	52	8	3	0	0	11
Pontiac	35.2	84.3	6,269	1,935	30.9	10.1	0.8	175	6	3	7	0	16	3	1	0	0	4
Saginaw	54.4	95.4	6,437	1,723	26.8	23.2	2.1	342	23	3	9	0	35	17	5	1	0	23
Subtotal	51.1	91.5	167,904	58,659	34.9	22.2	2.9	10,731	1,073	322	274	13	1,682	429	113	53	1	596
Michigan	27.0	71.3	781,759	149,445	19.1	13.0	1.4	15,566	1,295	394	325	17	2,031	665	136	97	1	899

\*U.S. Census Bureau, Census 2000

\*\*Detroit and Michigan: KIDcount.org (denies.org)

Dearborn, Flint, Grand Rapids, Kalamazoo, Lansing & Pontiac: U.S. Census Bureau, American Community Survey 2005

Battle Creek, Benton Harbor, Hamtramck, Highland Park, Jackson, Muskegon & Saginaw: U.S. Census Bureau, Census 2000

Note: Counts of children tested and blood lead levels are reported from Michigan Department of Community Health, Childhood Lead Poisoning Prevention Program statewide database.

April 28, 2008

**Childhood Lead Poisoning Data Facts**  
**Fourteen Target Communities in Michigan**  
**Calendar Year 2007**  
**Children One and Two Years of Age**

Target Community	%Pre-1950 Housing*	%Pre-1978 Housing*	Children Age 1 & 2, Tested for Lead during 2007		Children with Confirmed Elevated Blood Lead Levels					Children with Elevated Capillary Tests, Not Confirmed by Venous								
			Number of Children Tested	% Tested	% with BLL >= 5 ug/dL	% BLL >= 10 ug/dL, venous only**	5 to 9 ug/dL (capillary; venous or unknown)	10-14 ug/dL (venous only)	15-19 ug/dL (venous only)	20-44 ug/dL (venous only)	>45 ug/dL (venous only)	Total BLL >= 10 ug/dL	Capillary 10-14, not confirmed by venous	Capillary 15-19, not confirmed by venous	Capillary 20-44, not confirmed by venous	Capillary >= 45, not confirmed by venous	Total Elevated Capillary, not confirmed by venous	
Battle Creek	42.3	83.2	1,563	855	64.7	10.3	1.4	71	8	1	3	0	12	4	1	0	0	5
Benton Harbor	47.8	88.8	458	261	67.0	33.3	7.0	64	10	3	5	0	18	3	1	1	0	5
Dearborn	49.5	87.8	3,138	1,620	61.8	9.7	0.8	135	8	3	3	1	16	7	0	0	0	7
Detroit	56.0	95.2	27,058	14,345	68.0	30.0	4.4	3,471	374	132	106	3	816	150	50	19	1	220
Flint	40.9	93.7	3,685	1,783	48.4	14.3	1.7	215	22	4	5	0	31	7	2	0	0	9
Grand Rapids	48.9	84.9	6,743	3,503	62.0	23.2	3.2	671	67	23	20	0	110	24	6	2	0	32
Hamtramck	75.8	95.7	732	541	73.9	30.7	3.0	134	10	4	2	0	18	13	3	0	0	16
Highland Park	62.4	89.8	511	225	44.0	46.7	10.6	77	15	6	2	0	23	3	2	0	0	5
Jackson	65.9	92.6	1,321	643	48.7	30.3	2.2	164	6	6	2	0	14	15	1	1	0	17
Kalamazoo	40.0	81.5	1,669	907	64.3	25.1	1.8	184	10	4	3	0	17	22	5	0	0	27
Lansing	35.8	85.1	4,181	2,038	48.7	11.2	1.0	196	11	5	5	0	21	9	1	1	0	11
Muskegon/MuskHts	52.1	90.4	1,700	760	44.7	19.9	4.0	111	15	7	8	0	30	7	3	0	0	10
Pontiac	35.2	84.3	2,114	1,186	68.1	10.9	0.6	119	4	1	0	0	8	3	1	0	0	4
Saginaw	54.4	95.4	2,206	1,103	60.0	25.7	2.1	242	16	2	5	0	23	11	7	1	0	19
Subtotal	51.1	91.5	57,079	29,770	62.2	24.2	3.2	5,854	576	201	170	4	961	278	83	25	1	387
Michigan	27.0	71.3	258,777	84,438	32.8	13.6	1.4	9,685	714	253	204	10	1,181	443	101	58	1	603

\*U.S. Census Bureau, Census 2000

\*\*Detroit and Michigan: KIDcount.org (denies.org)

Dearborn, Flint, Grand Rapids, Kalamazoo, Lansing & Pontiac: U.S. Census Bureau, American Community Survey 2005

Battle Creek, Benton Harbor, Hamtramck, Highland Park, Jackson, Muskegon & Saginaw: U.S. Census Bureau, Census 2000

Note: Counts of children tested and blood lead levels are reported from Michigan Department of Community Health, Childhood Lead Poisoning Prevention Program statewide database.

April 28, 2008

**Childhood Lead Poisoning Data Facts - Calendar Year 2007**

Totals by Category	Children	Children Tested	Pct Tested	Children w/EBLL	Pct EBLL
Statewide CWSBT* (portion of All Children)	142,348 0.55	67,191 0.80	47.2	1,131 0.96	1.7
Children Who Should Not Be Tested (portion of All Children)	116,429 0.45	17,247 0.20	14.8	50 0.04	0.3
All Kids Insured by Medicaid (portion of All Children)	127,317 0.49	61,743 0.73	48.5	1,055 0.89	1.7
All Children living in Target Communities (portion of All Children)	53,488 0.21	27,926 0.33	52.2	931 0.79	3.4
All Medicaid in TCs (portion of All Children)	39,697 0.15	23,027 0.27	58.0	864 0.73	3.8
All Children	258,777 1.00	84,438 1.00	32.6	1,181 1.00	1.4

Source: MDCH Data Warehouse

**Efforts Toward Elimination in 2007**

**MDCH Childhood Lead Poisoning Prevention Program**

The MDCH Childhood Lead Poisoning Prevention Program is funded primarily through a grant from the CDC, with some additional funding from the federal Maternal and Child Health Block Grant, State general funds and the Healthy Michigan Fund. CLPPP continued to reach out in many directions in 2007:

***Reaching out to parents:***

A public awareness campaign was carried over from the previous year, with radio and television spots, as well as postcards and posters, conveying a message that encourages parents to have their children tested for lead. A new campaign has been developed, aiming at parents doing home repair and leading them to do the work in a lead-safe manner.

Door-to-door campaigns were held in several cities, involving staff from CLPPP, local health departments, Medicaid health plans and other organizations. These efforts included hanging informational pamphlets on doorknobs and talking with residents in neighborhoods identified as high risk for lead poisoning.

***Reaching out to communities:***

MDCH continues to work with community coalitions in Battle Creek, Benton Harbor, Detroit, Flint, Grand Rapids, Hamtramck/Highland Park, Kalamazoo, Lansing, Muskegon and Saginaw. Goals for all of these community coalitions include:

- increasing awareness of lead paint hazards
- establishing partnerships with local health agencies, housing agencies, and other community stakeholders

- increasing housing code enforcement
- identifying and controlling lead-based paint hazards
- establishing sources of public and private funding for lead hazard reduction
- developing community capacity to train workers to carry out low-level lead hazard reduction treatments
- identifying sustainable funding sources.

Through their coalitions, six of these communities have obtained HUD funding for lead hazard abatement. Three others obtained EPA funding to support the local coalition, and for code enforcement.

***Reaching out to providers:***

A letter from Michigan Surgeon General Kimberlydawn Wisdom, emphasizing the standard of care for testing children, was sent to more than 3,300 pediatric care providers throughout the state.

In an effort to improve the quality of blood lead specimens, especially those collected on filter paper, MDCH CLPPP began sending letters to providers alerting them to contaminated or unanalyzable specimens received by the MDCH lab. These mailings include instructions for hand-washing and other techniques. CLPPP nurse consultants also conducted several in-house trainings on filter paper specimen collection in WIC clinics, physician offices and health plans.

CLPPP nurse consultants also continued to conduct “Lead 101” sessions throughout the state, educating health department and provider staff on all things lead, and providing continuing education credits to nurses attending these sessions.

Through MCIR, providers are able to view complete blood lead testing history for every patient in their practice, regardless of where the tests occurred.

CLPPP staff scrambled in 2007 to keep on top of blood lead analyses by users of portable blood lead analyzers. Using a portable analyzer, a health department or physician’s office can become an instant “lab.” CLPPP applauds the use of portable analyzers as one more effective tool in getting kids tested and identifying those with lead poisoning. The portable analyzer can provide a blood lead result in minutes while the parent and child wait nearby. If the result is elevated, the child can receive a confirmatory venous test the same day. However, all laboratories analyzing blood lead specimens are required by law to report those results to MDCH CLPPP—to facilitate follow-up and to serve as the basis for data reporting on lead poisoning throughout Michigan. While staff at established laboratories know their reporting responsibilities, office staff using a new portable analyzer are not always aware. CLPPP staff spent much of the year beating the bushes to uncover every new portable analyzer and to make sure those results were reported appropriately. Thirty-eight “labs” with portable analyzers reported blood lead results in 2007—more than doubling the number of laboratories reporting over previous years.

2007 ANNUAL REPORT ON BLOOD LEAD LEVELS OF ADULTS AND CHILDREN IN MICHIGAN  
 — Part I: Childhood Lead Poisoning Prevention Program

Laboratories Analyzing and Reporting Blood Lead Specimens to MDCH CLPPP in 2007

		Number of Specimens Reported	% of Total Reported
<b>public labs:</b>			
1	Bay County Hlth Dept EPSDT Bay City	166	<0.1
1	Bay County Hlth Dept Lab Bay City	353	0.2
	Detroit Hlth Dept Lab Detroit	7,378	3.8
1	Edison School Based Hlth Care Kalamazoo	7	<0.1
1	Genesee County Hlth Dept Flint	96	<0.1
1	Guidance Ctr HS Southgate	35	<0.1
1	Huron County Hlth Dept Bad Axe	233	0.1
1	ICHD-Wall Child Clinic Lansing	269	0.1
1	Ingham County Hlth Dept Lansing	3,702	1.9
1	Kent County Hlth Dept Lab Grand Rapids	4,800	2.5
2	MDCH Lab Lansing	37,407	19.0
1	Mott Children's Hlth Ctr Flint	193	0.1
1	Muskegon County Hlth Dept Muskegon	298	0.2
1	St John Hlth System-Nolan	3	<0.1
1	Starfish Family Svcs Inkster	38	<0.1
1	Staffmeyer Early C C Westland	6	<0.1
1	Tuscola County Hlth Dept Caro	249	0.1
1	Wayne-Metro HS Hamtramck	2	<0.1
1	Western Wayne Fam Hlth Ctr Inkster	6	<0.1
1	YWCA Of West Wayne Co HS Redford	32	<0.1
	<b>subtotal</b>	<b>66,273</b>	<b>28.2</b>
<b>in-state private labs:</b>			
	BioTech Clinical Labs Farmington Hills	413	0.2
1	Chase Center Inc Detroit	23	<0.1
1	Clincon County Med Ctr St Johns	2	<0.1
1	Day One Healthcare Battle Creek	126	<0.1
	DMC Laboratories Detroit	23,982	12.2
	DMC University Labs Detroit	3,869	2.0
1	Dr Kamal Hassan Davison	12	<0.1
	Drug Analysis & Test Lab Ann Arbor	3,908	2.0
1	Garber Memorial Hlth Farmont	294	0.2
1	Hackley Hospital Lab Muskegon	2,105	1.1
1	Hackley Lakeshore Hospital Shelby	210	0.1
1	Health Specialists of Lenawee Tecumseh	124	<0.1
	Henry Ford Hospital Lab Detroit	5,579	2.9
	Henry Ford Hospital Research Detroit	3	<0.1
1	Kalamazoo Family Hlth Ctr Kalamazoo	486	0.3
1	Kids Creek Children's Clinic Traverse City	367	0.2
	Labcorp of America Liv Livonia	2	<0.1
	Marquette General Hospital Marquette	1,932	1.0
	MI Clemens Rag Med Ctr MI Clemens	1,178	1.0
1	Northside Pediatrics Battle Creek	258	0.1
1	Pediatric Care Center West Bloomfield	60	<0.1
1	Pediatric Healthcare Sterling Hts	169	<0.1
1	Port Huron Hospital Lab Port Huron	132	<0.1
	Quest Diagnostics MI Auburn Hills	17,779	9.0
1	Regional Medical Lab Battle Creek	1,922	1.0
1	River Oaks Pediatrics Dearborn Hts	17	<0.1
1	S E Zars MD Riverview	25	<0.1
1	Southwestern Med CC Lab Barren Springs	691	0.4
	Sparrow Regional Lab Lansing	3,652	1.9
2	Spectrum Hlth Grand Rapids	5,840	3.0
1	St Johns Hlth System-Butzel Detroit	47	<0.1
1	St Johns Hlth System-Hazel Park Ferndale	10	<0.1
1	U-Mich School Public Hlth Ann Arbor	2	<0.1
	Wanda Medical Ann Arbor	27,376	14.0
	<b>subtotal</b>	<b>102,596</b>	<b>52.3</b>
<b>out-of-state private labs:</b>			
	ACL Industrial Test Lab West Allis WI	71	<0.1
	ACM Medical Lab Rochester NY	7	<0.1
	Advanced Toxicology Network Memphis TN	1,365	1.0
	Asarco Reg & Univ Path Salt Lake City UT	13,439	6.9
	Bellis Hospital Lab Green Bay WI	69	<0.1
	Cleveland Clinic Foundation Cleveland OH	1	<0.1
	ESA Lab Chathamford MA	1	<0.1
	Labcorp of America NC Burlington NC	4,322	2.2
	Labcorp of America OH Dublin OH	1	<0.1
	Labone Inc Lenexa KS	64	<0.1
	Marshfield Lab Marshfield WI	10	<0.1
	Mayo Medical Lab Rochester MN	9,272	4.7
2	Medtox Labs St Paul MN	5,824	3.0
	Pacific Toxicology Labs Chatsworth CA	46	<0.1
	Pathology Labs Toledo OH	109	<0.1
	Premedica Health System Toledo OH	828	0.4
	Quest Diagnostics IL Wood Dale IL	104	<0.1
	Quest Diagnostics NJ Teletoro NJ	5	<0.1
	Quest Diagnostics VA Chantilly VA	16	<0.1
	Quest Nichols Institute CA San Juan Capistrano CA	14	<0.1
	SMDC Lab Duluth MN	2	<0.1
	South Bend Med Foundation South Bend IN	1,517	0.8
	Specialty Labs Valencia CA	865	0.4
	St Vincent Mercy Med Toledo OH	59	<0.1
2	Terence Medical Littleton CO	167	<0.1
	<b>subtotal</b>	<b>38,178</b>	<b>19.5</b>
	<b>Total</b>	<b>196,046</b>	<b>100.0</b>
1 LeadCare hand-held analyzer			
2 Filter paper analysis possible			

***Reaching out to local health departments:***

Through its surveillance system, MDCH CLPPP continues to provide weekly data files or reports to each local health department (LHD); each file or report contains all recent blood lead results for children in the jurisdiction. In 2007, CLPPP made the transition from e-mailing weekly files, to the use of MDCH's File Transfer Application, a Web-based system for secure transfer of protected health information.

In advance of weekly files, CLPPP sends an immediate fax of any highly elevated blood lead result (20 ug/dL or higher) as soon as it is received from the analyzing lab. This allows the local health department to move quickly to contact the family and initiate care.

CLPPP expanded the use of STELLAR lead tracking software, installing it in several additional LHDs (for a total 36 of 45 LHDs, covering 64 of 83 counties), and providing STELLAR training and consultation to new and old users as needed.

Lead 101 and filter paper specimen collection trainings were held in three local health department WIC clinics.

In March, MDCH CLPPP, in conjunction with Healthy Housing Solutions (a national non-profit organization), and with input from local Lead Initiative Coordinators, completed the standard protocol and forms for case management of children with venous blood lead levels (BLL)  $\geq 20$   $\mu\text{g}/\text{dL}$ . This protocol requires case management services, without exception, for all children with BLL  $\geq 20$   $\mu\text{g}/\text{dL}$ . Any local program funded by CLPPP must also use the state-developed forms. Healthy Housing Solutions conducted two Case Management Trainings in Lansing and metro-Detroit in March, providing an overview of case management and an introduction to the new forms. Forty-three participants attended, from nursing, environmental health and management, from sixteen different local public health agencies. In December, CLPPP staff conducted an additional case management training in Lansing. This training was attended by 22 nurses from nine LHDs, including six agencies not funded by CLPPP.

To date, the protocol and case management forms have been distributed to the 10 CLPPP-funded local health departments and 25 additional local public health agencies, per their request. For many of the local health departments whose lead programs are in their infancy, the receipt of these forms was very timely and will be used as the foundation for building their programs. All funded agencies have implemented the new protocol and forms.

Overall, evaluations indicated that the trainings were successful. The one area that received the most comments dealt with identifying ways to improve a health department's ability to define/meet case management objectives. Several of the attendees indicated that funding and/or reimbursement remains a significant barrier to meeting case management objectives.

***Reaching out to other state and local programs:***

CLPPP staff worked with state and local WIC staff to facilitate the testing of children enrolled in WIC, as mandated by a state law passed in 2006.

Migrant camp visits were provided in collaboration with Telamon Corporation to three camps—in Oceana, Van Buren and Cass counties. The itinerary included visits to clinics, farms, daycares and parents in the service areas to provide education and to identify issues faced by migrant parents.

“Lead 101” in-services were provided to ten Head Start and Community Coordinated Child Care (4C) programs throughout Michigan.

CLPPP staff worked throughout 2007 with the Michigan Public Health Institute to plan Michigan's first statewide Lead Safe and Healthy Homes conference, which was held in April 2008. The conference was

directed to public health staff, lead professionals, physicians, community educators, social workers and housing rehab contractors and workers. The conference served as a venue for national lead experts in the fields of health care and housing to provide insight and awareness to over 125 attendees.

CLPPP continued its collaboration with MSA, sending weekly updates to the MDCH Data Warehouse, where blood lead data is linked with Medicaid beneficiaries (and MCIR records). This allows MSA to create child-specific reports to Medicaid Health Plans indicating which children in each Plan have been tested and which have not. It also allows MSA to determine testing rates by Plan, among fee-for-service, by county and by other categories.

### **MDCH Healthy Homes Section**

The Healthy Homes Section (HHS) launched Michigan's Lead Safe Housing Registry in 2007. The Registry includes lead identification and abatement activities on rental properties statewide, and can be accessed at [www.michigan.gov/ismyhomeleadsafe](http://www.michigan.gov/ismyhomeleadsafe). The Registry information is updated twice a month. Families seeking lead-safe housing can use the Registry to find lead information on homes in their area, searching by specific address, ZIP code, city or county.

HHS administers the Michigan Lead Safe Home Program (LSHP), providing funding statewide for remediation of residential lead hazards in low and moderate income housing. To date, the LSHP has abated over 1500 homes in 44 counties statewide with an average cost per unit of approximately \$7,000. Through a network of Regional Field Consultants, including internal staff, local health departments and non-profit agencies, the program is administered regionally to provide lead hazard control interventions. In certain target communities these interventions occur in homes where children under six years of age reside; elsewhere they are reserved for units occupied by children with lead poisoning. The LSHP has functioned in this capacity since 1996 through HUD grants, Clean Michigan Initiative Bond funding, Maternal Child Health Block Grant dollars and Healthy Michigan funding. In 2007, the LSHP addressed and cleared lead hazards in 99 homes in 18 counties throughout Michigan, with funding from Healthy Michigan and HUD.

HHS also continues to certify lead professionals, including inspectors, risk assessors, clearance technicians, supervisors, workers, project designers and trainers, assuring a properly-trained workforce capable of addressing lead hazards in a safe and effective manner.

### **Michigan Legislature**

2007 saw a steady stream of Consumer Product Safety Commission alerts and news reports regarding imported products that were intended for children and contained harmful amounts of lead. In response, the Legislature passed a set of three laws (Public Acts 159, 160 & 161 of 2007) outlawing the sale of toys and child care articles, lunch boxes and children's jewelry that contain lead.

### **Local Health Departments**

Local health departments (LHDs) throughout Michigan participate, to varying degrees, in childhood lead poisoning prevention. For jurisdictions with active programs, health departments provide the foot soldiers for prevention—the public health nurses and environmental health sanitarians who visit the homes of lead-poisoned children. Nurses visit to educate parents on the significance of their children's lead levels and the importance of nutrition and cleaning, to assess the child's physical health and development, and to make appropriate referrals. Sanitarians visit homes to assess the condition of the home and investigate potential sources of lead. These services are critical to mitigating the damage of lead poisoning, because the most effective remedy is to stop further poisoning—i.e., to separate the child from the lead. If the child is insured by Medicaid, the LHD can be reimbursed for up to two nurse visits and two environmental health visits. If the child is not insured by Medicaid, the LHD must either bill the family for those services or bear the cost itself.

Other LHD activities, especially in the ten that are currently funded for lead by MDCH CLPPP, include comprehensive case management, increasing testing in the community, primary prevention, and surveillance.

Some LHDs are actively engaged in the remediation of homes. Over the past five years, the state and its partners have worked aggressively to apply for and receive Lead-Based Paint Hazard Control Grants from HUD's Office of Healthy Homes and Lead Hazard Control. Currently, the cities of Detroit, Grand Rapids, Lansing and Muskegon and the counties of Wayne, Jackson, and Saginaw are in receipt of these grants. Some of these communities have been supported in their efforts with funding for grant-writing assistance through the Healthy Michigan Fund—a few thousand dollars spread among several applicants. The Federal awards have brought in millions, and Michigan is now on par or exceeding other states in receiving Federal dollars for lead.

### **Other local agencies -- some highlights from around the State**

The Wayne County Prosecutor's Office, using a 2005 law that makes it a criminal offense for landlords to rent a home with known lead-paint hazards to a family with young children, has developed an effective program to remediate properties in the county. Working with certified lead investigators from the Wayne County and Detroit health departments, the Office uses the threat of prosecution to convince landlords to hire certified lead abatement contractors to remediate lead hazards in ALL of the landlord's rental properties. Failure to do so within proscribed time limits can result in criminal charges being filed, but this rarely happens. In most cases the properties are remediated and the case is dropped—and families who move in subsequently will be lead-safe. The program has brought about the remediation of hundreds of properties in Wayne County. CLPPP has encouraged other counties to adopt this same approach. The Lead Attorney for the Wayne County program conducted a training in Berrien County in April 2007, and a handful of other counties have looked into the matter, but to date no county but Wayne has made use of the "knowingly rent" law.

The Healthy Homes Coalition of West Michigan (HCC), using a Targeted Lead Grant from the EPA, conducts targeted outreach to Hispanic communities in the Grand Rapids area using culturally appropriate outreach strategies. These activities included training mentors within the Hispanic communities who can share lead safe work practices in the home; demonstrating the risk of unsafe work practices through dust sampling; and developing culturally appropriate HUD/EPA Lead Safe Work Practices lesson plans in Spanish.

CLEARCorps Detroit and the Center for Urban Studies at Wayne State University are using a Lead Elimination Action Program grant from EPA to target several ZIP codes in Detroit. This project, entitled Eliminating Repeat Offender Houses, is engaging several partners to facilitate lead poisoning control interventions. Data indicate there are over 1200 housing units in Detroit that have poisoned at least two children. These "repeat offenders" need to be addressed in several ways, including visual assessments, notification and education of property owners and residents, thorough risk assessments, enrollment in lead hazard reduction programs and, where necessary, threat of prosecution.

### **Cases of Interest in 2007**

Interesting cases/sources of childhood lead poisoning in 2007 include the following:

- Two siblings living in Ingham County were identified as being lead poisoned after being tested for lead two months after their arrival to the United States. The two children were refugees from Myanmar.\*
- A 16-month-old child living in Ingham County was poisoned as a result of mouthing behaviors. An assessment of the child's living environment and behaviors revealed that the child was sucking on old hand tools that were owned by the family.



- A child residing in Wayne County had an extremely high blood lead levels that has required chelation therapy four times since being diagnosed with an elevated blood lead level. The family had recently moved from Liberia. The family has lived at four different addresses since moving to the US. This child’s blood lead level continues to remain high related to the frequent moves to pre-1950 homes.\*
- A 4-year-old child residing in Wexford County had an elevated lead level from eating dirt. The soil was tested and was found to have high levels of lead. The family indicated that many old cars had been stored on the property for a significant period of time.
- An 18-month-old child residing in Kent County was poisoned through ingestion of azarcon powder. Azarcon is a bright orangish-red powder used in the Hispanic community to treat empacho (bloating, abdominal pain, vomiting). The child’s grandmother had sent the powder, from Mexico, to the family to treat the child’s vomiting and diarrhea. The child had been given two doses but the gastrointestinal symptoms did not improve. The child was taken to the emergency room and a blood lead test was done indicating that the child was lead poisoned. The family discontinued the use of the powder and the child has had a steadily declining blood lead level.

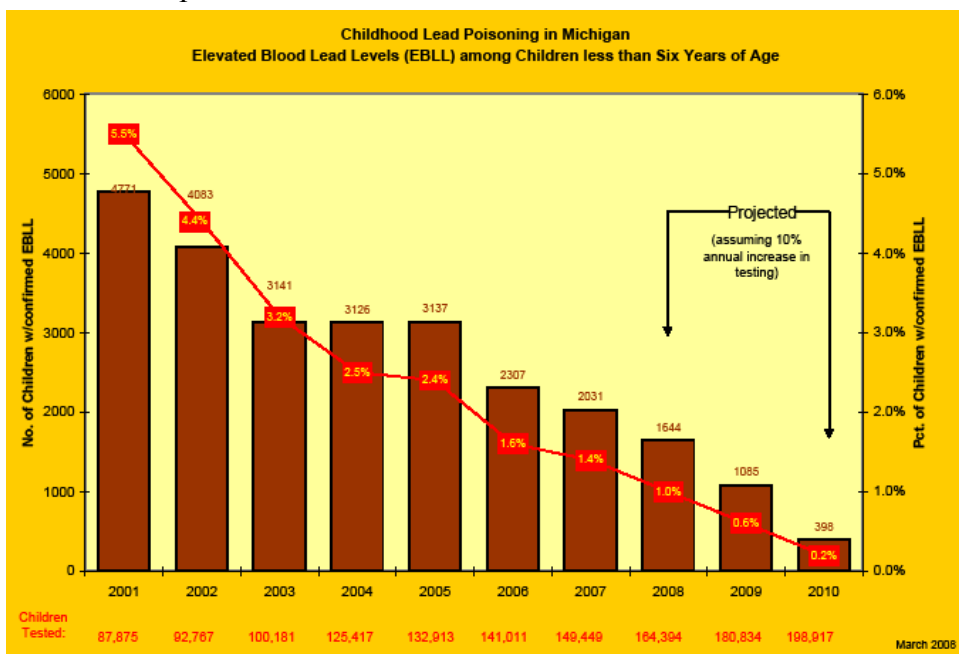
\* The CDC recommends that newly arrived refugee children and internationally adopted children (ages 6 months to 16 years) receive blood lead testing upon entry to the United States; repeat testing of children six months to six years and 3 to 6 months after placement in permanent residences. For more information, see CDC. “Elevated Blood Lead Levels in Refugee Children--New Hampshire, 2003--2004.” *MMWR*. January 21, 2005; 54(2):42-46. Also see the “Lead Poisoning Prevention in Newly Arrived Refugee Children” tool kit, available at [http://www.cdc.gov/nceh/lead/Publications/RefugeeToolKit/Refugee\\_Tool\\_Kit.htm](http://www.cdc.gov/nceh/lead/Publications/RefugeeToolKit/Refugee_Tool_Kit.htm).

### Moving Toward 2010

What does the future hold for lead poisoning prevention efforts as we strive for elimination by 2010? The Michigan Childhood Lead Poisoning Prevention and Control Commission issued a final report as the Commission’s first iteration drew to a close in June 2007. In this report, the Commission identified four priorities in its “Long Term Plan to Eliminate Childhood Lead Poisoning in Michigan.”

1. Eliminate lead from all Michigan homes and daycare settings used by children under age six
2. Test all children at high risk for lead hazard exposure
3. Develop adequate and sustainable funds to complete this work
4. Continue to monitor progress in all other areas of previous reports

These efforts must be sustained in the coming years. The rate of lead poisoning must decline by a factor of SEVEN in just three years—from 1.4% in 2007 to 0.2% in 2010—in order reach “elimination” as defined by the CDC. We have been saying it for years: **LEAD POISONING IS ENTIRELY PREVENTABLE.**





**-- Part II: Adult Blood Lead Epidemiology and Surveillance (ABLES)  
SUMMARY**

This is the tenth annual report on surveillance of blood lead levels in Michigan citizens. It is based on regulations that went into effect on October 11, 1997 that require laboratories to report all blood lead levels analyzed. Part I of this report summarizes the results of blood lead tests in children under the age of six and Part II of this report summarizes blood lead levels in adults (16 years and older).

In 2007, 15,893 blood lead tests were received for 14,585 individuals  $\geq 16$  years of age. Seven hundred sixty-eight (5.3%) individuals had blood lead levels greater than or equal to 10  $\mu\text{g}/\text{dL}$ ; 130 of those 768 had lead levels greater than or equal to 25  $\mu\text{g}/\text{dL}$  and 9 of the 130 had blood lead levels greater than or equal to 50  $\mu\text{g}/\text{dL}$ .

There were 141 more blood lead tests and 753 more individuals reported in 2007 compared to 2006. The number but not the percent of individuals with blood lead levels  $\geq 10$   $\mu\text{g}/\text{dL}$  increased from 730 (5.3%) in 2006 to 768 (5.3%) in 2007. The number and percent of individuals with blood lead levels greater than or equal to 25  $\mu\text{g}/\text{dL}$  increased, from 108 (0.8%) in 2006 to 130 (0.9%) in 2007. The number of individuals with blood lead levels  $\geq 50$   $\mu\text{g}/\text{dL}$  increased from 6 (0.04%) in 2006 to 9 (0.06%) in 2007. For eight consecutive years, 1999 to 2006 the blood lead levels  $\geq 25$   $\mu\text{g}/\text{dL}$  decreased from the previous year. This overall decrease was secondary to a decrease in elevated blood leads from occupational exposure. For 2007, there was a slight increase in blood lead levels  $\geq 25$   $\mu\text{g}/\text{dL}$  from both occupational and non-occupational exposures. For non-occupational exposures, the decrease only occurred in the years 2004-2006.

Individuals with blood lead levels  $\geq 10$   $\mu\text{g}/\text{dL}$  were likely to be men (96.4%) and white (90.7%). Their mean age was 46. They were most likely to live in Wayne (17.8%), Montcalm (12.7%), and St. Clair (11.1%) counties.

Occupational exposure remains the predominant source of lead exposure in Michigan adults (81.9% of all individuals with elevated blood lead,  $\geq 10$   $\mu\text{g}/\text{dL}$ ). These exposures typically occurred where individuals were performing abrasive blasting on outdoor metal structures such as bridges, overpasses or water towers; casting brass or bronze fixtures; fabricating metal products; or exposed to lead fumes or dust from firing guns or spent bullets at firing ranges. Individuals with elevated blood lead from exposure at firing ranges were exposed not only as part of work, but also from their involvement in the activity as recreation. This included individuals using commercial ranges and members of private clubs. This is the most common cause of non-occupational exposure (13.1% of all cases with blood lead  $\geq 10$   $\mu\text{g}/\text{dL}$  and 72.2% of all cases with blood lead  $\geq 10$   $\mu\text{g}/\text{dL}$  from non-occupational causes).

The tenth year of operation of an adult blood lead surveillance system in Michigan proved successful in continuing to identify individuals with elevated blood lead levels and sources of exposures that could be remediated to reduce lead exposure. Outreach activities that were continued this past year included distributing resources on diagnosis and management of lead exposure to health care providers with patients with elevated blood lead levels and distributing a "how to" guide for home renovation. Two educational brochures for individuals exposed to lead continued to be distributed this past year: one on the toxicity of lead and the second on controlling lead exposure in firing ranges. Copies of these brochures and a diagnosis management plan for health care providers are available at [www.oem.msu.edu](http://www.oem.msu.edu) under resources for lead.

Average blood lead in the general population has dropped to 1.45 µg/dL (1) and health effects are documented at levels considerably below the allowable OSHA blood lead level of 50 µg/dL (2-5). OSHA should reevaluate the adequacy of its standard given medical evidence of health effects at levels as low as 5 µg/dL (2-5).

Ongoing surveillance in future years will continue to allow targeting and evaluation of intervention activity to reduce exposure to lead.

## **BACKGROUND**

This is the tenth annual report on surveillance of blood lead levels in Michigan residents. Blood lead levels of Michigan residents, including children, have been monitored by the state since 1992. From 1992 to 1995, laboratories performing analyses of blood lead levels, primarily of children, were voluntarily submitting reports to the Michigan Department of Public Health and then beginning in 1996 to the Michigan Department of Community Health (MDCH). The Michigan Department of Community Health promulgated regulations effective October 11, 1997, that require laboratories to submit reports of both children and adults to the MDCH for any blood testing for lead. Coincident with this, the Michigan Occupational Safety and Health Administration (MIOSHA) in the Michigan Department of Labor and Economic Growth (MDLEG) (formerly called the Occupational Health Division within the Michigan Department of Consumer and Industry Services (MDCIS); which formerly had been part of the Michigan Department of Public Health) received federal funding in 1997 from the Centers for Disease Control and Prevention (CDC) to monitor adult blood lead levels as part of the Adult Blood Lead Epidemiology and Surveillance (ABLES) Program. Beginning this past year the funds have been provided directly to Michigan State University. Currently 40 states have established lead registries through the ABLES Program for surveillance of adult lead absorption, primarily based on reports of elevated blood lead levels (BLL) from clinical laboratories.

## **THE MICHIGAN ADULT BLOOD LEAD REGISTRY**

### **Reporting Regulations and Mechanism**

Since October 11, 1997, laboratories performing blood lead analyses of Michigan residents are required to report the results of all blood lead level (BLL) tests to the Michigan Department of Community Health (R325.9081-.9087 – Appendix A). Prior to these new regulations, few reports of elevated lead levels among adults were received.

The laboratories are required to report blood sample analysis results, patient demographics, and employer information on a standard Michigan Department of Community Health Lead Reporting Form (Appendix A). The physician or health provider ordering the blood lead analysis is responsible for completing the patient information, the physician/provider information and the specimen collection information. Upon receipt of the blood sample for lead analysis, the clinical laboratory is responsible for completion of the laboratory information. All clinical laboratories conducting business in Michigan that analyze blood samples for lead must report all adult and child blood lead results to the Michigan Department of Community Health, Childhood Lead Poisoning Prevention Program (MDCH/CLPPP) within five working days.

All blood lead results on individuals 16 years or older are forwarded to the Michigan Occupational Safety and Health Administration (MIOSHA) in the Michigan Department of Labor and Economic Growth (MDLEG) for potential follow-up. A summary of blood lead results from 2007 on children less than six years old is in Part I of this report.

### **Laboratories**

Employers providing blood lead analysis on their employees as required by the Michigan Occupational Safety and Health Administration (MIOSHA) are required to use a laboratory approved by OSHA to be in compliance with the lead standard. Appendix B lists the ten approved laboratories in Michigan. This number is the same as in the previous year.

### **Data Management**

When BLL reports are received at the MDCH, they are reviewed for completeness. For those reports where information is missing, copies are returned to the physician/provider to complete. Lead Registry staff code the information on the lead reporting form using a standard coding scheme and enter this information into a computerized database. Each record entered into the database is visually checked for any data entry errors, duplicate entries, missing data, and illogical data. These quality control checks are performed monthly.

### **Case Follow-Up**

Adults whose BLL is 25 µg/dL or greater are contacted for an interview. Interviews are conducted of individuals with blood lead levels ranging from 10 to 24 µg/dL if the source of their lead exposure cannot be identified from the reporting form. A letter is sent to individuals explaining Michigan's lead surveillance program and inviting them to answer a 15-20 minute telephone questionnaire about their exposures to lead and any symptoms they may be experiencing. The questionnaire collects patient demographic data, work exposure and history information, symptoms related to lead exposure, information on potential lead-using hobbies and non-work related activities, and the presence of young children in the household to assess possible take-home lead exposures among these children. Trained interviewers administer the questionnaire.

## **MICHIGAN OCCUPATIONAL SAFETY AND HEALTH ADMINISTRATION REQUIREMENTS**

### **Medical Monitoring and Medical Removal**

The Michigan Occupational Safety and Health Administration (MIOSHA) requirements for medical surveillance (i.e., biological monitoring) and medical removal are identical to those of Federal OSHA. The requirements for medical removal differ for general industry and construction. For general industry, an individual must have two consecutive blood lead levels above 60 µg/dL or an average of three blood lead levels greater than 50 µg/dL before being removed (i.e., taken pursuant to the standard or the average of all blood tests conducted over the previous six months, whichever is longer). For construction, an individual needs to have only two consecutive blood lead level measurements taken pursuant to the standard above 50 µg/dL. However, an employee shall not be required to be removed if the last blood-sampling test indicates a blood lead level ≤ 40 µg/dL. See Appendix C for a more detailed description of the requirements.

In the absence of a specific exposure to lead, the 95<sup>th</sup> percentile for blood lead levels in the adult general population are 5.3 for men and 3.6 for women (i.e. 95% of individuals in the general population have blood lead levels below these values) (6).

### **Dissemination of Surveillance Data**

Quarterly data summaries, without personal identifiers, are forwarded to the Program's funding agency, the National Institute for Occupational Safety and Health (NIOSH). NIOSH compiles quarterly reports from all states that require reporting of BLLs and publishes them in the Morbidity and Mortality Weekly Report (MMWR) (7). See Appendix D for the most recent publication which used ABLES data specifically for evaluation of lead exposure among females of childbearing age.

### **Results**

2007 is the tenth year with complete laboratory reporting in Michigan since the lead regulations became effective on October 11, 1997. Accordingly, this report provides a summary of all the reports of adult blood lead levels received in 2007 as well as more detailed information from interviews of those adults with BLLs 25 µg/dL and greater and the sample of individuals interviewed who had blood lead levels ranging 10-24 µg/dL. It also describes the Michigan Occupational Safety and Health Administration (MIOSHA) inspections at the work sites where these individuals were exposed to lead.

## **BLOOD LEAD LEVELS REPORTED IN 2007**

### **Number of Reports and Individuals**

Between January 1 and December 31, 2007, the State of Michigan received 15,893 blood lead level reports for individuals 16 years of age or older. Because an individual may be tested more than once each year, the 15,893 reports received were for 14,585 individuals (Table 1). The overall trend for number of individuals tested for blood lead each year has been a gradual increase (Figure 1). The initial steeper increase in 1999 and 2000 probably was secondary to better compliance by the laboratories with the new reporting regulation. The increase in more recent years is assumed secondary to increased testing.

The following descriptive statistics are based on the 14,585 individuals reported in 2007, and are based on the highest BLL reported for each of these adults.

### **Distribution of Blood Lead Levels**

In 2007, 768 (5.3%) of the 14,585 adults reported had blood lead levels greater than or equal to 10 µg/dL; 130 of those 768 (16.9%) had blood lead levels greater than or equal to 25 µg/dL and 9 of those 130 had blood lead levels greater than or equal to 50 µg/dL (Table 1). A total of 13,817 (94.7%) of the adults reported in 2007 had BLLs less than 10 µg/dL. Among those individuals whose blood lead was 10 µg/dL – 24 µg/dL, the percentage of individuals whose source of lead was work exposure was 85% as compared to individuals with higher blood leads ≥ 25µg/dL where work exposure was the source for 68%. There were 140 individuals whose source of elevated blood still needed to be determined (Table 1).

There has been a gradual decline in the overall number of individuals with elevated blood lead because of a reduction in elevated blood leads from occupational exposure from 2000-2005 with a plateau in 2006 and 2007 (Figure 2). For non-work exposures elevated blood lead increased from 1998 until 2003, when they began to decrease from 2004 to 2006 with a slight increase in 2007. (Figure 3).

## **GENDER AND AGE DISTRIBUTION**

### **All Blood Lead Levels**

Fifty-seven percent of the adults reported to the Registry were male, and 43 percent were females (Table 2). The age distribution is shown in Table 3. The mean age was 43.

### **Blood Lead Levels $\geq$ 10 $\mu\text{g}/\text{dL}$**

For the 768 adults reported to the Registry with blood lead levels  $\geq$  10  $\mu\text{g}/\text{dL}$ , 740 (96.4%) were men and 28 (3.6%) were women (Table 2). The age distribution for these adults is shown in Table 3. The mean age was 46.

## **RACE DISTRIBUTION**

### **All Blood Lead Levels**

Although laboratories are required to report the patients' race, this information is frequently not provided. Race was missing for 8,763 (60.1%) of the 14,585 adults reported. Where race was known, 4,923 (84.6%) were reported as Caucasian, 756 (13.0%) were reported as African American, 64 (1.1%) were reported as Native American, 45 (0.8%) were reported as Asian/Pacific Islander, and 34 (0.6%) were reported as Multiracial/Other (Table 4).

### **Blood Lead Levels $\geq$ 10 $\mu\text{g}/\text{dL}$**

For adults with blood lead levels greater than or equal to 10  $\mu\text{g}/\text{dL}$  where race was indicated, 488 (90.7%) were reported as Caucasian, 35 (6.5%) were reported as African American, 7 (1.3%) were reported as Multiracial/Other, 5 (0.9%) were reported as Native American, and 3 (0.6%) were reported as Asian/Pacific Islander, (Table 4). The percentage of African-Americans with blood leads levels  $\geq$  10 $\mu\text{g}/\text{dL}$  was decreased as compared to all blood lead levels.

## **GEOGRAPHIC DISTRIBUTION**

County of residence was determined for 11,491 of the 14,585 adults reported to the Registry. They lived in all of Michigan's 83 counties. The largest number of adults reported in 2007 lived in Wayne County (2,079, 18.1%), followed by Kent County (1,427, 12.4%) and Oakland County (898, 7.8%). The county was unknown for 3,094 adults (Figure 4 and Table 5).

Figure 5 and Table 5 show the county of residence of the 631 adults with blood lead levels greater than or equal to 10  $\mu\text{g}/\text{dL}$  where county of residence could be determined. The largest number of adults reported with a BLL of 10  $\mu\text{g}/\text{dL}$  and greater were from Wayne County (112, 17.8%), followed by Montcalm County (80, 12.7%) and St. Clair County (70, 11.1%). The county was unknown for 137 adults.

Figure 6 and Table 5 show the county of residence for the 119 adults with blood lead levels greater than or equal to 25  $\mu\text{g}/\text{dL}$  where county of residence could be determined. The largest

number of adults reported with a BLL of 25 µg/dL and above were from Wayne County (26, 21.9%), followed by Macomb County (12, 10.1%). The county was unknown for 11 adults.

Figure 7 and Table 5 show the percentage of adults tested for blood lead within each county with BLLs of 10 µg/dL or greater. Montcalm (80, 46.8%), St. Clair (70, 28.0%), and Kalkaska (20, 18.2%) counties had the highest percentages of adults with BLLs of 10 µg/dL or greater.

Figure 8 and Table 5 show the percentage of adults tested for blood lead within each county with BLLs of 25 µg/dL or greater. Montmorency (1, 11.1%), Iosco (1, 7.1%) and Gratiot (3, 4.1%) counties had the highest percentage of adults with BLLs of 25 µg/dL or greater.

Figure 9 and Table 6 show the incidence rates of BLLs of 10 µg/dL and above, by county, for women. There were 25 women reported in 2007 with a BLL of 10 µg/dL or greater where county of residence could be determined. Crawford (17/100,000) and Clinton (2/100,000) had the two highest incidence rates. With source of exposure known, women with elevated blood lead had their exposure from work (5, 50%), one in stone/clay/glass, one in fabricated metal products, one in automotive repair services, one in educational services, and one in government. Women with elevated blood leads also had non-work exposures mostly from firearms (3, 30%), remodeling performed in their homes (1, 10%), and leather tooling (1, 10%). Source of exposure was unknown for 18 of the 28.

Figure 10 and Table 7 show the incidence rates of BLLs of 10 µg/dL and above, by county, for men. There were 606 men reported in 2007 with a BLL of 10 µg/dL or greater where county of residence could be determined. Montcalm (311/100,000), St. Clair (104/100,000) and Clinton, (70/100,000) had the highest incidence rates. The elevated rates in these counties were secondary to individuals exposed to lead while working in brass/bronze foundries. The overall incidence rate for men was 16 times higher than that for women (16/100,000 vs. 1/100,000).

## SOURCE OF EXPOSURE

Table 8 shows the source of exposure of lead for individuals with blood lead levels greater than 10 µg/dL reported in 2007. For 519 (81.9%) individuals, work was the identified source. For 115 (18.1%) additional individuals non-occupational activities were identified as the source of exposure. Of those 115, 83 (72.2%) individuals were exposed from a hobby related to guns and 9 (7.8%) were exposed during home remodeling. For an additional 136 individuals, we are still investigating the source.

Table 9 shows the occupational sources of lead for individuals reported in 2007. The most frequent reports were on individuals in the manufacturing sector (51.6%), and construction (32.7%).

Figure 11 shows the distribution of the twenty-two non-construction companies that reported at least one adult with a BLL of 25 µg/dL or greater in Michigan during 2007. For eight additional companies we were unable to determine county. These thirty companies included brass/bronze casting operations, radiator repair facilities and indoor firing ranges. Of the 519 individuals with blood lead  $\geq$  10 µg/dL where exposure occurred at work, 260 (50.4%) were from these thirty companies. Of the 88 individuals with blood lead  $\geq$  25µg/dL and exposure occurred at work, 54 (61.4%) were also from these thirty companies.

Blood leads have generally been decreasing across all types of industry, although results have plateaued or slightly increased in 2006 and 2007 (Figure 12).



## Summary of Industrial Hygiene Inspections

Since the 2006 report, the statewide surveillance system identified ten companies where MIOSHA had not performed a recent inspection for lead. Five of the ten companies were inspected in 2007.

The first company inspected was a manufacturer of custom colored plastic pellets. Although, the process that had the highest exposures to lead was only run approximately four times per year, the quantities run were 40,000-82,000 pounds. No air monitoring was performed by the company. Air sampling for lead performed during the MIOSHA inspection showed values 3-12 times greater than the allowable limit. The company received a citation that was abated during the investigation because the company elected to use "encapsulated" lead in the future.

The second company inspected was a construction company involved in a building renovation of a former state hospital. Paint containing lead that was being removed was the source of exposure. The company received three citations, two of which were lead-related for inadequate assessment of the presence of lead and for lack of interim protection of workers when lead exposure was unknown.

The third company inspected performed automotive radiator repair services. The source of the lead exposure was determined to be the tear down and assembly of copper/brass radiators with the use of lead solder. The company received four non-lead related citations.

The fourth company inspected was a stained glass window operation. The company did not receive any citations as a result of this investigation. The company had previously been cited during a 2003 investigation for inadequate assessment of lead exposure and notification of workers.

The fifth company inspected was a heating equipment manufacturer. The source of lead at the company was determined to be in the milling of red brass, trimming of yellow brass, and soldering with lead/tin paste solder. The company received two lead-related citations for lack of adequate training and the hazards of lead and inadequate assessment of personal protective equipment needed to protect against lead exposure.

Of the ten companies identified, two were identified by an elevated blood lead report collected because of the company's medical surveillance program, seven from a private provider, and one we were unable to determine the source of the report. Sixty-four percent of the individuals with blood leads greater than 25 µg/dL were from 30 companies. This indicates a highly focused effort on a relatively small number of companies could potentially reduce the majority of the highest blood leads.

## CASE NARRATIVES

Appendix E contains brief narratives about individuals with blood lead greater than or equal to 50 µg/dL.

### Interviews of Adults with Blood Lead Levels of 10 µg/dL or Greater

Between October 15, 1997, and December 31, 2007, there were 1,478 reports received on adults with blood lead levels  $\geq 10$  µg/dL that completed an interview by telephone. The following summary of interview data is based on the 1,478 questionnaires completed by telephone.

Table 10 lists the demographic characteristics of the 1,478 adults with completed questionnaires by highest lead level reported. Most of the completed questionnaires were of males (90.1%), which parallels the gender distribution of the number of lead level reports  $> 10$  µg/dL. There was no difference in gender by highest blood lead level. Although based on small numbers the percentage of African-Americans was greater among adults with the highest blood lead levels ( $\geq 60$  µg/dL). The percentage of ever or current smokers was higher among adults with the higher blood lead levels. The group with the highest lead levels had the youngest mean age.

The higher blood leads were most common in high school graduates without any college education and high school graduates with 1-3 years of college or technical school than in those who had not graduated high school or had completed college (Table 11).

Table 12 presents the types of lead-related symptoms reported during the interviews, by lead level. Only individuals who had daily or weekly symptoms were included in this table. Loss of 10+ pounds without dieting, continued loss of appetite, frequent pain/soreness, headache, being tired, feeling nervous, waking up at night, and being irritable were associated with a statistically significant increasingly higher levels of blood lead. Having any gastro-intestinal, musculoskeletal, nervous or reproductive system symptom was associated with statistically significant increasingly higher levels of blood lead. Table 13 shows the reporting of anemia, kidney disease, high blood pressure and hearing loss by lead level category.

Table 14 presents the type of industry by lead level reported among those interviewed. Overall, 32.9% worked in special trade construction, followed by 22.5% who worked in the primary metals industry. Among individuals with the higher blood leads ( $\geq 40$  µg/dL), the most common exposure was the same as for all elevated blood lead levels with construction followed by the primary metals industry (non-ferrous foundries). Table 15 presents the number of years worked by highest lead level reported for the adults who completed a questionnaire. Higher blood lead level results were more likely to occur in shorter-term workers (i.e., worked in a lead exposed job for five or fewer years).

Table 16 lists the types of working conditions reported by the interviewed adults, again by highest lead level reported. Workers with lower lead levels were more likely to report having their work clothing laundered at work, having a showering facility and having a separate lunch room. They also were more likely to report eating in the lunch room. As expected, workers with higher blood lead levels were more likely to have been removed from the job.

Figures 13 and 14 depict the trend of percent of working conditions, and personal habits reported by the interviewed adults, by interview year, for the last ten years of surveillance. Figure 13 shows a slight downward trend for separate lockers for street and work clothes, a shower facility, work clothes laundered at work, and an available lunch room, all working conditions or work practices that reduce lead exposure; no change in washing before eating or eating in lunch room; and an improvement with less smoking of cigarettes in the work area or carrying cigarettes in exposed pockets into work area.

The questionnaire also asks about children in the household, in order to document the potential for and extent of take-home lead. Twenty-seven percent of the adults interviewed reported children age 6 and younger living or spending time in the home (Table 17). Children from 115 of the 391 (32.5%) households where an adult had an elevated lead level and young children lived or frequently visited were tested for blood lead. Among the 115 households where the adult interviewed reported the child's blood test results, 38 (35.2%) households had a child with an elevated blood lead level ( $\geq 10$   $\mu\text{g}/\text{dL}$ ). A letter was sent to all adults encouraging them to test any children age 6 and younger who lived or frequently visited their house for lead.

Figure 15 depicts the percent of households with children being tested for blood lead reported by the interviewed adults, by interview year, for the last ten years of surveillance. In 1999 and 2002, there were peaks in the percent of households with children with elevated blood lead, 60% and 66% respectively, which then decreased and was at its lowest value of 17% in 2006 but then increased slightly in 2007 to 20%. In 2004, there was a peak of the percent of households with children tested for lead (58%), which then decreased and remained unchanged from 2005 to 2006 and then increased to 48% in 2007.

## DISCUSSION

An individual may have a blood lead test performed as part of an employer medical-screening program or as part of a diagnostic evaluation by their personal physician. Whatever the reason for testing, the results are then sent by the testing laboratories to the MDCH as required by law. If the individual reported is an adult, the report is then forwarded to the MDLEG and maintained in the ABLES Program Lead Registry. Individuals with a blood lead level of 25  $\mu\text{g}/\text{dL}$  or greater, and a sample of individuals with blood lead levels of 10-24  $\mu\text{g}/\text{dL}$ , are interviewed by a trained interviewer by telephone. The interview details demographic information, exposure history and the presence and nature of lead related symptoms. A MIOSHA enforcement inspection is conducted to assess the company's compliance with the lead standard when an individual from a company is identified with a blood lead value of 25  $\mu\text{g}/\text{dL}$  or greater.

Michigan is one of 40 states conducting surveillance of elevated blood lead levels. Michigan requires the reporting of all blood lead level results. Major benefits for reporting all blood lead levels are: the ability to calculate the rates of elevated blood lead levels in specific groups of interest, the ability to monitor compliance with the testing requirements of the lead standard, and facilitating the tracking of reports from particular employers to monitor their progress in reducing workers' exposures to lead.

Data from the state surveillance systems shows that elevated lead levels from occupational exposures are an important public health problem in the United States (7). It is well-documented that exposure to lead may cause serious health effects in adults, including injury to the nervous system, kidneys, and blood-forming and reproductive systems in men and women. The level of lead in the blood is a direct index of a worker's recent exposure to lead as well as an indication of the potential for adverse effects from that exposure (8). A further problem is that workers can bring lead home on their clothes and expose children to lead. This is a high risk group because when these children are tested, 35% are found to have blood levels greater than or equal to 10µg/dL (Table 17). Children can experience serious adverse effects on neurological and intellectual development from lead exposure. And while the number of children state wide being tested for lead has markedly increased, there has only been a slight increase of blood lead testing among the children of lead exposed workers (Figure 15).

Symptoms involving the gastrointestinal, musculoskeletal and nervous systems occurred at levels within the allowable MIOSHA and OSHA standards (Table 12). The presence of these symptoms supports the need to lower the blood lead level that mandates medical removal. The current allowable level is up to 50 µg/dL. Ninety-six percent of individuals with blood lead below this level had daily or weekly symptoms consistent with lead toxicity. A recent mini-monograph of articles in Environmental Health Perspectives (EHP) has documented the inadequacy of the current OSHA standard to protect against the health effects of lead (5). Articles in this mini-symposium included a systemic review of lead exposure and cardiovascular disease (3) and lead exposure and cognitive function in adults (4). It also included a useful guide for management of individuals with blood lead levels above the population average of 1.45 µg/dL (5). In 2006, a letter was sent to the ten Michigan approved laboratories by OSHA to perform blood lead analysis recommending the laboratories change the interpretative language on their laboratory reports to confirm with Table 3 in one of the recent articles in EHP (5).

In 2007, there were 768 adults reported in Michigan with blood lead levels  $\geq 10$  µg/dL. Approximately ninety-six percent were men. The mean age was 46. They were predominately white (90.7%) and lived in a band of counties stretching across the state from Muskegon and Oceana to Wayne and Macomb. The source of exposure to lead was predominately occupational in origin (82%). Exposure occurred during the manufacture of non-ferrous metal parts such as plumbing fixtures, during abrasive blasting to remove paint from outdoor metal structures, during the fabricating of metal products, during the repair of car radiators or during work in indoor firing ranges.

Individuals with the highest blood leads were more likely to be younger (Table 11). We attribute this finding to a higher percentage of younger workers in construction doing abrasive blasting on metal structures. Also younger, less experienced workers may be given the dirtier, less desirable tasks.

Based on the experience in other states we presume that the number of reports of elevated blood lead levels we receive is an underestimate of the true number of Michigan citizens with elevated blood lead levels (9, 10). For example, a study in California in the early 90's reported that while 95% of lead battery employees had blood leads performed by their employers, only 8% of employees from radiator repair facilities and 34% of employees from secondary smelters of non-ferrous metal had blood leads performed by their employer (9). Overall it was estimated that less than 3% of employees in California exposed to lead were provided blood lead testing by their employer (10). On a national basis it was estimated that less than 12% of companies using lead provided blood lead testing for their employees (9). Our survey performed 15 years later on 28 Michigan radiator repair facilities showed only slightly better results with 25% were performing blood testing for lead. MIOSHA inspected 11 radiator repair facilities which were not performing blood tests found that 7 (64%) were required by OSHA regulations to be performing such testing.

Nine adults had blood lead levels above 50 µg/dL, which is the maximum blood lead level allowed in the workplace. Five of the nine adults were exposed to lead at work (two from foundries, one from wrecking/demolition, one from metal working machinery and equipment, one from sanitary services, and one from metal finishing). The remaining four adults were exposed to lead from remodeling, casting bullets, using firearms, and one from a gun shot wound.

In its tenth year of operation, the surveillance system for lead continues to prove successful in identifying large numbers of adults with elevated lead levels and sources of exposure that could be remediated to reduce exposures. Continued outreach is planned to the medical community on the recognition and management of individuals with potential lead-related medical problems. Increased focus should be made on the high risk group of children in the homes of occupationally exposed adults recognizing that when these children are tested, 35% are found to have blood leads greater than or equal to 10µg/dL (Table 17). Reevaluation of the current occupational lead standard is needed as health effects have been documented at levels allowed within the current standard. We continue to be encouraged by the continued compliance with the reporting law by laboratories. The reduction in elevated blood lead levels, particularly from occupational exposures has appeared to plateau (Figure 3). This plateau coupled with a decrease in the number of individuals who report preventive workplace practices to reduce lead at the facility where they were exposed to lead (Figure 13) has us concerned that the progress in previous years to reduce lead exposure has stalled. We will continue to monitor for these trends in 2008.

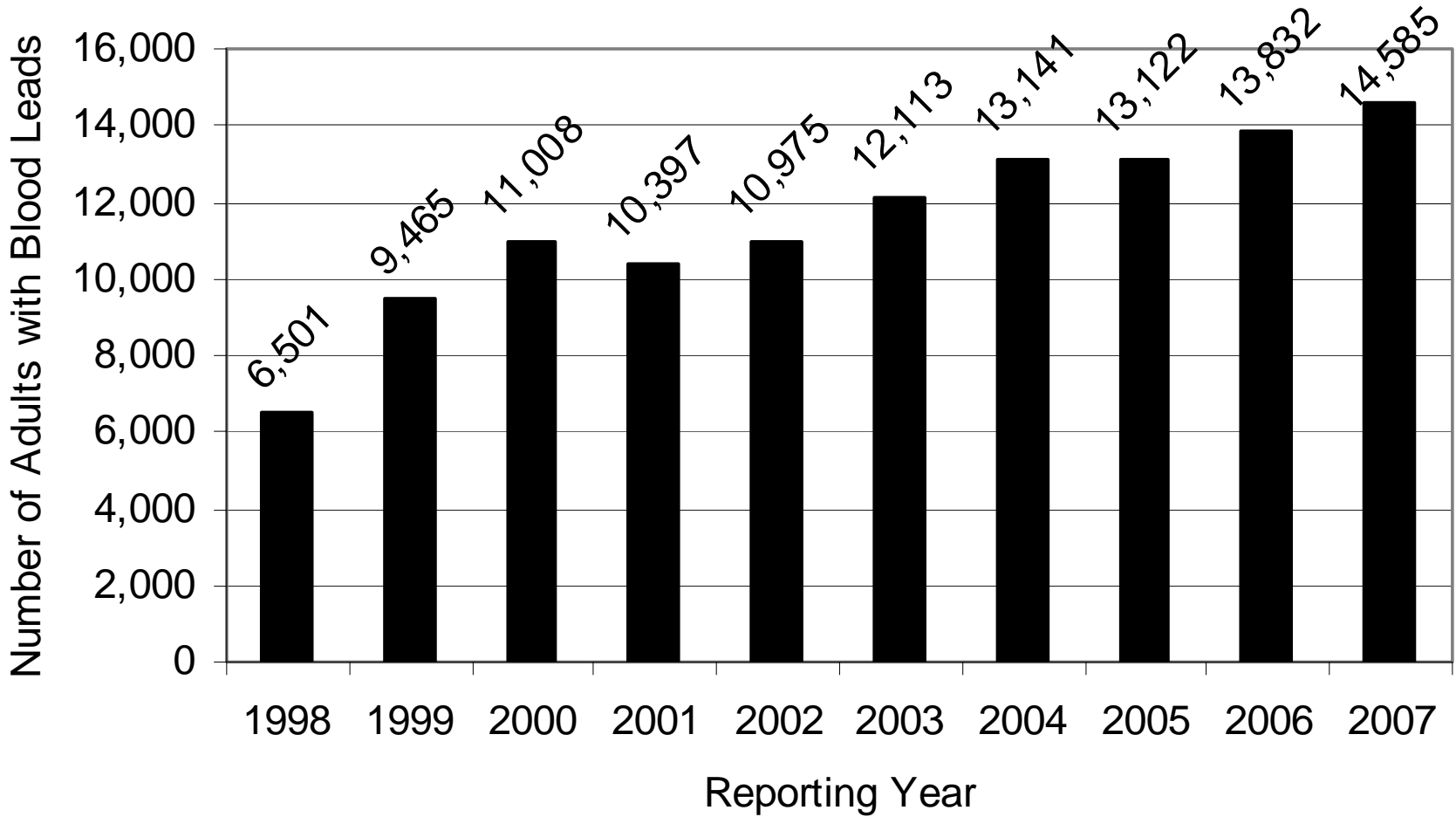
## REFERENCES

1. CDC. Third National Report on Human Exposure to Environmental Chemicals. Atlanta: Centers for Disease Control and Prevention 2005: NCEH Publication No. 05-0570.
2. Schwartz B, Hu H. Adult Lead Exposure: Time for Change: Environmental Health Perspective 2007; 115: 451-454.
3. Navas-Acien A, Guallar E, Silbergeld E, Rothenberg S. Lead Exposure and Cardiovascular Disease – A Systematic Review. Environmental Health Perspective 2007; 115: 472-482.
4. Shih R, Hu H, Weisskopf M, Schwartz B. Cumulative Lead Dose and Cognitive Function in Adults: A Review of Studies That Measured Both Blood Lead and Bone Lead. Environmental Health Perspective 2007; 115: 483-492.
5. Kosnett M, Wedeen R, Rothenberg S, Hipkins K, Materna B, Schwartz B, Hu H, Woolf A. Recommendations for Medical Management of Adult Lead Exposure. Environmental Health Perspective 2007; 115: 463-471.
6. Centers for Disease Control and Prevention. Third National report on Human Exposure to Environmental Chemicals. Atlanta, Georgia: CDC, 2005
7. Lead Exposure Among Females of Childbearing Age --- United States, 2004. Morbidity and Mortality Weekly Report. MMWR. 2007; 56(16); 397 - 400.
8. ATSDR. Toxicological Profile for Lead. US Department of Health Human Services. Agency for Toxic Substances and Disease Registry. August 1997.
9. Baser ME. The Development of Registries for Surveillance of Adult Lead Exposure, 1981 to 1992. American Journal of Public Health. 1992; 82: 1113-1118.
10. Rudolph L, Sharp DS, Samuels S, Perkins C, Rosenberg J. Environmental and Biological Monitoring for Lead Exposure in California Workplaces. American Journal of Public Health 1990; 80: 921-925.

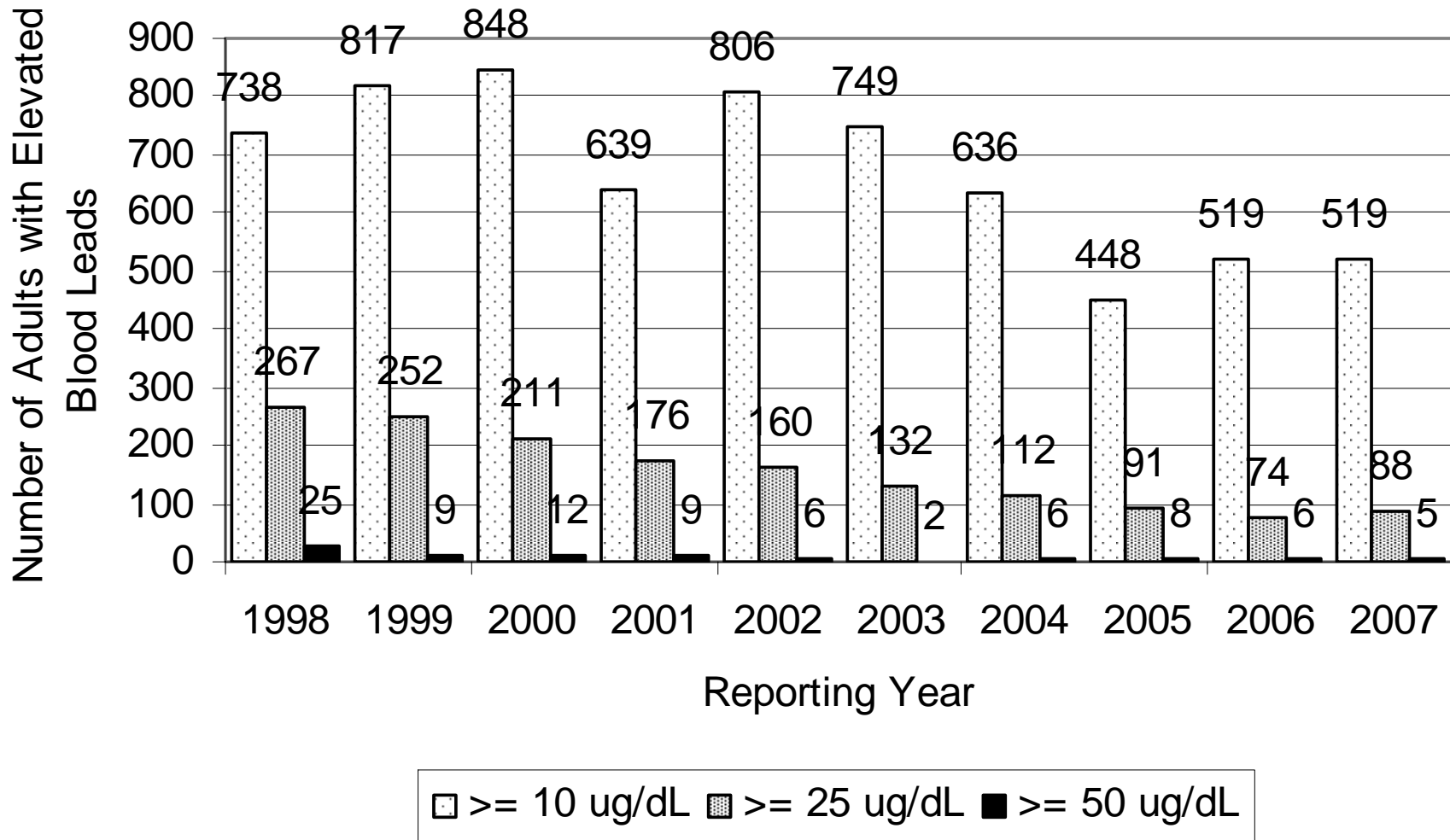
## APPENDICES

Appendix A	Blood Lead Analysis Reporting
Appendix B	OSHA Blood Lead Laboratories: Michigan
Appendix C	Summary of Michigan's Lead Standards
Appendix D	Morbidity and Mortality Weekly Report (MMWR): Lead Exposure Among Females of Childbearing Age ---United States, 2004
Appendix E	Case Narratives

**FIGURE 1**  
**Number of Adults Tested for Blood Lead, Michigan 1998-2007**

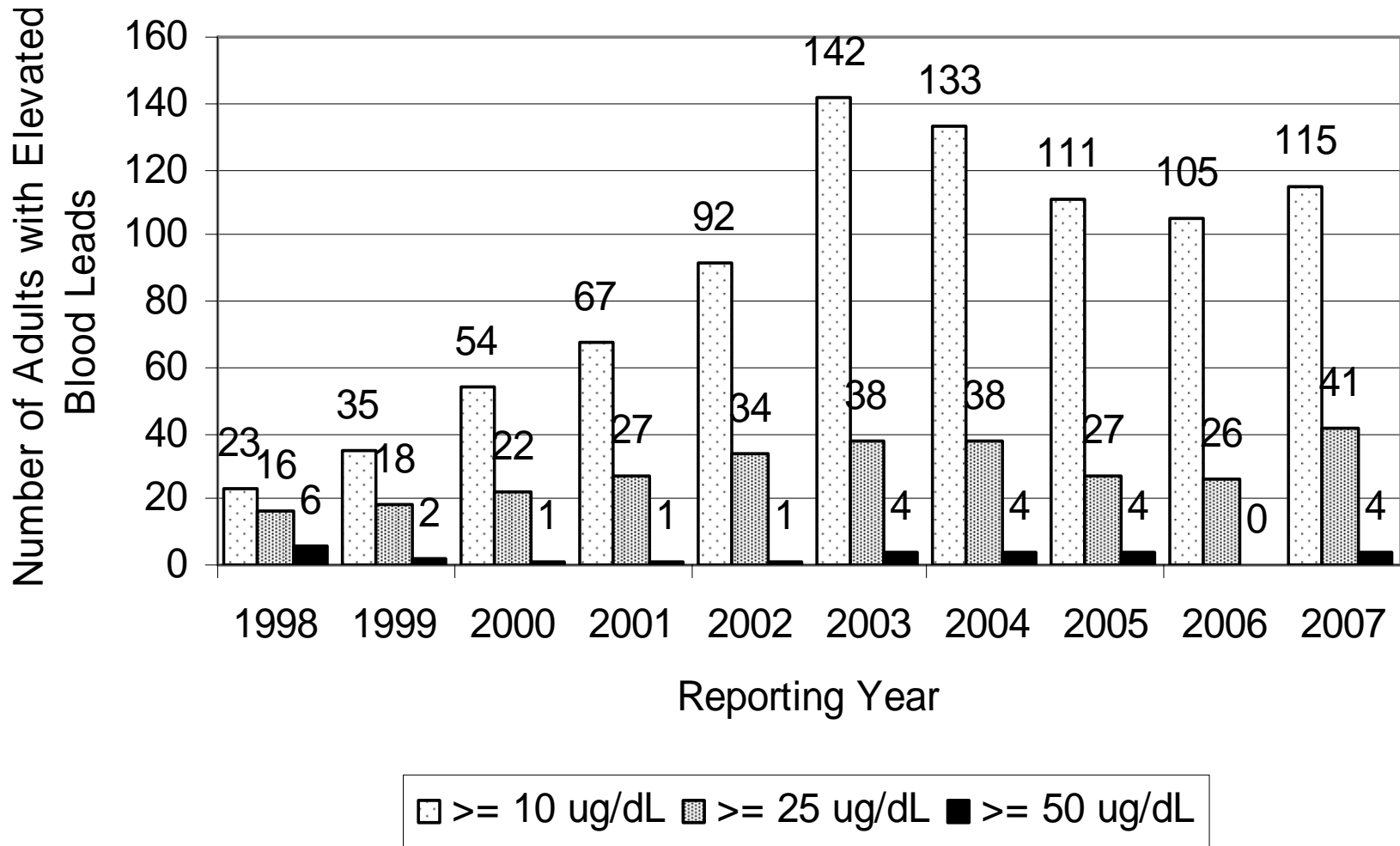


**FIGURE 2**  
**Number of Adults with Blood Lead Levels  $\geq 10 \mu\text{g/dL}$ ,  $\geq 25 \mu\text{g/dL}$  and  $\geq 50 \mu\text{g/dL}$  Exposed to Lead at WORK, Michigan 1998 - 2007**

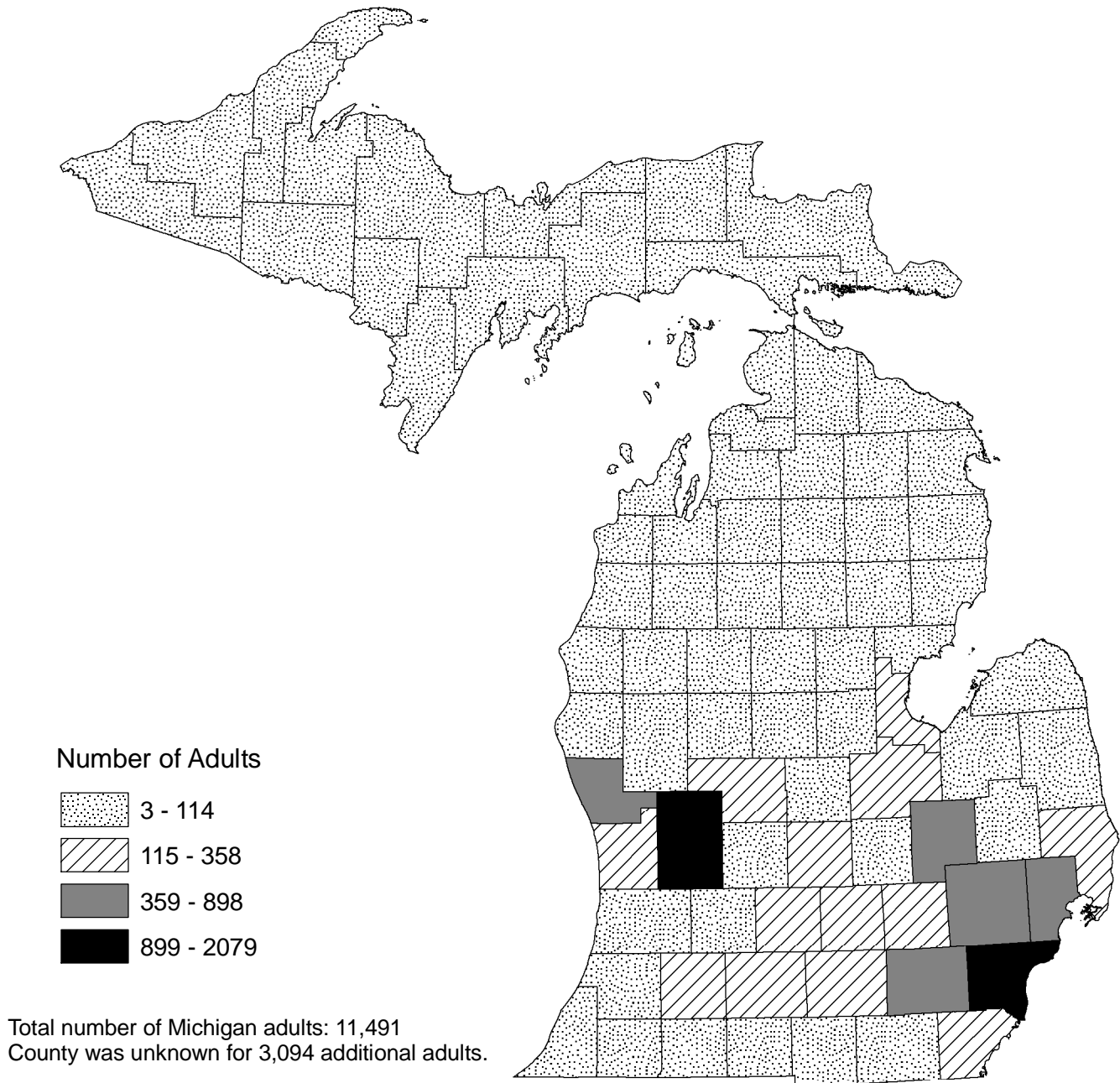




**FIGURE 3**  
**Number of Adults with Blood Lead Levels  $\geq 10 \mu\text{g/L}$ ;  $\geq 25 \mu\text{g/dL}$  and  $\geq 50 \mu\text{g/dL}$  Exposed to Lead NOT AT WORK, Michigan 1998-2007**

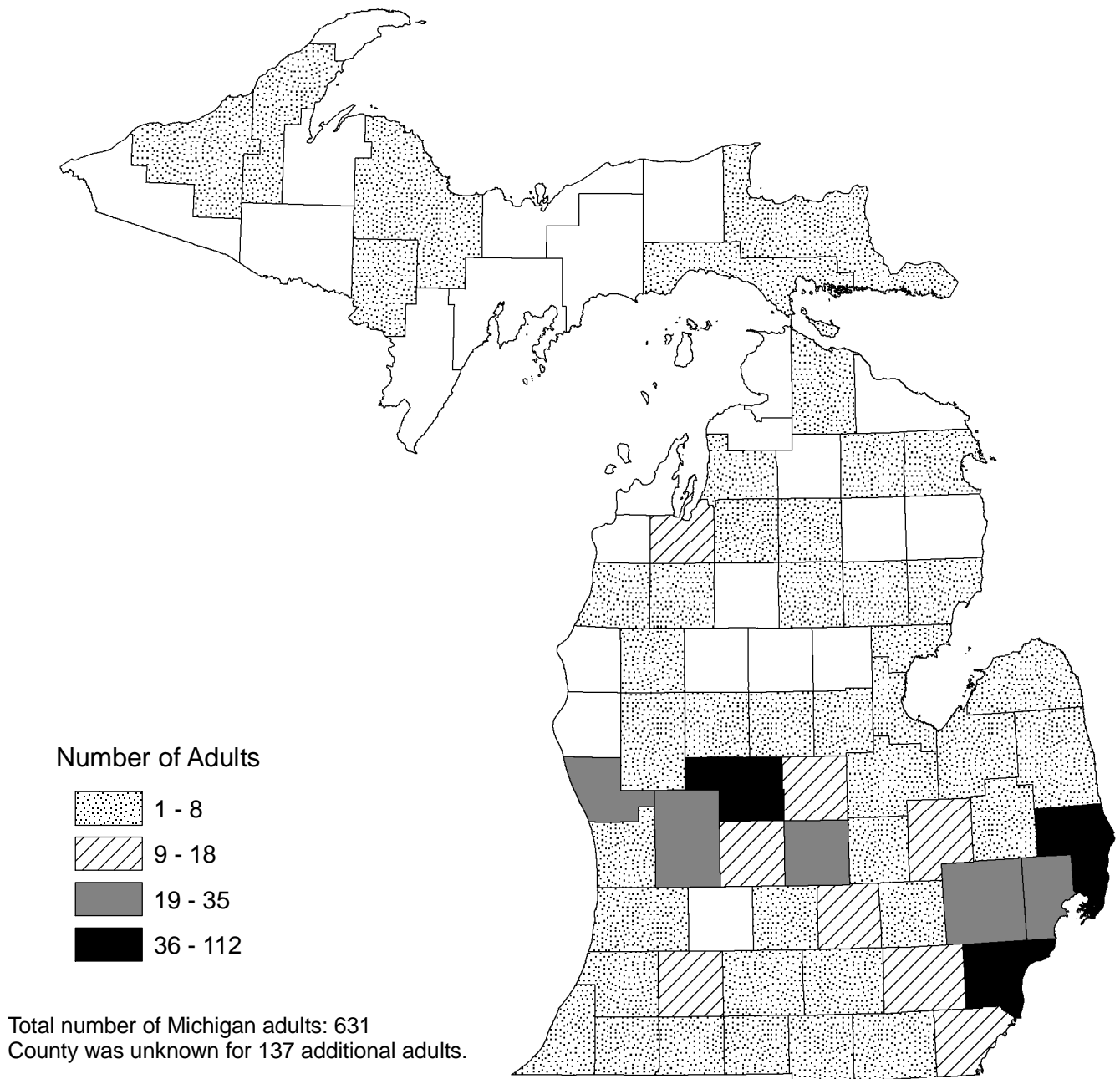


**FIGURE 4**  
**Distribution of Adults Tested for Blood Lead**  
**in Michigan by County of Residence, 2007**



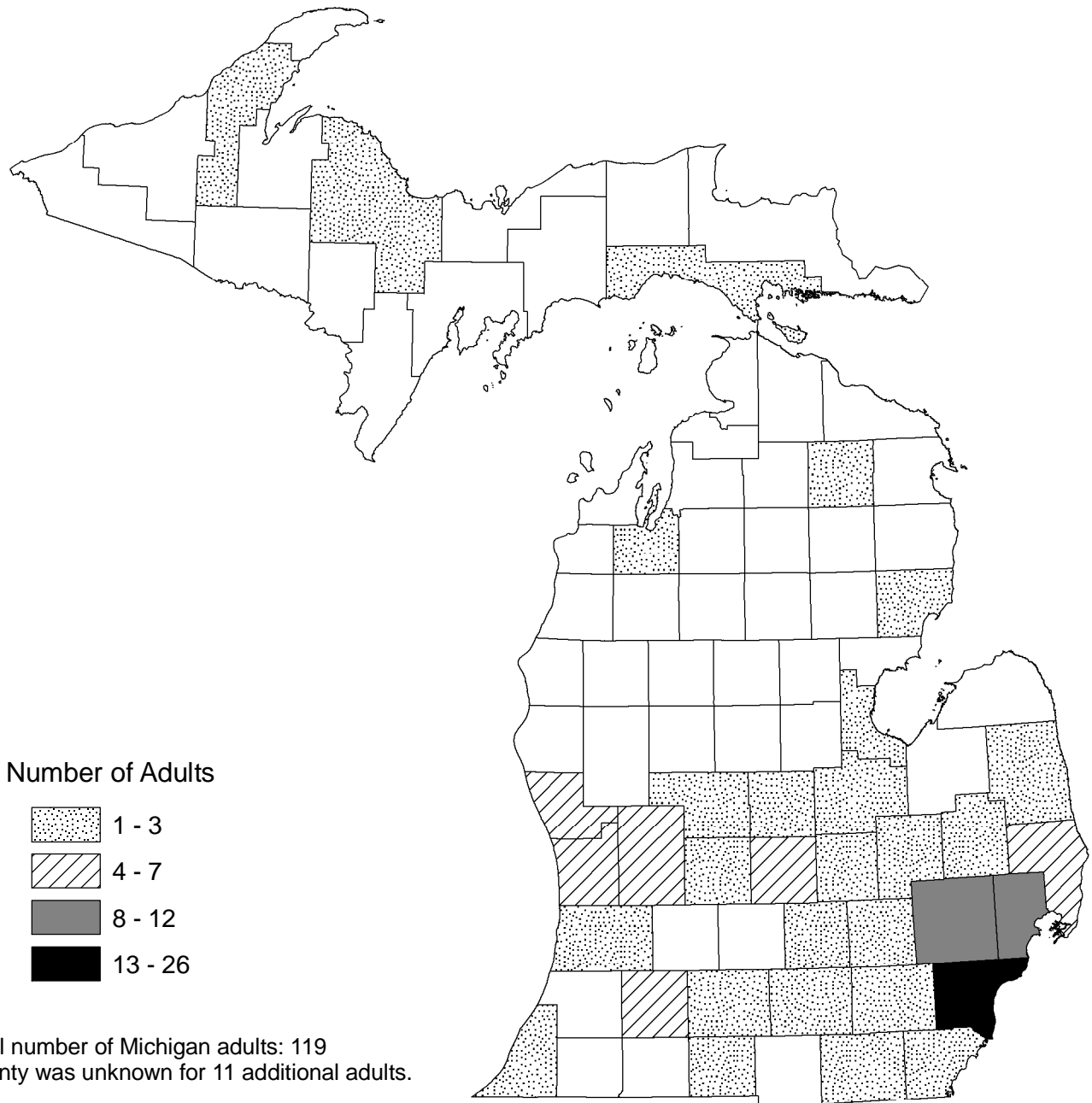
Kent and Wayne counties had the highest number of adults reported, with 1,427 and 2,079, respectively.

**FIGURE 5**  
**Distribution of Adults with Blood Lead Levels (BLLs)  $\geq 10$  ug/dL**  
**in Michigan by County of Residence, 2007**



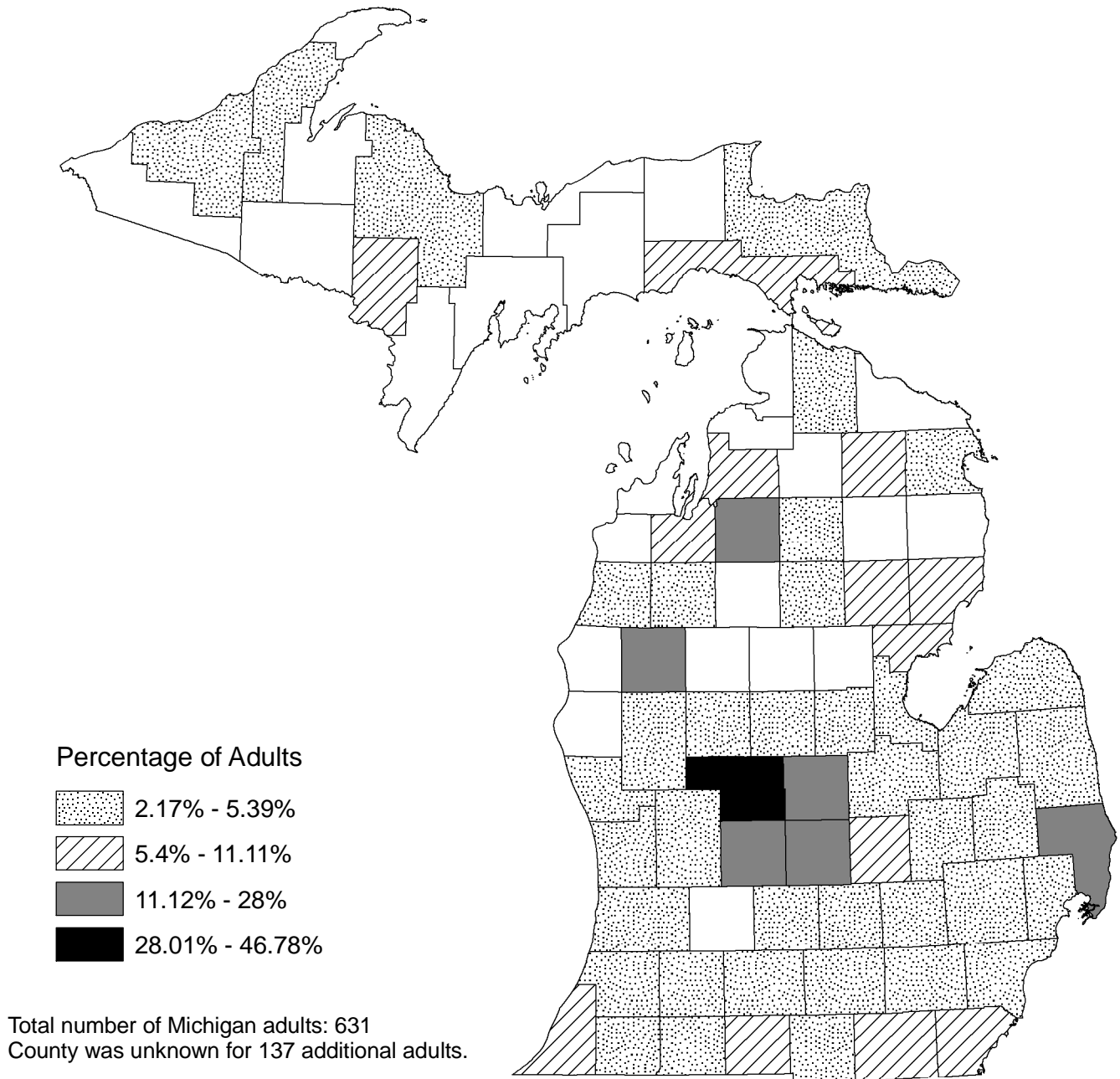
Montcalm and Wayne counties had the highest number of adults reported, with 80 and 112, respectively.

**FIGURE 6**  
**Distribution of Adults with Blood Lead Levels (BLLs)  $\geq$  25 ug/dL**  
**in Michigan by County of Residence, 2007**



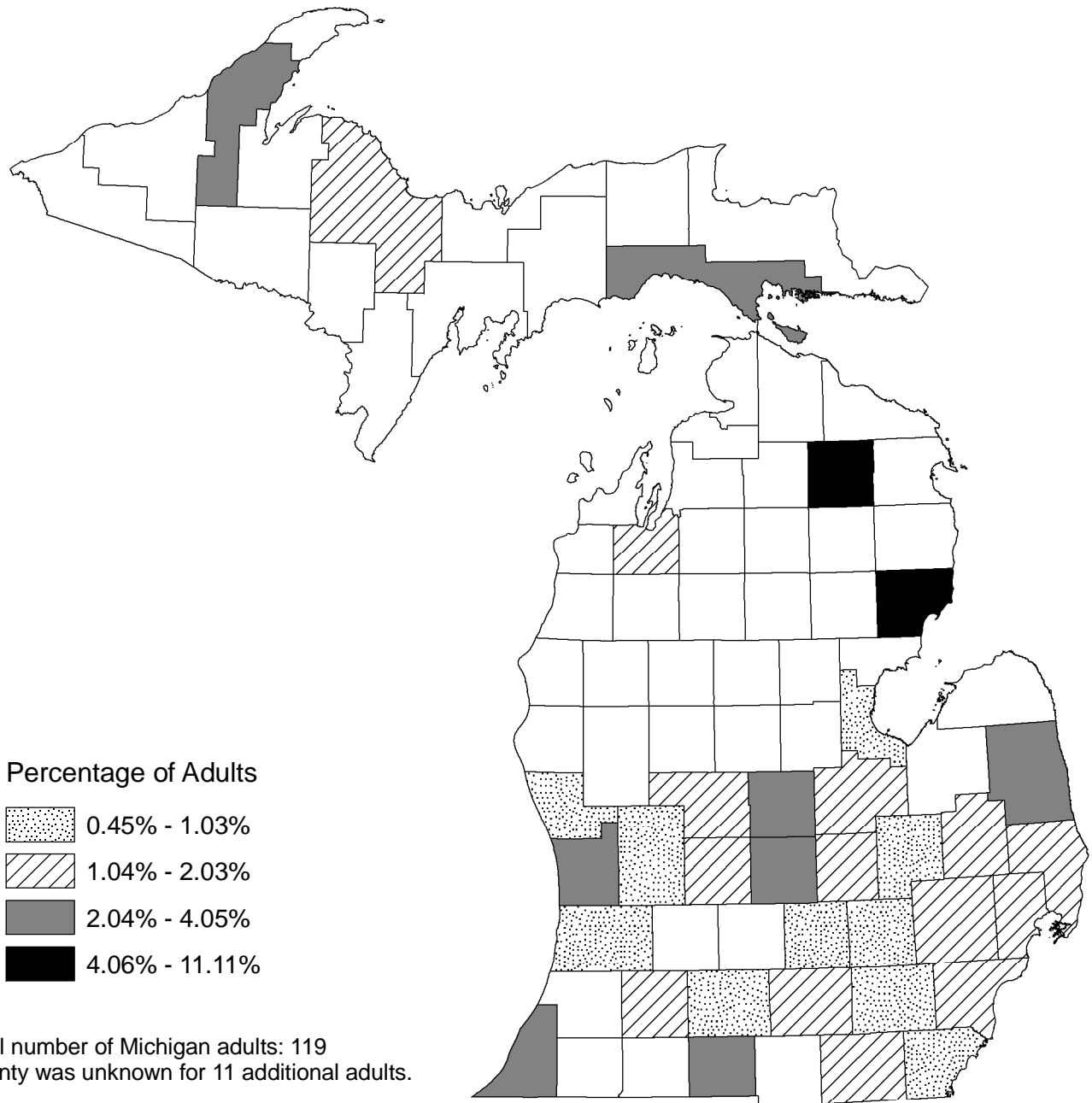
Macomb and Wayne counties had the highest number of adults reported, with 12 and 26, respectively.

**FIGURE 7**  
**Percentage of Adults with Blood Lead Levels (BLLs)  $\geq$  10 ug/dL**  
**in Michigan by County of Residence, 2007\***



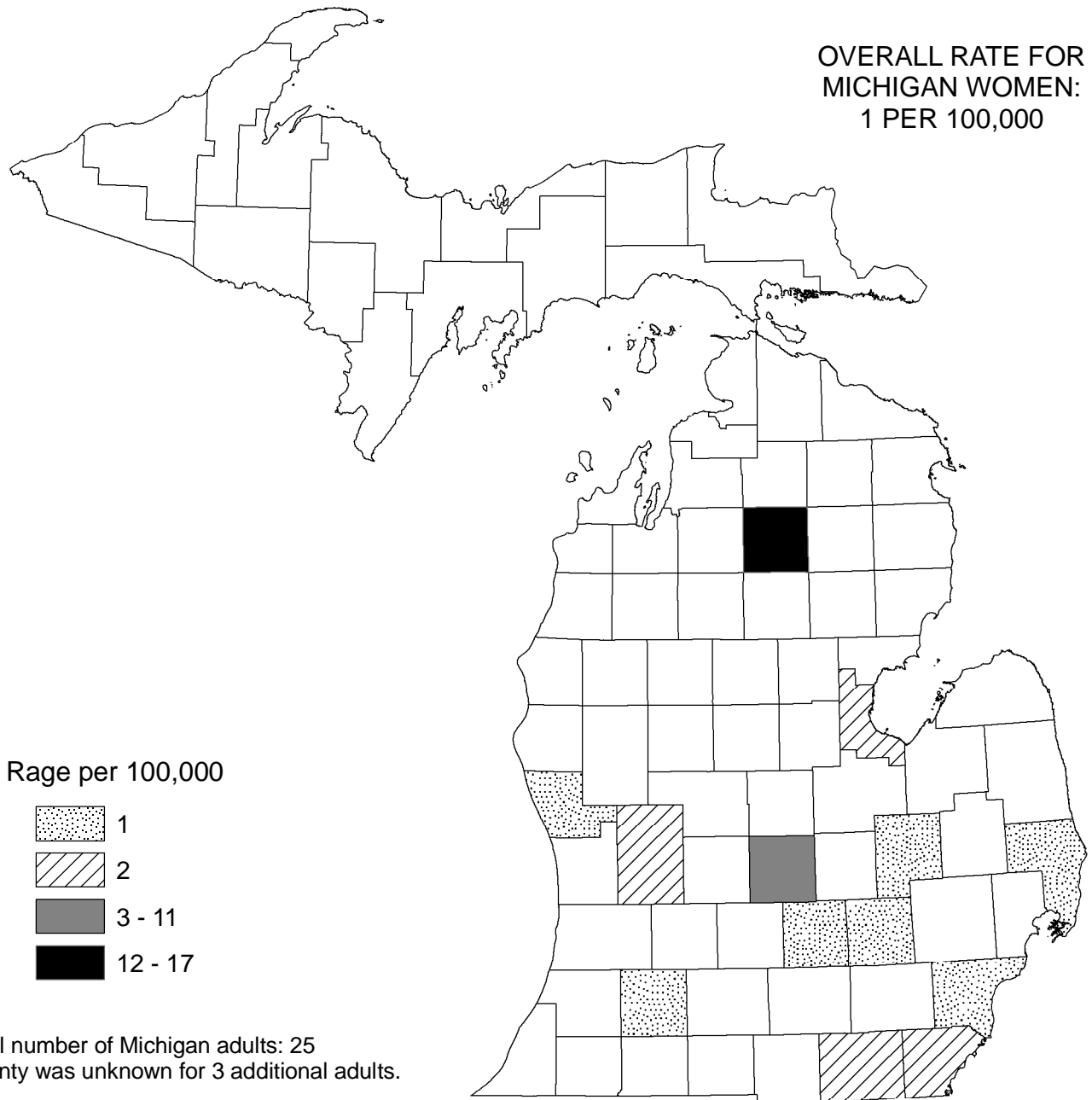
\*Denominator used was the total number of adults tested for blood lead within each county.

**FIGURE 8**  
**Percentage of Adults with Blood Lead Levels (BLLs)  $\geq$  25 ug/dL**  
**in Michigan by County of Residence, 2007\***



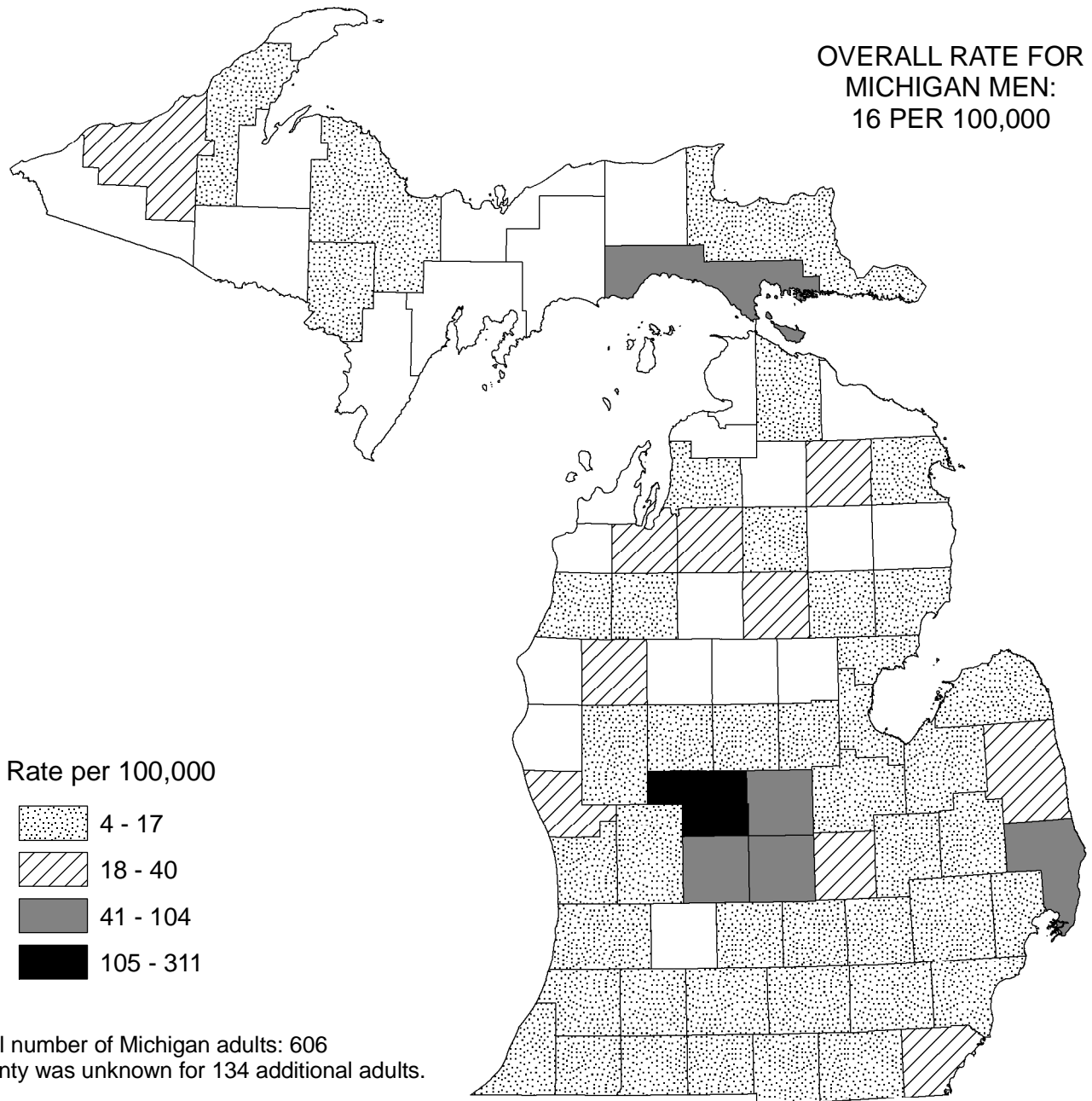
\*Denominator used was the total number of adults tested for blood lead within each county.

**FIGURE 9**  
**Annual Incidence of Blood Lead Levels (BLLs)  $\geq$  10 ug/dL**  
**Among Women in Michigan by County of Residence, 2007\***



\*Rate per 100,000 women age 16+; denominator is the Census County Population Estimates: April 1, 2000 to July 1, 2006.

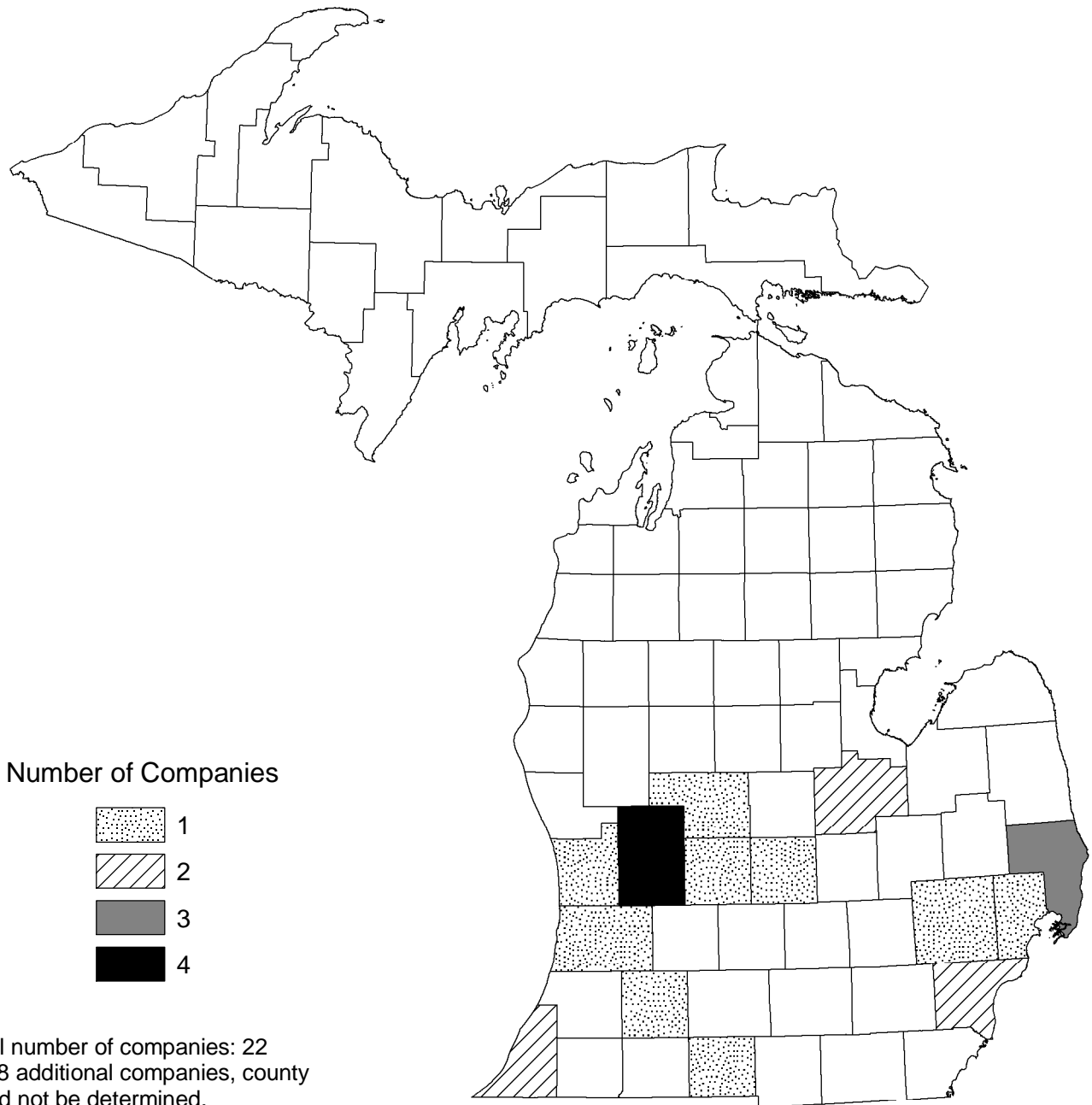
**FIGURE 10**  
**Annual Incidence of Blood Lead Levels (BLLs)  $\geq$  10 ug/dL**  
**Among Men in Michigan by County of Residence, 2007\***



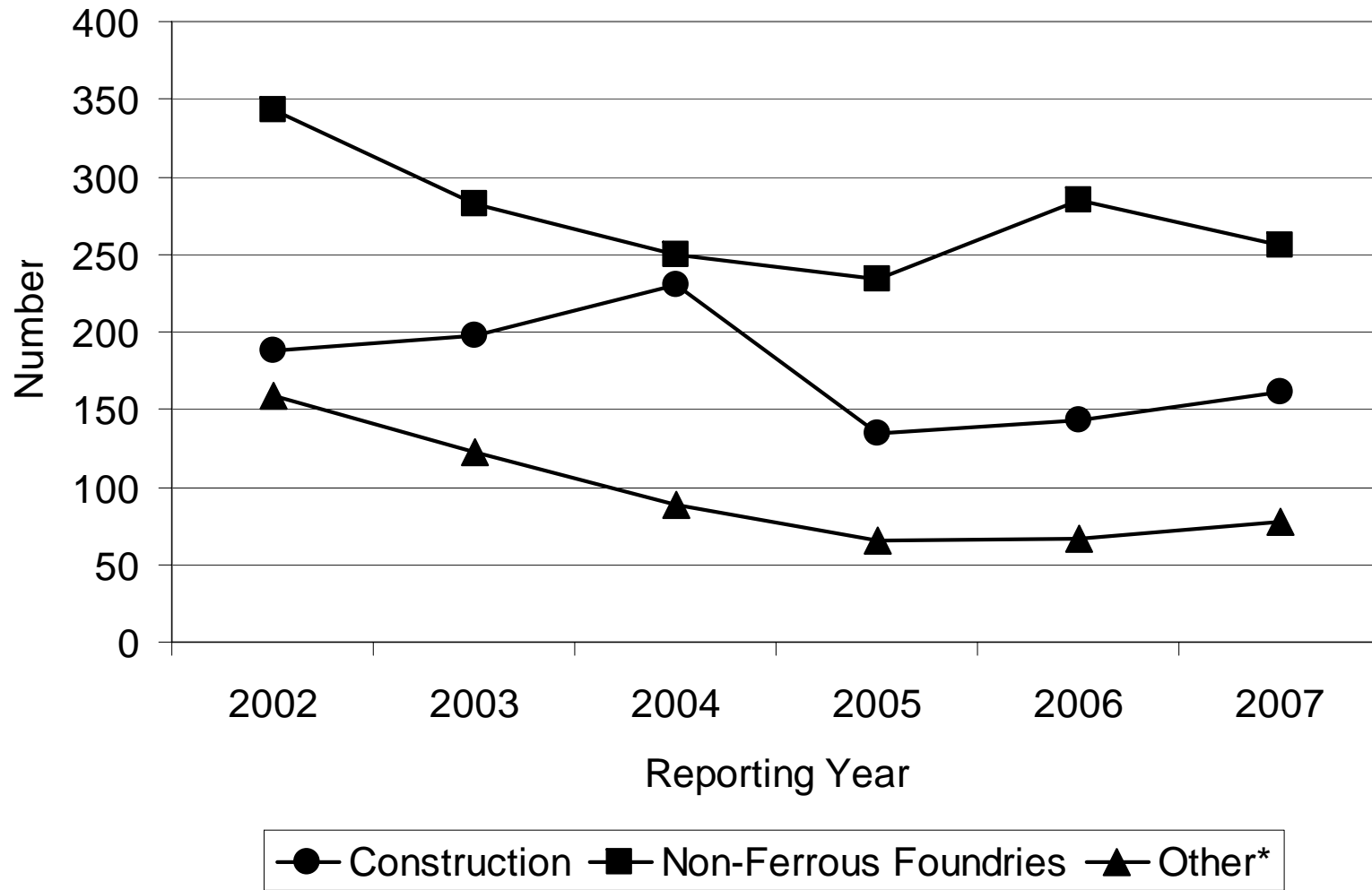
\*Rate per 100,000 men age 16+; denominator is the Census County Population Estimates: April 1, 2000 to July 1, 2006.



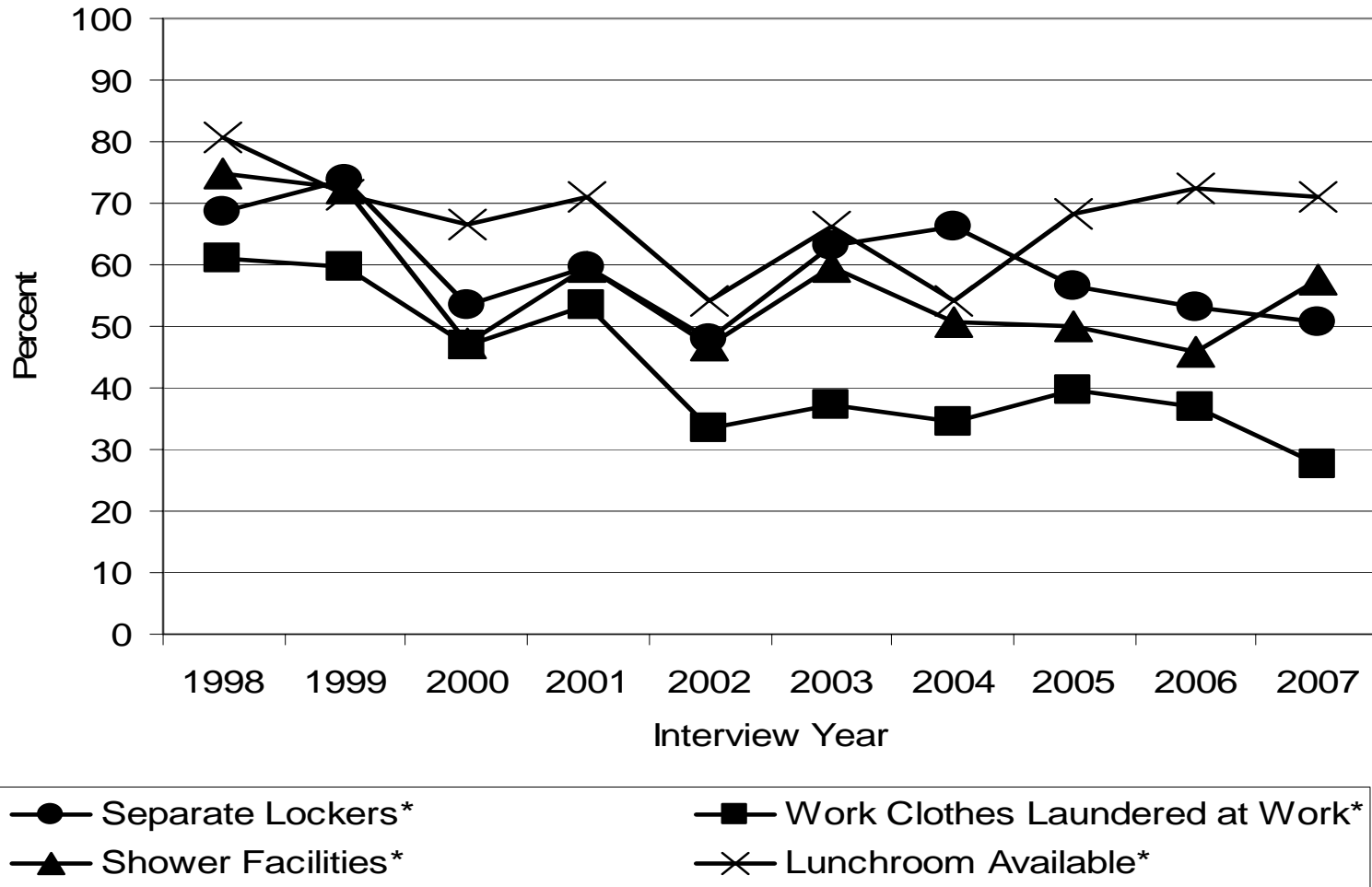
**FIGURE 11**  
**Geographic Distribution of Non-Construction Companies Reporting Adults with Blood Lead Levels (BLLs)  $\geq 25$  ug/dL in Michigan, 2007**



**FIGURE 12**  
**Number of Individuals with BLLs  $\geq 10$   $\mu\text{g}/\text{dL}$  by Industry,**  
**Where Exposed to Lead in Michigan, 2002 - 2007**

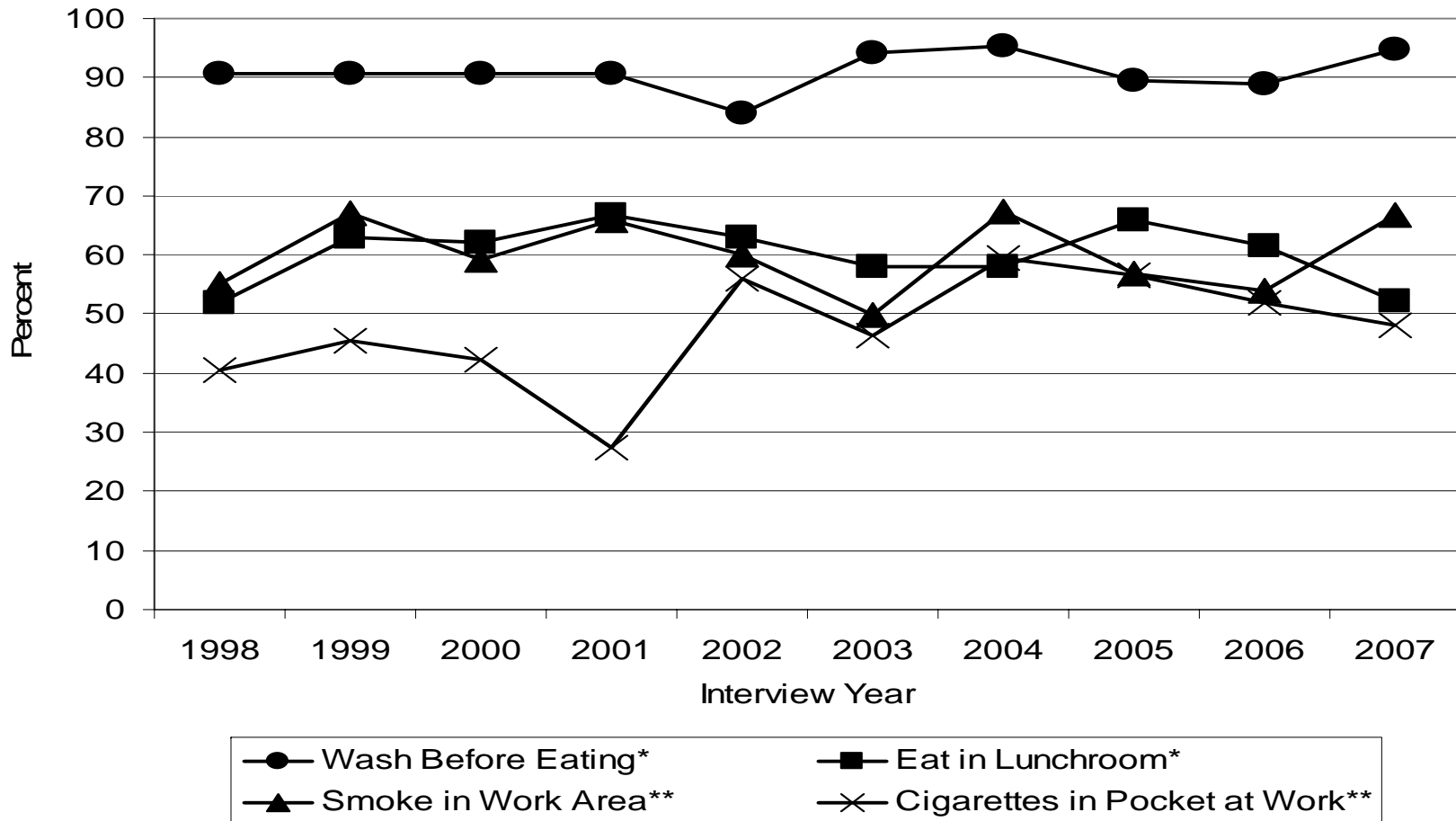


**FIGURE 13**  
**Percent of Individuals with BLLs  $\geq 10$   $\mu\text{g}/\text{dL}$  by Interview Year,**  
**Trend of Working Conditions, Michigan 1998-2007**



\* Based on positive questionnaire responses

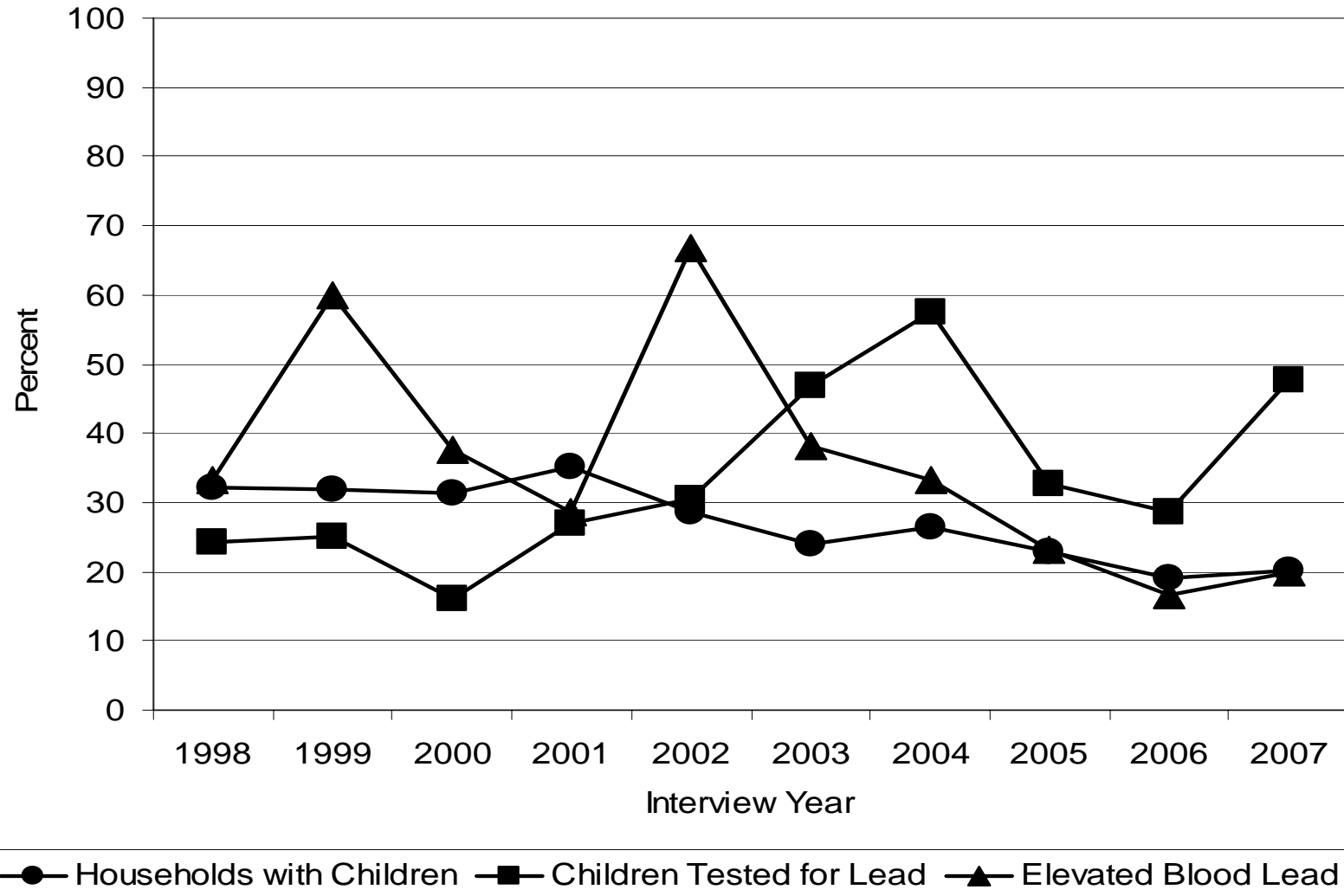
**FIGURE 14**  
**Percent of Individuals with BLLs  $\geq 10$   $\mu\text{g/dL}$  by Interview Year,**  
**Trend of Personal Habits, Michigan 1998 - 2007**



\* Based on positive questionnaire responses

\*\*Based on negative questionnaire responses

**FIGURE 15**  
**Percent of Individuals with BLLS  $\geq 10$   $\mu$ g/dL by Interview Year**  
**Trend of Children Being Tested for Blood Lead, Michigan 1998 - 2007**



**TABLE 1**  
**Distribution of Highest Blood Lead Levels (BLLs) Among Adults and Source of Exposure in Michigan: 2007**

BLLs (ug/dL)	Work BLLs		Non-Work BLLs		Source Not Yet Identified		All BLLs	
	Number	Percent	Number	Percent	Number	Percent	Number	Percent
<10	*	*	*	*	*	*	13,817	94.7
10-24	431	83.0	74	64.3	133	99.3	638	4.4
25-29	39	7.5	17	14.8	0	0.0	56	0.4
30-39	34	6.6	15	13.0	1	0.7	50	0.3
40-49	10	1.9	5	4.3	0	0.0	15	0.1
50-59	3	0.6	2	1.8	0	0.0	5	0.0
≥ 60	2	0.4	2	1.8	0	0.0	4	0.0
<b>TOTAL</b>	<b>519</b>	<b>100.0</b>	<b>115</b>	<b>100.0</b>	<b>134</b>	<b>100.0</b>	<b>14,585</b>	<b>** 100.0</b>

\*No follow-up is conducted of individuals with blood leads < 10 ug/dL.

\*\*In 2007, 15,893 BLL reports were received for 14,585 individuals.

**TABLE 2**  
**Distribution of Gender Among Adults Tested for**  
**Blood Lead in Michigan: 2007**

<u>Gender</u>	<b>All Blood Lead Level Tests</b>		<b>Blood Lead Levels <math>\geq</math> 10 ug/dL</b>	
	<u>Number</u>	<u>Percent</u>	<u>Number</u>	<u>Percent</u>
Male	8,365	57.4	740	96.4
Female	6,203	42.6	28	3.6
<b>Total</b>	<b>14,568 *</b>	<b>100.0</b>	<b>768</b>	<b>100.0</b>

\*Gender was unknown for 17 additional individuals.

**TABLE 3**  
**Distribution of Age Among Adults Tested for Blood Lead**  
**in Michigan: 2007**

<u>Age</u> <u>Range</u>	<b>All Blood Lead Level Tests</b>		<b>Blood Lead Levels <math>\geq</math> 10 ug/dL</b>	
	<u>Number</u>	<u>Percent</u>	<u>Number</u>	<u>Percent</u>
16-19	1,407	9.6	6	0.8
20-29	2,619	18.0	102	13.3
30-39	2,525	17.3	136	17.7
40-49	3,000	20.6	217	28.3
50-59	2,609	17.9	204	26.6
60-69	1,260	8.6	83	10.8
70-79	728	5.0	14	1.8
80-89	402	2.8	6	0.8
90-99	33	0.2	0	0.0
100+	2	0.0	0	0.0
<b>TOTAL</b>	<b>14,585</b>	<b>100.0</b>	<b>768</b>	<b>100.0</b>



**TABLE 4**  
**Distribution of Race Among Adults Tested for**  
**Blood Lead in Michigan: 2007**

<u>Race</u>	<b>Blood Lead Levels</b>			
	<b>All Results</b>		<b>Results <math>\geq</math> 10 ug/dL</b>	
	<u>Number</u>	<u>Percent</u>	<u>Number</u>	<u>Percent</u>
Caucasian	4,923	84.6	488	90.7
African American	756	13.0	35	6.5
Native American	64	1.1	5	0.9
Asian/Pacific Islander	45	0.8	3	0.6
Multiracial/Other	34	0.6	7	1.3
<b>TOTAL</b>	<b>5,822 *</b>	<b>100.0</b>	<b>538 *</b>	<b>100.0</b>

\*Race was unknown for 8,763 additional individuals.

\*\*Race was unknown for 230 additional individuals.

**TABLE 5. Number and Percent of Adults With All Blood Lead Levels (BLLs), BLLs  $\geq$  10 ug/dL and  $\geq$  25 ug/dL by County of Residence and Percent of Adults with BLLs  $\geq$  10 ug/dL and  $\geq$  25 ug/dL Among All Adults Tested for BLL in Each County of Residence in Michigan: 2007**

<u>County</u>	<u>All BLLs</u>		<u>BLLs &gt;10 ug/dL</u>			<u>BLLs &gt;25 ug/dL</u>		
	<u>Number</u>	<u>Percent</u>	<u>Number</u>	<u>Percent of all BLLs in State</u>	<u>Percent of all BLLs in County</u>	<u>Number</u>	<u>Percent of all BLLs in State</u>	<u>Percent of all BLLs in County</u>
Alcona	12	0.10	0	0.00	0.00	0	0.00	0.00
Alger	11	0.10	0	0.00	0.00	0	0.00	0.00
Allegan	114	0.99	4	0.63	3.51	1	0.84	0.88
Alpena	20	0.17	1	0.16	5.00	0	0.00	0.00
Antrim	15	0.13	1	0.16	6.67	0	0.00	0.00
Arenac	10	0.09	1	0.16	10.00	0	0.00	0.00
Baraga	12	0.10	0	0.00	0.00	0	0.00	0.00
Barry	50	0.44	0	0.00	0.00	0	0.00	0.00
Bay	131	1.14	4	0.63	3.05	1	0.84	0.76
Benzie	10	0.09	0	0.00	0.00	0	0.00	0.00
Berrien	69	0.60	6	0.95	8.70	2	1.68	2.90
Branch	34	0.30	3	0.48	8.82	1	0.84	2.94
Calhoun	195	1.70	6	0.95	3.08	2	1.68	1.03
Cass	29	0.25	1	0.16	3.45	0	0.00	0.00
Charlevoix	18	0.16	0	0.00	0.00	0	0.00	0.00
Cheboygan	32	0.28	1	0.16	3.13	0	0.00	0.00
Chippewa	75	0.65	3	0.48	4.00	0	0.00	0.00
Clare	21	0.18	0	0.00	0.00	0	0.00	0.00
Clinton	126	1.10	22	3.49	17.46	4	3.36	3.17
Crawford	51	0.44	2	0.32	3.92	0	0.00	0.00
Delta	44	0.38	0	0.00	0.00	0	0.00	0.00
Dickinson	13	0.11	1	0.16	7.69	0	0.00	0.00
Eaton	124	1.08	6	0.95	4.84	0	0.00	0.00
Emmet	9	0.08	0	0.00	0.00	0	0.00	0.00
Genesee	449	3.91	16	2.54	3.56	2	1.68	0.45
Gladwin	23	0.20	0	0.00	0.00	0	0.00	0.00
Gogebic	18	0.16	0	0.00	0.00	0	0.00	0.00
Grand Traverse	82	0.71	9	1.43	10.98	1	0.84	1.22
Gratiot	74	0.64	11	1.74	14.86	3	2.52	4.05
Hillsdale	20	0.17	1	0.16	5.00	0	0.00	0.00
Houghton	38	0.33	1	0.16	2.63	1	0.84	2.63
Huron	20	0.17	1	0.16	5.00	0	0.00	0.00
Ingham	358	3.12	13	2.06	3.63	2	1.68	0.56
Ionia	104	0.91	15	2.38	14.42	2	1.68	1.92
Iosco	14	0.12	1	0.16	7.14	1	0.84	7.14
Iron	8	0.07	0	0.00	0.00	0	0.00	0.00
Isabella	53	0.46	2	0.32	3.77	0	0.00	0.00
Jackson	179	1.56	7	1.11	3.91	2	1.68	1.12
Kalamazoo	295	2.57	15	2.38	5.08	6	5.04	2.03
Kalkaska	11	0.10	2	0.32	18.18	0	0.00	0.00
Kent	1,427	12.42	35	5.55	2.45	7	5.88	0.49
Keweenaw	3	0.03	0	0.00	0.00	0	0.00	0.00
Lake	7	0.06	1	0.16	14.29	0	0.00	0.00
Lapeer	69	0.60	3	0.48	4.35	1	0.84	1.45

Continued

**TABLE 5. Number and Percent of Adults With All Blood Lead Levels (BLLs), BLLs  $\geq$  10 ug/dL and  $\geq$  25 ug/dL by County of Residence and Percent of Adults with BLLs  $\geq$  10 ug/dL and  $\geq$  25 ug/dL Among All Adults Tested for BLL in Each County of Residence in Michigan: 2007**

<u>County</u>	<u>All BLLs</u>		<u>BLLs &gt;10 ug/dL</u>			<u>BLLs &gt;25 ug/dL</u>		
	<u>Number</u>	<u>Percent</u>	<u>Number</u>	<u>Percent of all BLLs in State</u>	<u>Percent of all BLLs in County</u>	<u>Number</u>	<u>Percent of all BLLs in State</u>	<u>Percent of all BLLs in County</u>
Leelanau	13	0.11	0	0.00	0.00	0	0.00	0.00
Lenawee	71	0.62	6	0.95	8.45	1	0.84	1.41
Livingston	224	1.95	8	1.27	3.57	1	0.84	0.45
Luce	9	0.08	0	0.00	0.00	0	0.00	0.00
Mackinac	30	0.26	3	0.48	10.00	1	0.84	3.33
Macomb	777	6.76	28	4.44	3.60	12	10.08	1.54
Manistee	24	0.21	1	0.16	4.17	0	0.00	0.00
Marquette	55	0.48	2	0.32	3.64	1	0.84	1.82
Mason	18	0.16	0	0.00	0.00	0	0.00	0.00
Mecosta	44	0.38	2	0.32	4.55	0	0.00	0.00
Menominee	12	0.10	0	0.00	0.00	0	0.00	0.00
Midland	74	0.64	3	0.48	4.05	0	0.00	0.00
Missaukee	16	0.14	0	0.00	0.00	0	0.00	0.00
Monroe	287	2.50	18	2.85	6.27	2	1.68	0.70
Montcalm	171	1.49	80	12.68	46.78	3	2.52	1.75
Montmorency	9	0.08	1	0.16	11.11	1	0.84	11.11
Muskegon	614	5.34	28	4.44	4.56	5	4.20	0.81
Newaygo	45	0.39	1	0.16	2.22	0	0.00	0.00
Oakland	898	7.81	24	3.80	2.67	10	8.40	1.11
Oceana	20	0.17	0	0.00	0.00	0	0.00	0.00
Ogemaw	15	0.13	1	0.16	6.67	0	0.00	0.00
Ontonagon	19	0.17	1	0.16	5.26	0	0.00	0.00
Osceola	8	0.07	0	0.00	0.00	0	0.00	0.00
Oscoda	10	0.09	0	0.00	0.00	0	0.00	0.00
Otsego	17	0.15	0	0.00	0.00	0	0.00	0.00
Ottawa	201	1.75	7	1.11	3.48	5	4.20	2.49
Presque Isle	10	0.09	0	0.00	0.00	0	0.00	0.00
Roscommon	50	0.44	2	0.32	4.00	0	0.00	0.00
Saginaw	135	1.17	7	1.11	5.19	2	1.68	1.48
Saint Clair	250	2.18	70	11.09	28.00	5	4.20	2.00
Saint Joseph	31	0.27	1	0.16	3.23	0	0.00	0.00
Sanilac	80	0.70	4	0.63	5.00	2	1.68	2.50
Schoolcraft	5	0.04	0	0.00	0.00	0	0.00	0.00
Shiawassee	88	0.77	6	0.95	6.82	1	0.84	1.14
Tuscola	46	0.40	1	0.16	2.17	0	0.00	0.00
Van Buren	93	0.81	5	0.79	5.38	0	0.00	0.00
Washtenaw	443	3.86	13	2.06	2.93	2	1.68	0.45
Wayne	2,079	18.09	112	17.75	5.39	26	21.85	1.25
Wexford	23	0.20	1	0.16	4.35	0	0.00	0.00
<b>TOTAL</b>	<b>11,491</b>	<b>100.00</b>	<b>631</b>	<b>100.00</b>	<b>5.49</b>	<b>119</b>	<b>100.00</b>	<b>1.04</b>

\*County was unknown for 3,094 additional adults.

\*\*County was unknown for 137 additional adults.

\*\*\*County was unknown for 11 additional adults.

**TABLE 6**  
**Annual Incidence of Blood Lead Levels (BLLs)  $\geq$**   
**10  $\mu$ g/dL Among Women in Michigan**  
**by County of Residence: 2007**

<u>County</u>	<u>Number</u> <u>Reported</u>	<u>Michigan</u> <u>Population</u> <u>Women</u>	<u>Rate per</u> <u>100,000 women</u>
Bay	1	45,196	2
Clinton	3	27,911	11
Crawford	1	5,973	17
Genesee	2	179,814	1
Ingham	1	115,565	1
Kalamazoo	1	99,637	1
Kent	4	231,870	2
Lenawee	1	40,839	2
Livingston	1	72,508	1
Monroe	1	62,245	2
Muskegon	1	69,476	1
St Clair	1	69,283	1
Wayne	7	707,329	1
<b>TOTAL</b>	<b>25 *</b>	<b>3,982,052</b>	<b>1 **</b>

\*County was unknown for 3 additional female adults.

\*\*Total number of women in all 83 counties of Michigan age 16+ years;  
 Census County Population Estimates: April 1, 2000 to July 1, 2006.

\*\*\*Rate per 100,000 women, age 16+ years.

**TABLE 7**  
**Annual Incidence of Blood Lead Levels (BLLs)  $\geq$  10  $\mu$ g/dL**  
**Among Men in Michigan by County of Residence: 2007**

County	Number Reported	Michigan Population Men	Rate per 100,000 Men	County	Number Reported	Michigan Population Men	Rate per 100,000 Men
Alcona	0	5,059	0	Keweenaw	0	896	0
Alger	0	4,476	0	Lake	1	5,174	19
Allegan	4	43,744	9	Lapeer	3	37,605	8
Alpena	1	11,981	8	Leelanau	0	9,115	0
Antrim	1	9,928	10	Lenawee	5	40,581	12
Arenac	1	7,153	14	Livingston	7	72,938	10
Baraga	0	3,876	0	Luce	0	3,192	0
Barry	0	23,598	0	Mackinac	3	4,525	66
Bay	3	41,783	7	Macomb	28	321,946	9
Benzie	0	7,057	0	Manistee	1	10,509	10
Berrien	6	60,579	10	Marquette	2	27,083	7
Branch	3	18,597	16	Mason	0	11,480	0
Calhoun	6	52,041	12	Mecosta	2	17,511	11
Cass	1	20,577	5	Menominee	0	10,003	0
Charlevoix	0	10,395	0	Midland	3	32,320	9
Cheboygan	1	10,937	9	Missaukee	0	5,993	0
Chippewa	3	18,278	16	Monroe	17	60,680	28
Clare	0	12,383	0	Montcalm	80	25,700	311
Clinton	19	27,084	70	Montmorency	1	4,345	23
Crawford	1	6,366	16	Muskegon	27	67,051	40
Delta	0	15,263	0	Newaygo	1	19,184	5
Dickinson	1	10,792	9	Oakland	24	464,657	5
Eaton	6	41,545	14	Oceana	0	11,149	0
Emmet	0	13,140	0	Ogemaw	1	8,750	11
Genesee	14	161,037	9	Ontonagon	1	3,142	32
Gladwin	0	10,890	0	Osceola	0	9,140	0
Gogebic	0	7,371	0	Oscoda	0	3,663	0
Grand Traverse	9	33,734	27	Otsego	0	9,723	0
Gratiot	11	18,016	61	Ottawa	7	96,599	7
Hillsdale	1	18,522	5	Presque Isle	0	5,887	0
Houghton	1	15,882	6	Roscommon	2	10,670	19
Huron	1	13,813	7	Saginaw	7	76,577	9
Ingham	12	105,934	11	Saint Clair	69	66,399	104
Ionia	15	27,913	54	Saint Joseph	1	23,802	4
Iosco	1	10,811	9	Sanilac	4	17,285	23
Iron	0	5,201	0	Schoolcraft	0	3,599	0
Isabella	2	25,878	8	Shiawassee	6	27,947	21
Jackson	7	66,034	11	Tuscola	1	22,756	4
Kalamazoo	14	91,706	15	Van Buren	5	30,178	17
Kalkaska	2	6,831	29	Washtenaw	13	138,206	9
Kent	31	222,863	14	Wayne	105	707,329	15
				Wexford	1	12,472	8
				<b>TOTAL</b>	<b>606</b>	<b>3,856,829</b>	<b>16</b>

\*County was unknown for 134 additional male adults.

\*\*Total number of men in all 83 counties of Michigan age 16+ years;  
 Census County Population Estimates: April 1, 2000 to July 1, 2006.

\*\*\*Rate per 100,000 men, age 16+ years.

**TABLE 8**  
**Source of Exposure Among Adults with**  
**BLLs  $\geq$  10  $\mu$ g/dL in Michigan: 2007**

<u>Exposure Source Description</u>	<u>Number</u>	<u>Percent</u>
Work-Related	519	81.9
Hobby: Firearms, Reloading, Casting	83	13.1
Remodeling	9	1.4
Hobby: Leather Tooling (2), Painting, Car Racing	6	0.9
Gun Shot Wound	5	0.8
Hobby: Sinkers	4	0.6
Other, Non-work	6	0.9
Hobby: Stained Glass	1	0.2
Lead Paint Ingestion	1	0.2
<b>TOTAL</b>	<b>634 *</b>	<b>100.0</b>

\*For 88 additional adults source is pending an interview; for 20 additional adults source is pending medical records review; for 23 additional adults source was inconclusive based on interview; for 5 additional adults, source was inconclusive and no patient interview was attempted.

**TABLE 9**  
**Industries Where Individuals with BLLs  $\geq$  10  $\mu$ g/dL were Exposed to Lead in Michigan: 2007**

Industry (SIC Code)*	Work-Exposed Individuals (BLL $\geq$ 10 $\mu$ g/dL)	
	Number	Percent
<b>Construction (15-17)</b>	<b>162</b>	<b>32.7</b>
Painting (17)	152	
<b>Manufacturing (20-39)</b>	<b>256</b>	<b>51.6</b>
Fabricated and Primary Metals (33-34)	235	
<b>Transportation and Public Utilities (40-49)</b>	<b>17</b>	<b>3.4</b>
<b>Wholesale and Retail Trade (50-59)</b>	<b>10</b>	<b>2.0</b>
<b>Services (70-89)</b>	<b>36</b>	<b>7.3</b>
Automotive Repair Services (75)	10	
<b>Public Administration (91-97)</b>	<b>15</b>	<b>3.0</b>
Justice, Public Order, Safety (92)	10	
<b>TOTAL</b>	<b>496**</b>	<b>100.0</b>

\*Standard Industrial Classification.

\*\*Another 23 were work-related, however, the industry was unknown.

**TABLE 10**  
**Demographic Characteristics of Michigan Adults with Blood Lead Levels (BLLs) of  $\geq 10$   $\mu\text{g/dL}$ ,**  
**Interviewed from 10-15-1997 to 12-31-2007, by Highest Reported Blood Lead Level ( $\mu\text{g/dL}$ )**

<b>Demographic Characteristics</b>	10-24 $\mu\text{g/dL}$		25-29 $\mu\text{g/dL}$		30-39 $\mu\text{g/dL}$		40-49 $\mu\text{g/dL}$		50-59 $\mu\text{g/dL}$		$\geq 60$ $\mu\text{g/dL}$		TOTAL	
	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent
Male	727	(87.1)	207	(92.8)	265	(95.0)	83	(92.2)	35	(97.2)	14	(93.3)	1331	(90.1)
Female	108	(12.9)	16	( 7.2)	14	( 5.0)	7	( 7.8)	1	( 2.8)	1	( 6.7)	147	( 9.9)
Hispanic Origin	48	( 6.0)	9	( 4.3)	9	( 3.4)	12	(13.8)	1	( 2.9)	0	--	79	( 5.6)
Caucasian	707	(85.9)	196	(89.5)	242	(87.7)	78	(86.7)	33	(91.7)	12	(80.0)	1268	(86.9)
African American	69	( 8.4)	10	( 4.6)	19	( 6.9)	6	( 6.7)	3	( 8.3)	3	(20.0)	110	( 7.5)
Asian/Pacific Islander	3	( 0.4)	1	( 0.5)	2	( 0.7)	0	--	0	--	0	--	6	( 0.4)
Native American/Alaskan	6	( 0.7)	4	( 1.8)	8	( 2.9)	0	--	0	--	0	--	18	( 1.2)
Other	38	( 4.6)	8	( 3.7)	5	( 1.8)	6	( 6.7)	0	--	0	--	57	( 3.9)
Average Age	49	n=835	50	n=223	49	n=279	51	n=90	50	n=36	43	n=15	49	n=1478
Ever Smoked	526	(64.4)	158	(73.5)	186	(71.8)	61	(72.6)	26	(81.2)	8	(66.7)	965	(68.0)*
Now Smoke**	251	(47.1)	85	(53.5)	130	(69.1)	43	(69.4)	21	(80.8)	6	(75.0)	536	(54.9)*

\* $p < 0.05$  for linear trend.

\*\*The percentages of *now smoke* are calculated using the denominator of those who *ever smoked*.



**TABLE 11**  
**Highest Education Level of Michigan Adults with Blood Lead Levels (BLLs) of  $\geq 10$   $\mu\text{g/dL}$ ,**  
**Interviewed from 10-15-1997 to 12-31-2007 by Highest Reported Blood Lead Level ( $\mu\text{g/dL}$ )**

Highest Education Level	10-24 $\mu\text{g/dL}$		25-29 $\mu\text{g/dL}$		30-39 $\mu\text{g/dL}$		$\geq 40$ $\mu\text{g/dL}$		TOTAL	
	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent
7th Grade or Less	17	( 2.2)	3	( 2.0)	3	( 2.2)	3	( 4.6)	26	( 2.3)
8 <sup>th</sup> -11 <sup>th</sup> Grade	96	(12.6)	6	( 4.0)	18	(13.1)	12	(18.5)	132	(11.8)
High School Graduate	252	(33.0)	57	(37.7)	51	(37.2)	17	(26.2)	377	(33.8)
1-3 Years College/Technical School	253	(33.1)	62	(41.1)	40	(29.2)	20	(30.8)	375	(33.6)
4 or more years College/Technical School	146	(19.1)	23	(15.2)	25	(18.2)	13	(20.0)	207	(18.5)
<b>TOTAL</b>	<b>764</b>	<b>(100)</b>	<b>151</b>	<b>(100)</b>	<b>137</b>	<b>(99.9*)</b>	<b>65</b>	<b>(100.1*)</b>	<b>1117</b>	<b>(100)</b>

\*Percentages do not add to 100 due to rounding.

**TABLE 12**  
**Symptoms of Michigan Adults with Blood Lead Levels (BLLs) of  $\geq 10$   $\mu\text{g/dL}$ ,**  
**Interviewed from 10-15-1997 to 12-31-2007, by Highest Reported Blood Lead Level ( $\mu\text{g/dL}$ )**

Symptoms	10-24 $\mu\text{g/dL}$		25-29 $\mu\text{g/dL}$		30-39 $\mu\text{g/dL}$		40-49 $\mu\text{g/dL}$		50-59 $\mu\text{g/dL}$		$\geq 60$ $\mu\text{g/dL}$		TOTAL	
	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent
<b>GASTRO-INTESTINAL</b>														
Lost 10+ lbs without diet	84	(10.3)	15	( 7.0)	32	(11.7)	20	(22.5)	7	(20.6)	3	(23.1)	161	(11.1)*
Continued loss of appetite	90	(10.9)	19	( 8.7)	38	(13.7)	19	(21.3)	7	(20.0)	3	(21.4)	176	(12.1)*
Pains in belly	140	(16.9)	22	(10.1)	44	(16.1)	23	(25.6)	9	(25.7)	3	(21.4)	241	(16.5)
<b>MUSCULOSKELETAL</b>														
Frequent pain/soreness	281	(34.3)	70	(32.3)	101	(36.7)	44	(50.6)	14	(40.0)	7	(50.0)	517	(35.7)*
Muscle weakness	201	(24.6)	27	(12.4)	51	(18.8)	31	(35.2)	12	(34.3)	7	(50.0)	329	(22.8)
<b>NERVOUS</b>														
Headaches	139	(16.8)	28	(12.7)	58	(20.9)	24	(26.7)	11	(30.6)	5	(35.7)	242	(18.1)*
Dizziness	84	(10.2)	14	( 6.4)	16	( 5.9)	12	(13.5)	4	(11.4)	5	(35.7)	135	( 9.3)
Depressed	126	(15.4)	22	(10.2)	40	(14.8)	14	(15.9)	10	(27.8)	6	(42.9)	218	(15.1)
Tired	316	(38.5)	67	(30.6)	130	(47.3)	51	(57.3)	21	(58.3)	8	(57.1)	593	(40.8)*
Nervous	119	(14.5)	22	(10.1)	44	(16.3)	20	(22.2)	10	(28.6)	6	(42.9)	221	(15.3)*
Waking up at night	242	(29.4)	44	(20.1)	91	(33.2)	32	(36.0)	15	(41.7)	5	(38.5)	429	(29.5)*
Nightmares	58	( 7.1)	4	( 1.8)	12	( 4.5)	5	( 5.7)	4	(11.4)	3	(21.4)	86	( 6.0)
Irritable	167	(20.4)	45	(20.9)	75	(27.5)	29	(32.6)	16	(45.7)	7	(50.0)	339	(23.5)*
Unable to concentrate	133	(16.3)	24	(11.1)	55	(19.9)	16	(18.4)	9	(25.0)	4	(28.6)	241	(16.6)
<b>REPRODUCTIVE</b>														
Unable to have an erection	8	(17.8)	5	( 8.2)	10	( 8.1)	5	(12.8)	7	(36.8)	0	--	35	(11.9)
Trouble having a child	37	( 4.6)	13	( 6.1)	15	( 5.6)	1	( 1.2)	0	--	1	( 8.3)	67	( 4.7)
Gastro-Intestinal Symptoms	205	(24.7)	38	(17.3)	70	(25.2)	35	(38.9)	15	(41.7)	6	(42.9)	369	(25.1)*
Musculoskeletal Symptoms	329	(39.9)	73	(33.5)	109	(39.6)	49	(55.1)	16	(45.7)	8	(57.1)	584	(40.1)*
Nervous Symptoms	470	(56.8)	103	(46.8)	175	(63.2)	59	(65.6)	27	(75.0)	8	(57.1)	842	(57.5)*
Reproductive Symptoms	41	(51.2)	15	(21.4)	22	(16.7)	4	(10.0)	2	(10.5)	1	(14.3)	85	(24.4)*
Any Symptoms	553	(66.5)	131	(59.5)	189	(68.0)	68	(75.6)	30	(83.3)	9	(64.3)	980	(66.7)
Average Number Symptoms	2.7	n=831	2.0	n=220	2.9	n=278	3.8	n=90	4.2	n=36	5.2	n=14	2.7	n=1469

\*p < 0.05 for linear trend.

**TABLE 13**  
**Lead Related Health Conditions of Michigan Adults with Blood Lead Levels (BLLs) of  $\geq 10$   $\mu\text{g/dL}$ ,**  
**Interviewed from 10-15-1997 to 12-31-2007 by Highest Reported Blood Lead Level ( $\mu\text{g/dL}$ )**

Lead Related Disease	10-24 $\mu\text{g/dL}$		25-29 $\mu\text{g/dL}$		30-39 $\mu\text{g/dL}$		40-49 $\mu\text{g/dL}$		50-59 $\mu\text{g/dL}$		$\geq 60$ $\mu\text{g/dL}$		TOTAL	
	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent
Anemia	47	( 5.9)	7	( 3.3)	11	( 4.1)	7	( 8.1)	2	( 5.7)	1	( 8.3)	75	( 5.3)
Kidney Disease	23	( 2.8)	2	( 0.9)	5	( 1.8)	2	( 2.2)	1	( 2.9)	0	--	33	( 2.3)
High Blood Pressure	43	( 5.3)	11	( 5.0)	28	(10.3)	13	(15.5)	4	(11.8)	1	( 7.7)	100	( 7.0)*
Hearing Loss	160	(25.6)	27	(31.8)	21	(28.4)	5	(21.7)	1	(12.5)	1	(25.0)	215	(26.3)

\*p < 0.05 for linear trend.

**TABLE 14**  
**Industry of Michigan Adults with Blood Lead Levels (BLLs) of  $\geq 10$   $\mu\text{g/dL}$ , Interviewed from 10-15-1997 to 12-31-2007**  
**by Highest Reported Blood Lead Level ( $\mu\text{g/dL}$ )**

Standard Industrial Classification	10-24 $\mu\text{g/dL}$		25-29 $\mu\text{g/dL}$		30-39 $\mu\text{g/dL}$		40-49 $\mu\text{g/dL}$		50-59 $\mu\text{g/dL}$		$\geq 60$ $\mu\text{g/dL}$		TOTAL	
	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent
Construction, Building (15)	13	( 2.8)	2	( 1.2)	0	--	0	--	0	--	0	--	15	( 1.6)
Construction, Heavy (16)	15	( 3.2)	1	( 0.6)	2	( 0.9)	0	--	0	--	0	--	18	( 1.9)
Special Trade Construction (17)	156	(33.5)	40	(24.2)	73	(32.7)	29	(43.9)	13	(41.9)	6	(46.2)	317	(32.9)
Food and Kindred Products (20)	0	--	1	( 0.6)	0	--	0	--	0	--	0	--	1	( 0.1)
Lumber and Wood (24)	1	( 0.2)	0	--	0	--	0	--	0	--	0	--	1	( 0.1)
Furniture and Fixtures (25)	1	( 0.2)	0	--	0	--	0	--	0	--	0	--	1	( 0.1)
Printing and Publishing (27)	1	( 0.2)	0	--	1	( 0.4)	0	--	0	--	0	--	2	( 0.2)
Chemicals and Allied Products (28)	0	--	0	--	1	( 0.4)	0	--	0	--	0	--	1	( 0.1)
Stone/Clay/Glass (32)	8	( 1.7)	3	( 1.8)	4	( 1.8)	2	( 3.0)	2	( 6.5)	0	--	19	( 2.0)
Primary Metals Industry (33)	47	(10.1)	52	(31.5)	84	(37.7)	22	(33.3)	8	(25.8)	4	(30.8)	217	(22.5)
Fabricated Metal Products (34)	39	( 8.4)	19	(11.5)	18	( 8.1)	5	( 7.6)	0	--	0	--	81	( 8.4)
Industrial, Commercial Machinery (35)	13	( 2.8)	3	( 1.8)	5	( 2.2)	1	( 1.5)	2	( 6.5)	1	( 7.7)	25	( 2.6)
Electronics (36)	13	( 2.8)	1	( 0.6)	0	--	0	--	0	--	0	--	14	( 1.5)
Transportation Equipment (37)	14	( 3.0)	3	( 1.8)	5	( 2.2)	2	( 3.0)	1	( 3.2)	0	--	25	( 2.6)
Measuring, Analyzing, Crtl Instr. (38)	1	( 0.2)	0	--	0	--	0	--	0	--	0	--	1	( 0.1)
Misc. Manufacturing Industries (39)	2	( 0.4)	1	( 0.6)	0	--	0	--	0	--	0	--	3	( 0.3)
Railroad Transportation (40)	1	( 0.2)	3	( 1.8)	3	( 1.3)	0	--	0	--	0	--	7	( 0.7)
Motor Freight Trans, Warehousing (42)	1	( 0.2)	0	--	0	--	0	--	0	--	0	--	1	( 0.1)
Water Transportation (44)	2	( 0.4)	0	--	0	--	0	--	0	--	0	--	2	( 0.2)
Trans., Electric, Gas & San. Svcs. (49)	20	( 4.3)	4	( 2.4)	2	( 0.9)	1	( 1.5)	0	--	0	--	27	( 2.8)
Wholesale-Durable Goods (50)	8	( 1.7)	1	( 0.6)	1	( 0.4)	0	--	0	--	0	--	10	( 1.0)
Building Materials, Hardware (52)	1	( 0.2)	0	--	0	--	0	--	0	--	0	--	1	( 0.1)
Automotive Dealers, Gas (55)	1	( 0.2)	3	( 1.8)	1	( 0.4)	0	--	0	--	0	--	5	( 0.5)
Other Retail Trade (59)	3	( 0.6)	0	--	1	( 0.4)	0	--	0	--	0	--	4	( 0.4)
Depository Institutions (60)	1	( 0.2)	0	--	0	--	0	--	0	--	0	--	1	( 0.1)
Finance, Insurance, Real Estate (65)	2	( 0.4)	0	--	0	--	0	--	0	--	0	--	2	( 0.2)
Business Services (73)	6	( 1.3)	0	--	0	--	0	--	0	--	0	--	6	( 0.6)
Automotive Repair Services (75)	18	( 3.9)	7	( 4.2)	6	( 2.7)	4	( 6.1)	2	( 6.5)	0	--	37	( 3.8)
Misc. Repair Services (76)	6	( 1.3)	1	( 0.6)	3	( 1.3)	0	--	0	--	0	--	10	( 1.0)
Amusement and Recreation (79)	15	( 3.2)	5	( 3.0)	4	( 1.8)	0	--	3	( 9.7)	2	(15.4)	29	( 3.0)
Health Services (80)	1	( 0.2)	0	--	0	--	0	--	0	--	0	--	1	( 0.1)
Educational Services (82)	11	( 2.4)	3	( 1.8)	1	( 0.4)	0	--	0	--	0	--	15	( 1.6)
Museum, Art Galleries (84)	1	( 0.2)	1	( 0.6)	0	--	0	--	0	--	0	--	2	( 0.2)
Engineering Services (87)	11	( 2.4)	2	( 1.2)	2	( 0.9)	0	--	0	--	0	--	15	( 1.6)
Services, NEC (89)	2	( 0.4)	0	--	0	--	0	--	0	--	0	--	2	( 0.2)
General Government (91)	1	( 0.2)	0	--	0	--	0	--	0	--	0	--	1	( 0.1)
Justice, Public Order, Safety (92)	21	( 4.5)	8	( 4.8)	5	( 2.2)	0	--	0	--	0	--	34	( 3.5)
Human Resources (94)	0	--	0	--	1	( 0.4)	0	--	0	--	0	--	1	( 0.1)
Admin Of Environmental Quality (95)	1	( 0.2)	0	--	0	--	0	--	0	--	0	--	1	( 0.1)
Admin Of Economic Programs (96)	4	( 0.9)	1	( 0.6)	0	--	0	--	0	--	0	--	5	( 0.5)
National Security, Int'l Affairs (97)	3	( 0.6)	0	--	0	--	0	--	0	--	0	--	3	( 0.3)
<b>TOTAL</b>	<b>465</b>	<b>(100)</b>	<b>165</b>	<b>(100)</b>	<b>223</b>	<b>(100)</b>	<b>66</b>	<b>(100)</b>	<b>31</b>	<b>(100)</b>	<b>13</b>	<b>(100)</b>	<b>963</b>	<b>(100)</b>

**TABLE 15**  
**Number of Years Worked of Michigan Adults with Blood Lead Levels (BLLs) of  $\geq 10$   $\mu\text{g}/\text{dL}$ ,  
 Interviewed from 10-15-1997 to 12-31-2007 by Highest Reported Blood Lead Level ( $\mu\text{g}/\text{dL}$ )**

Number of Years Worked	10-24 $\mu\text{g}/\text{dL}$		25-29 $\mu\text{g}/\text{dL}$		30-39 $\mu\text{g}/\text{dL}$		40-49 $\mu\text{g}/\text{dL}$		50-59 $\mu\text{g}/\text{dL}$		$\geq 60$ $\mu\text{g}/\text{dL}$		TOTAL	
	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent
$\leq 5$	270	(57.9)	101	(63.1)	121	(53.5)	38	(57.6)	17	(56.7)	7	(58.3)	554	(57.7)
6 – 10	65	(13.9)	28	(17.5)	36	(15.9)	8	(12.1)	8	(26.7)	2	(16.7)	147	(15.3)
11 – 20	69	(14.8)	21	(13.1)	36	(15.9)	10	(15.2)	3	(10.0)	2	(16.7)	141	(14.7)
21 – 30	40	( 8.6)	9	( 5.6)	27	(11.9)	2	( 3.0)	1	( 3.3)	1	( 8.3)	80	( 8.3)
$\geq 31$	22	( 4.7)	1	( 0.6)	6	( 2.7)	8	(12.1)	1	( 3.3)	0	--	38	( 4.0)

**TABLE 16**  
**Working Conditions Reported by Michigan Adults with Blood Lead Levels (BLLs) of  $\geq 10$   $\mu\text{g/dL}$ ,**  
**Interviewed from 10-15-1997 to 12-31-2007 by Highest Reported Blood Lead Level ( $\mu\text{g/dL}$ )**

Working Conditions	10-24 $\mu\text{g/dL}$		25-29 $\mu\text{g/dL}$		30-39 $\mu\text{g/dL}$		40-49 $\mu\text{g/dL}$		50-59 $\mu\text{g/dL}$		$\geq 60$ $\mu\text{g/dL}$		TOTAL	
	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent
Separate lockers: dirty and clean*	245	(54.1)	114	(71.2)	151	(68.9)	35	(53.8)	20	(62.5)	3	(27.3)	568	(60.4)
Work clothes laundered: work*	156	(35.1)	94	(59.9)	127	(57.5)	28	(43.1)	12	(37.5)	3	(27.3)	420	(45.1)*
Shower facility*	231	(50.9)	103	(64.8)	158	(71.5)	31	(47.0)	14	(45.2)	5	(45.5)	542	(57.5)
Lunch room*	293	(65.4)	114	(72.2)	174	(79.1)	36	(54.5)	16	(51.6)	5	(45.5)	638	(68.3)
Clean off dust and wash hands before eating*	417	(93.1)	141	(88.7)	205	(91.9)	55	(85.9)	28	(87.5)	9	(81.8)	855	(91.2)*
Eat in lunchroom*	198	(60.4)	87	(68.5)	116	(62.4)	28	(49.1)	9	(34.6)	4	(44.4)	442	(60.3)*
Wear respirator*	285	(62.5)	111	(69.8)	168	(75.0)	51	(78.5)	21	(65.6)	9	(81.8)	645	(68.1)*
Smoke in work area**	147	(59.5)	53	(62.4)	83	(65.4)	16	(38.1)	11	(52.4)	4	(66.7)	314	(59.5)
Keep cigarettes in pocket while working**	116	(48.1)	35	(40.7)	67	(53.6)	17	(40.5)	7	(33.3)	3	(50.0)	245	(47.0)
Exposed to Lead now*	258	(57.6)	94	(60.6)	147	(67.4)	34	(55.7)	18	(64.3)	3	(27.3)	554	(60.2)
Removal from job*	22	( 4.8)	13	( 8.1)	30	(13.5)	15	(23.4)	9	(28.1)	4	(36.4)	93	( 9.8)*

\*Based on positive questionnaire responses.

\*\*Based on negative questionnaire responses.

**TABLE 17**  
**Number of Households with Children (6 or under) Potentially Exposed to Take-Home Lead from Michigan Adults with Blood Lead Levels (BLLs) of  $\geq 10$   $\mu\text{g}/\text{dL}$ , Interviewed from 10-15-1997 to 12-31-2007, by Highest Reported Blood Lead Level ( $\mu\text{g}/\text{dL}$ )**

Description of Households	10-24 $\mu\text{g}/\text{dL}$		25-29 $\mu\text{g}/\text{dL}$		30-39 $\mu\text{g}/\text{dL}$		40-49 $\mu\text{g}/\text{dL}$		50-59 $\mu\text{g}/\text{dL}$		$\geq 60$ $\mu\text{g}/\text{dL}$		TOTAL	
	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent
Households with Children living or spending time in house	208	(25.3)*	61	(27.9)	82	(29.6)	26	(29.2)	11	(30.6)	3	(21.4)	391	(26.8)
Households with Children tested for Lead	68	(37.0)**	13	(22.4)	17	(22.4)	11	(50.0)	4	(36.4)	2	(66.7)	115	(32.5)
Households where Children had elevated Lead levels	21	(33.9)***	3	(25.0)	8	(42.1)	4	(40.0)	1	(33.3)	1	(50.0)	38	(35.2)

\* Among individuals within blood lead category, percentage of their households with children living or spending time in house.  
 \*\* Among individuals within blood lead category, percentage of households with children living or spending time in house where the children were tested for lead. Because of missing data the denominator may be less than the number with children living or spending time in house in the first row of the table.  
 \*\*\* Among individuals within blood lead category, percentage of households with children living or spending time in house where children, who had blood lead tests, had blood lead levels  $\geq 10$   $\mu\text{g}/\text{dL}$ . Because of missing data, the denominator may be less then the number tested for lead in the second row of the table.

DEPARTMENT OF COMMUNITY HEALTH

HEALTH LEGISLATION AND POLICY DEVELOPMENT

BLOOD LEAD ANALYSIS REPORTING

Filed with the Secretary of State on September 25, 1997. These rules take effect 15 days after filing with the Secretary of State.

(By authority conferred on the community public health agency by section 5111 of Act No. 368 of the Public Acts of 1978, as amended, section 8 of Act No. 312 of the Public Acts of 1978, and Executive Reorganization Order No. 1996-1, being §§333.5111 and 325.78, and 330.3101 of the Michigan Compiled Laws)

R 325.9081 Definitions.

Rule 1. (1) As used in these rules:

(a) "Blood lead analysis report form" means the form used to report the required reportable information for blood that has been analyzed for lead.

(b) "Agency" means the community public health agency.

(c) "Physician/provider" means a licensed professional who provides health care services and who is authorized to request the analysis of blood specimens. For this purpose, provider may also mean the local health department.

(2) The term "local health department," as defined in Act No. 368 of the Public Acts of 1978, as amended, being §333.1101 et seq. of the Michigan Compiled Laws, has the same meaning when used in these rules.

R 325.9082 Reportable information.

Rule 2. (1) Reportable information is specifically related to blood samples submitted to clinical laboratories for lead analysis.

(2) Upon initiating a request for blood lead analysis, the physician/provider ordering the blood lead analysis shall complete the client information (section I) and the physician/provider information (section II) of a blood lead analysis report form designated by the agency or shall complete another similar form that ensures the inclusion of the same required data and shall provide all of the following information:



2007 ANNUAL REPORT ON BLOOD LEAD LEVELS ON ADULTS AND CHILDREN IN MICHIGAN  
- Part II: Adult Blood Lead Epidemiology and Surveillance - **APPENDIX A**

---

(a) All of the following information with respect to the individual tested:

- (i) Name.
- (ii) Sex.
- (iii) Racial/ethnic group.
- (iv) Birthdate.
- (v) Address, including county.
- (vi) Telephone number.
- (vii) Social security number and medicaid number, if applicable.
- (viii) If the individual is a minor, the name of a parent or guardian and social security number of the parent or guardian.
- (ix) If the individual is an adult, the name of his or her employer.

(b) The date of the sample collection.

(c) The type of sample (capillary or venous).

(3) The blood lead analysis report form or a document with the same data shall be submitted with the sample for analysis to a clinical laboratory that performs blood lead analysis.

(4) Upon receipt of the blood sample for lead analysis, the clinical laboratory shall complete the laboratory information (section III) and provide all of the information required and/or submitted by the physician/provider and the following:

(a) The name, address, and phone number of the laboratory.

(b) The date of analysis.

(c) The results of the blood lead analysis in micrograms of lead per deciliter of whole blood rounded to the nearest whole number.

R 325.9083 Reporting responsibilities.

Rule 3. (1) All clinical laboratories doing business in this state that analyze blood samples for lead shall report all blood lead results, rounded to the nearest whole number, for adults and children to the Community Public Health Agency, Childhood Lead Poisoning Prevention Program (CPHA/CLPPP), 3423 N.M.L. King Jr. Blvd., Lansing, MI 48909. Reports shall be made within 5 working days after test completion.

(2) Nothing in this rule shall be construed to relieve a laboratory from reporting results of a blood lead analysis to the physician or other health care provider who ordered the test or to any other entity as required by state, federal, or local statutes or regulations or in accordance with accepted standard of practice, except that reporting in compliance with this rule satisfies the blood lead reporting requirements of Act No. 368 of the Public Acts of 1978, as amended, being §333.1101 et seq. of the Michigan Compiled Laws.

R 325.9084 Electronic communications.

Rule 4. (1) A clinical laboratory may submit the data required in R 325.9083 electronically to the agency.

(2) For electronic reporting, upon mutual agreement between the reporting laboratory and the agency, the reporting shall utilize the data format specifications provided by the agency.

R 325.9085 Quality assurance.

Rule 5. For purposes of assuring the quality of submitted data, each reporting entity shall allow the agency to inspect copies of the medical records that will be submitted by the reporting entity to verify the accuracy of the submitted data. Only the portion of the medical record that pertains to the blood lead testing shall be submitted. The copies of the medical records shall not be recopied by the agency and shall be kept in a locked file cabinet when not being used. After verification of submitted data, the agency shall promptly destroy the copies of the medical records.

R 325.9086 Confidentiality of reports.

Rule 6. (1) The agency shall maintain the confidentiality of all reports of blood lead tests submitted to the agency and shall not release reports or any information that may be used to directly link the information to a particular individual, unless the agency has received written consent from the individual, or from the individual's parent or legal guardian, requesting the release of information.

(2) Medical and epidemiological information that is released to a legislative body shall not contain information that identifies a specific individual. Aggregate epidemiological information concerning the public health that is released to the public for informational purposes only shall not contain information that identifies a specific individual.

R 325.9087 Blood lead analysis report form.

Rule 7. The blood lead analysis report form reads as follows:

**MICHIGAN DEPARTMENT OF COMMUNITY HEALTH**  
**BLOOD LEAD ANALYSIS REPORT**  
**DATA/INFORMATION REQUIRED BY ADMINISTRATIVE RULE # R325.9082 AND R 325.9083**

**PATIENT INFORMATION**

*To be completed by Parent/Guardian or Patient*

**PLEASE PRINT**

\_\_\_\_\_  
Last Name

\_\_\_\_\_  
First Name

\_\_\_\_\_  
M. Initial

\_\_\_\_\_  
Address – No PO Boxes, please

\_\_\_\_\_  
Apt. #

\_\_\_\_\_  
City

\_\_\_\_\_  
MI  
State

\_\_\_\_\_  
Zip

( ) \_\_\_\_\_  
Area Code and Phone Number

\_\_\_\_\_  
Birthdate (month/day/year)

\_\_\_\_\_  
Parent/Guardian Name (please print)

*Race (Check all that apply):*

- American Indian or Alaskan Native
- Asian
- Black or African American
- Native Hawaiian or Other Pacific Islander
- White
- Hispanic or Latino
- Middle Eastern or Arabic

*Sex:*

- Male
- Female

*Funding Sources:*

- Self Pay/Insurance
- Medicaid

ID# (Medicaid only): \_\_\_\_\_

If Patient is an adult (≥ 16 years):

Employer: \_\_\_\_\_

Social Security #: \_\_\_\_\_

**PROVIDER/PHYSICIAN INFORMATION**

*To be completed by provider's office*

\_\_\_\_\_  
Clinic, Hospital or Agency Name

\_\_\_\_\_  
Physician name

\_\_\_\_\_  
Mailing Address

\_\_\_\_\_  
City

\_\_\_\_\_  
State

\_\_\_\_\_  
Zip

( ) \_\_\_\_\_  
Area Code and Phone Number

\_\_\_\_\_  
Fax Number

**SPECIMEN COLLECTION INFORMATION**

*To be completed by person who draws specimen*

\_\_\_\_\_  
Specimen Collection Date

Source of Specimen    Capillary    Venous    Filter Paper

**LABORATORY INFORMATION**

*To be completed by testing laboratory*

\_\_\_\_\_  
Laboratory Name

\_\_\_\_\_  
Specimen ID Number

( ) \_\_\_\_\_  
Area Code and Phone Number

\_\_\_\_\_  
Analysis Date

BLOOD LEAD LEVEL in Micrograms per Deciliter \_\_\_\_\_ (round to nearest whole number, please)

**APPENDIX B**

**OSHA BLOOD LEAD LABORATORIES\*: MICHIGAN**

<b>Laboratory Name</b>	<b>City</b>	<b>County</b>
Detroit Health Department	Detroit	Wayne
DMC University Laboratories	Detroit	Wayne
Hackley Hospital Laboratory	Muskegon	Muskegon
Marquette General Health Systems	Marquette	Marquette
Michigan Department of Community Health	Lansing	Ingham
Mount Clemens General Hospital	Mount Clemens	Macomb
Quest Diagnostics	Auburn Hills	Oakland
Regional Medical Laboratories	Battle Creek	Calhoun
Sparrow Regional Laboratories	Lansing	Ingham
Warde Medical Laboratory	<b>Ann Arbor</b>	Washtenaw

\*OSHA approved blood lead laboratories as of May 13, 2008. For a complete listing of OSHA approved blood lead laboratories, visit the OSHA web site at <http://www.osha.gov/SLTC/bloodlead/program.html>

### **SUMMARY OF MICHIGAN'S LEAD STANDARDS**

In 1981, under the authority of the Michigan Occupational Safety and Health Act (MIOSHA), Michigan promulgated a comprehensive standard to protect workers exposed to lead in general industry (i.e., R325.51901 - 325.51958). That standard was most recently amended in October, 2000. In October 1993, MIOSHA adopted by reference the federal Occupational Safety and Health Administration's (OSHA) Lead Standard for Construction (i.e., 29 CFR 1926.62). That standard was most recently amended October 18, 1999. Both the MIOSHA Lead Exposure in Construction Standard (Part 603) and the Lead Exposure in General Industry Standard (Part 310) establish an "action level" (30 micrograms of lead per cubic meter of air [ $\mu\text{g}/\text{m}^3$ ] averaged over an eight-hour period) and a permissible exposure limit (50  $\mu\text{g}/\text{m}^3$  averaged over an eight hour period) for employees. Both standards require employers to conduct initial exposure monitoring and to provide employees written notification of these monitoring results. If employee exposure levels exceed the permissible exposure limit (PEL), employers are required to develop a written compliance program that addresses the implementation of feasible engineering and/or work practice controls to reduce and maintain employee exposures below the PEL. The Lead Exposure in Construction Standard (Part 603) also allows the use of administrative controls to achieve this objective. An employer's obligations concerning hygiene facilities, protective work clothing and equipment, respiratory protection, medical surveillance and training under the Lead Exposure in Construction Standard (Part 603) are triggered initially by job tasks and secondarily by actual employee exposure level to lead. Under the Lead Exposure in General Industry Standard (Part 310), these potential obligations are triggered by actual employee exposure levels to lead. Medical surveillance and training are triggered by exposures above the action level (AL), whereas protective clothing and equipment, respiratory protection and hygiene facilities are triggered by exposures above the PEL.

The medical surveillance program requirements for Michigan's Lead Exposure in General Industry Standard (Part 310) versus those required in Lead Exposure in Construction Standard (Part 603) do vary. Under the Lead Exposure in General Industry Standard (Part 310), a medical surveillance program must be implemented which includes periodic biological monitoring (blood tests for lead and zinc protoporphyrin [ZPP] levels), and medical exams/consultation for all workers exposed more than 30 days per year to lead levels exceeding the AL. Under the Lead Exposure in Construction Standard (Part 603), a distinction is made between "initial medical surveillance" (consisting of biological monitoring in the form of blood sampling and analysis for lead and ZPP levels) and secondary medical surveillance (consisting of follow-up biological monitoring and a medical examination/consultation). The initial medical exam is triggered by employee exposure to lead on any day at or above the AL. The secondary medical exam is triggered by employee exposures to lead at or above the AL for more than 30 days in any 12 consecutive months period.

Michigan's Lead Exposure in General Industry Standard (Part 310) mandates that employees exposed at or above the AL must be removed from the lead exposure when:

4.

- A periodic blood test and follow-up blood test indicate that the blood lead level (BLL) is at or above 60 micrograms per deciliter ( $\mu\text{g}/\text{dL}$ ) of whole blood.
- Medical removal is also triggered if the average of the last three BLL or the average of all blood sampling tests conducted over the previous six months, whichever is longer, indicates the employees blood lead level is at or above 50  $\mu\text{g}/\text{dL}$ . Medical removal is not required however, if the last blood sampling test indicates a blood lead level at or below 40  $\mu\text{g}/\text{dL}$  of whole blood.
- When a final medical determination reveals that an employee has a detected medical condition which places that employee at an increased risk of material impairment to health from the lead exposure.

The Lead Exposure in Construction Standard (Part 603) mandates removal of an employee from a lead exposure at or above the AL when:

- A periodic and follow-up blood test indicates that an employee's BLL is at or above 50  $\mu\text{g}/\text{dL}$ ; or
- There is a final medical determination that an employee has a detected medical condition which places that employee at an increased risk of material impairment to health from the lead exposure.

2007 ANNUAL REPORT ON BLOOD LEAD LEVELS ON ADULTS AND CHILDREN IN MICHIGAN  
Part II: Adult Blood Lead Epidemiology and Surveillance – **APPENDIX C**

---

When an employee can return to work at their former job also differs by standard. The Lead Exposure in General Industry Standard (Part 310) allows an employee to return to his or her former job status under any of the following circumstances:

- If the employee's BLL was at or above 70 ug/dL, then two consecutive blood tests must have the BLL at or below 50 ug/dL.
- If the employee's BLL was at or above 60 ug/dL or due to an average BLL at or above 50 ug/dL, then two consecutive BLL must be at or below 40 ug/dL.
- For an employee removed due to a final medical determination, when a subsequent medical determination no longer detects a medical condition which places the employee at an increased risk of material impairment to health from exposure to lead.

The Lead Exposure in Construction Standard (Part 603) allows the employer to return an employee to their former job status under these circumstances:

- If the employee's BLL was at or above 50 ug/dL, then two consecutive blood tests must have the employee's BLL at or below 40 ug/dL.
- For an employee removed due to a final medical determination, when a subsequent medical determination no longer has a detected medical condition which places the employee at an increased risk of material impairment to health from exposure to lead.

Both the Lead Exposure in General Industry (Part 310) and Lead Exposure in Construction (Part 603) Standards have a medical removal protection benefits provision. This provision requires employers maintain full earnings, seniority and other employment rights and benefits of temporarily removed employees up to 18 months on each occasion that an employee is removed from exposure to lead. This includes the right to their former job status as though the employee had not been medically removed from the job or otherwise medically limited.

#### **Provisions of Lead Exposure in General Industry (Part 310) and Lead Exposure in Construction (Part 603) Standards**

Workers exposed to lead have a right to: an exposure assessment, respiratory protection, protective clothing and equipment, hygiene facilities, medical surveillance, medical removal and training. The triggering mechanisms that activate these rights are primarily based upon employee lead exposure levels. However, under the Lead Exposure in Construction Standard (Part 603), many of these rights are initially triggered by the specific work activity being performed.

#### **Exposure Assessment**

Air monitoring must be conducted to determine employee airborne lead exposure levels when a potential lead exposure exists. Under the Lead Exposure in Construction Standard (Part 603), however, specific work activities are identified/categorized that require "interim protection" (i.e., respiratory protection, personal protective clothing and equipment, work clothes change areas, hand washing facilities, biological monitoring and training) until air monitoring has been performed that establishes that these lead exposure levels are within the acceptable limits (AL or PEL).

#### **Respiratory Protection**

Respiratory protection is required whenever employee exposure levels exceed the PEL and as an interim control measure under the Lead Exposure in Construction Standard (Part 603). The level of respiratory protection required is dependent upon the actual employee exposure level or by the job activities identified in the Lead Exposure in Construction Standard (Part 603).

### **Protective Clothing/Equipment**

Protective clothing/equipment (i.e., coveralls or similar full body clothing; gloves, hats, shoes or disposable shoe coverlets; and face shield, vented goggles, or other applicable equipment) is required whenever employee exposure levels exceed the PEL and as an interim protection measure under the Lead Exposure in Construction Standard (Part 603).

### **Hygiene Facilities**

Hygiene facilities (i.e., clothing change areas, showers, eating facilities) are required whenever employee exposures to lead exceed the PEL. Except for shower facilities, these same hygiene facilities must be provided as interim protection under the Lead Exposure in Construction Standard (Part 603). The construction employer must, however, provide hand washing facilities in lieu of the shower facility as an interim protection.

### **Medical Surveillance**

Medical surveillance (i.e., medical exam and consultation) is required when workers are exposed to lead at or exceeding the AL for more than 30 days a year. Biological blood sampling and analysis to determine lead and ZPP levels is required initially under the Lead Exposure in Construction Standard (Part 603) when employee lead exposure is at or exceeds the AL on any single day. Under the Lead Exposure in General Industry Standard (Part 310), it is required when employees are exposed to concentrations of airborne lead greater than the A.L. for more than 30 days per year.

### **Medical Removal**

Workers covered by the Lead Exposure in General Industry (Part 310) Standard have the right to be removed from airborne lead exposures at or above the AL when their periodic and follow-up blood lead level is at or above 60 ug/dL or when an average of the last three blood lead levels or the average of all blood sampling tests conducted over the previous six months, whichever is longer, indicates the employee blood lead level is at or above 50 ug/dL. However, under this later removal criteria, they are not required to be removed if the last blood sampling test indicates a blood lead level at or below 40 ug/dL.

Workers covered by the Lead Exposure in Construction Standard (Part 603) have the right to be removed from airborne lead exposures at or above the AL on each occasion that a periodic and follow-up blood sample test indicate that the employee's blood lead level is at or above 50 ug/dL.

Under both the Lead Exposure in General Industry (Part 310) and Lead Exposure in Construction (Part 603) Standards, workers also have the right to be removed from airborne lead exposures at or above the AL whenever there is a final medical determination that has detected that they have a medical condition that places them at an increased risk of material impairment to health from exposure to lead.

### **Training**

Under the Lead Exposure in General Industry Standard (Part 310) and Lead Exposure in Construction (Part 603), employees exposed to any level of airborne lead must be informed of the contents of appendices A and B from that standard.

Under both the Lead Exposure in General Industry (Part 310) and Lead Exposure in Construction (Part 603) Standards, employees who are exposed at or above the AL on any day or who are subject to exposure to lead compounds which may cause skin or eye irritation must be provided comprehensive training covering all topics specified in those standards.

Also, under the Lead Exposure in Construction Standard (Part 603), employees involved in any of the specified work activities requiring interim controls, must receive training prior to initiating those activities that addresses the recognition and avoidance of unsafe conditions involving lead and the specific regulations applicable to the worksite that have been established to control or eliminate the hazards associated with exposure to lead.



CDC Home

Search

Health Topics A-Z

MMWR™

Weekly

April 27, 2007 / 56(16);397-400

## Lead Exposure Among Females of Childbearing Age --- United States, 2004

For centuries, exposure to high concentrations of lead has been known to pose health hazards, and evidence is mounting regarding adverse health effects from moderate- and low-level blood lead concentrations. Public health authorities use higher levels to define blood lead levels (BLLs) of concern in nonpregnant females ( $\geq 25 \mu\text{g/dL}$ ) compared with children ( $\geq 10 \mu\text{g/dL}$ ) and a lower level ( $\geq 5 \mu\text{g/dL}$ ) for pregnant females (1--3). This difference in levels for nonpregnant and pregnant females has raised concern because of the recognition that a proportion of nonpregnant females with BLLs  $\geq 5 \mu\text{g/dL}$  will become pregnant and potentially expose their infants to a risk for adverse health effects from lead. Maternal and fetal BLLs are nearly identical because lead crosses the placenta unencumbered (4). This report summarizes 2004 surveillance data regarding elevated BLLs among females of childbearing age (i.e., aged 16--44 years) in 37 states participating in CDC's Adult Blood Lead Epidemiology and Surveillance (ABLES) program. The results indicated that rates of elevated BLLs ranged from 0.06 per 100,000 females of childbearing age at BLLs of  $\geq 40 \mu\text{g/dL}$  to 10.9 per 100,000 females at BLLs of  $\geq 5 \mu\text{g/dL}$ . Primary and secondary prevention of lead exposure among females of childbearing age is needed to avert neurobehavioral and cognitive deficits in their offspring.

ABLES tracks laboratory-reported BLLs in persons aged  $\geq 16$  years who have been tested through workplace monitoring programs or on the basis of clinical suspicion of lead exposure; BLLs are reported for both occupational and nonoccupational exposures.\* The Occupational Safety and Health Administration (OSHA) mandates BLL testing of all persons working in areas where airborne lead exceeds a certain level. States participating in ABLES require all laboratories to report BLL results. The lowest reportable BLL varies by state. During 2004, a total of 37 states participated in ABLES. These states all reported BLL rates of  $\geq 25 \mu\text{g/dL}$  and  $\geq 40 \mu\text{g/dL}$ . Ten of the 37 states also reported BLLs of any level, enabling these states to calculate prevalences of persons with BLLs  $\geq 5 \mu\text{g/dL}$  and  $\geq 10 \mu\text{g/dL}$ , in addition to the two higher levels.

To assess the prevalence of elevated BLLs in females of childbearing age, ABLES data for 2004 were analyzed at four different BLLs: 1)  $5 \mu\text{g/dL}$ , the level at or above which the Association of Occupational and Environmental Clinics recommends intervention for pregnant women (3); 2)  $10 \mu\text{g/dL}$ , the level at or above which CDC recommends intervention for children (1); 3)  $25 \mu\text{g/dL}$ , the limit set by *Healthy People 2010* in its public health objective to eliminate elevated BLLs in adults (2); and 4)  $40 \mu\text{g/dL}$ , the limit at or below which OSHA will permit a worker to return to work after being medically removed from work because of lead poisoning (5). Unique identifiers were used to exclude females who had multiple tests performed in 2004; for females with multiple tests, only the highest value was included.



Occupationally exposed females were defined as those whose medical records contained either a valid industry code or a report of work-related exposure. Exposures lacking at least one of these two criteria were considered nonoccupational. Occupational denominators were based on the Bureau of Labor Statistics 2004 Current Population Survey (6). Rates of elevated BLLs resulting from all exposures (i.e., both occupational and nonoccupational) also were calculated per 100,000 female residents aged 16--44 years in the reporting states, using U.S. census population estimates for 2004 as the denominators. Using case data from all 37 ABLES states, rates of BLLs  $\geq 25 \mu\text{g/dL}$  and BLLs  $\geq 40 \mu\text{g/dL}$  among occupationally exposed females aged 16--44 years were calculated per 100,000 female workers aged 16--44 years overall and in individual industries with high numbers of workers with elevated BLLs. Using data from 10 ABLES states, rates also were calculated at BLLs of  $\geq 5 \mu\text{g/dL}$  and  $\geq 10 \mu\text{g/dL}$ .

In 2004, in 10 ABLES states, a total of 10,527 females aged 16--44 years were tested, and all BLLs for this group were reported. Of the number tested, 1,370 (13.0%) had BLLs  $\geq 5 \mu\text{g/dL}$  (10.9 per 100,000 female residents aged 16--44 years), and 476 had BLLs  $\geq 10 \mu\text{g/dL}$  (3.8 per 100,000 female residents aged 16--44 years) (Table). A total of 442 (32.3%) of the 1,370 females with BLLs  $\geq 5 \mu\text{g/dL}$  had occupational exposures. In all 37 ABLES states, the total number of females aged 16--44 years who were tested is unknown. Among those tested, 0.7 per 100,000 female residents aged 16--44 years had BLLs  $\geq 25 \mu\text{g/dL}$ , and 0.08 per 100,000 female residents had BLLs  $\geq 40 \mu\text{g/dL}$  (Table).

The rates of elevated BLLs associated with occupational exposure were similar to or lower than the rates associated with all exposures (i.e., both occupational and nonoccupational) at all four levels examined; however, certain industry-specific rates of occupational exposure were substantially higher than all other rates (Table). The majority of occupationally exposed females were employed in the manufacturing sector, with 178 of 199 (89%) working in the industry that includes battery manufacturing (Table).<sup>†</sup> For that industry, these 178 females yielded a rate of 244 cases of BLLs  $\geq 25 \mu\text{g/dL}$  per 100,000 females aged 16--44 years employed in the industry. This rate compares with rates of 7.1 cases of BLLs  $\geq 25 \mu\text{g/dL}$  per 100,000 in the entire manufacturing sector and 0.6 cases per 100,000 employed in all sectors. Similarly, the industry that includes battery manufacturing had a rate of 8.4 cases of BLLs  $\geq 40 \mu\text{g/dL}$  per 100,000 females aged 16--44 years employed in that industry, compared with rates of 0.4 per 100,000 employed in the entire manufacturing sector and 0.04 per 100,000 employed in all sectors (Table).

**Reported by:** *GM Calvert, MD, RJ Roscoe, MS, Div of Surveillance, Hazard Evaluations, and Field Studies, National Institute for Occupational Safety and Health; SE Luckhaupt, MD, EIS Officer, CDC.*

### **Editorial Note:**

Health effects in infants born to females with moderately elevated BLLs (i.e., 10--15  $\mu\text{g/dL}$ ) include preterm birth, decreased gestational maturity, lower birth weight, reduced postnatal growth, increased incidence of minor congenital anomalies, and early neurologic or neurobehavioral deficits (7). How long these neurologic effects are likely to persist is unclear, but some evidence documents associations between prenatal elevated BLLs and decreased intelligence at ages 3--7 years (8).

Conducting surveillance of elevated BLLs among all females of childbearing age is important because approximately one third to one half of U.S. pregnancies are unplanned (9). Identification of a female with elevated BLLs can facilitate prevention of any further lead exposure that might, in the event she becomes pregnant, endanger the health of the fetus.

Estimates of the number and rate of females of childbearing age with elevated BLLs have varied widely. Data from the National Health and Nutrition Examination Survey (NHANES) for 1999--2002 suggest a national rate of 300 cases of BLLs  $\geq 10 \mu\text{g/dL}$  per 100,000 women aged 20--59 years, a 25% decrease from 1991--1994 NHANES estimates of 400 cases per 100,000 population. For comparison, in this report, data from the 10 states that reported all BLLs to ABLES in 2004 indicated a rate of only 3.8 cases of BLLs  $\geq 10 \mu\text{g/dL}$  per 100,000 females aged 16--44 years for all types of exposures. Because the rates of BLLs  $\geq 25 \mu\text{g/dL}$  and BLLs  $\geq 40 \mu\text{g/dL}$  from the 10 states were similar to the rates derived from reports of all 37 ABLES states (Table), the ABLES data offer no indication that lead exposures in the 10 states would differ substantially from exposures in all 50 states combined. The data presented in this report, however, used the general population of female residents aged 16--44 years as the denominator. For the ABLES rate to approximate the rate from NHANES, all females in that population who met lead exposure criteria for workplace monitoring programs or who were suspected of lead exposure by health-care providers would have been tested and reported to ABLES. However, the low numbers (10,527) of females tested in the 10 states suggests this likely was not the case; using the NHANES rate, approximately 37,000 females aged 16--44 years in the 10 states would have had BLLs  $\geq 10 \mu\text{g/dL}$ . The difference between the ABLES population-based rates and the rates from NHANES suggest that a large proportion of females with moderately elevated BLLs likely are not being tested or the results are not being reported to ABLES.

Rates of elevated BLLs detected in ABLES among females in the manufacturing sector, especially in the industry that includes battery manufacturing, were much higher than rates among the general population for all lead exposures. These higher rates suggest that despite OSHA's recent focus on reducing workplace lead exposures among all U.S. workers, the workplace remains a substantial source of exposure, and clinicians should consider work history when determining whether to measure BLLs.

The findings in this report are subject to at least three limitations. First, elevated BLLs are underreported by ABLES because all employers might not provide BLL testing to all lead-exposed workers as required by OSHA regulations, and testing of nonoccupationally exposed adults is dependent on a clinician's index of suspicion. Underreporting likely varies by industry. For example, high rates of elevated BLLs in the industry that includes battery manufacturing might partially reflect more thorough testing programs in this industry. In addition, certain laboratories might not report all tests as required by state regulations. Second, data on occupational sources of exposure might be incomplete, resulting in misclassification of occupational versus nonoccupational cases. Finally, a wide margin of error is associated with certain industry-specific rates because of the small sample size.

The difference between BLLs that are considered elevated in females who are pregnant and those who might become pregnant has substantial public health implications. Identifying and counseling females of childbearing age who might become pregnant and expose children to lead in utero might help to prevent neurobehavioral and cognitive deficits.

## **Acknowledgment**

This report is based, in part, on data contributed by ABLES state coordinators.

## **References**

1. CDC. Preventing lead poisoning in young children. Atlanta, GA: US Department of Health and Human Services, CDC; 2005. Available at

<http://www.cdc.gov/nceh/lead/publications/prevleadpoisoning.pdf>.

2. US Department of Health and Human Services. Healthy people 2010 (conference ed, in 2 vols). Washington, DC: US Department of Health and Human Services; 2000. Available at <http://www.health.gov/healthypeople>.
3. Association of Occupational and Environmental Clinics. Medical management guidelines for lead-exposed adults. Washington, DC: Association of Occupational and Environmental Clinics; 2005. Available at [http://www.aoec.org/documents/positions/mmg\\_final.pdf](http://www.aoec.org/documents/positions/mmg_final.pdf).
4. Goyer RA. Transplacental transport of lead. Environ Health Perspect 1990;89:101--5.
5. Occupational Safety and Health Administration. Standard 29 CFR 1910.1025: Lead. Washington, DC: US Department of Labor, Occupational Safety and Health Administration. Available at <http://www.osha.gov/>.
6. Bureau of Labor Statistics. Current population survey 2004 microdata files. Washington DC: US Department of Labor, Bureau of Labor Statistics; 2004.
7. Dietrich KN. Human fetal lead exposure: intrauterine growth, maturation, and postnatal neurobehavioral development. Fundam Appl Toxicol 1991;16:17--9.
8. Wasserman GA, Liu X, Popovac D, et al. The Yugoslavia prospective lead study: contributions of prenatal and postnatal lead exposure to early intelligence. Neurotoxicol Teratol 2000;22:811--8.
9. [CDC. Monitoring progress toward achieving maternal and infant healthy people 2010 objectives---19 states, Pregnancy Risk Assessment Monitoring System \(PRAMS\), 2000--2003. MMWR 2006;55\(No. SS-9\).](#)

\* Additional information regarding the ABLES program is available at <http://www.cdc.gov/niosh/topics/ables/ables.html>.

† 2002 Census Industry Code 3490.

## Table

TABLE. Number and rate of females aged 16–44 years with elevated blood lead levels (BLLs), by BLL and occupational exposure status — Adult Blood Lead Epidemiology and Surveillance (ABLES), United States, 2004

Occupational exposure status	BLL $\geq$ 5 $\mu$ g/dL		BLL $\geq$ 10 $\mu$ g/dL		BLL $\geq$ 25 $\mu$ g/dL		BLL $\geq$ 40 $\mu$ g/dL	
	No.	Rate	No.	Rate	No.	Rate	No.	Rate
<b>Among 10 states that reported all BLLs to ABLES*</b>								
All exposures <sup>†</sup>	1,370	10.9	476	3.8	86	0.7	8	0.06
Occupational exposure <sup>‡</sup>	442	5.0	254	2.9	55	0.6	2	0.02
<b>Among all 37 states that participated in ABLES<sup>§</sup></b>								
All exposures <sup>†</sup>	—**	—	—	—	342	0.7	42	0.08
Occupational exposure <sup>‡</sup>	—	—	—	—	224	0.6	14	0.04
All manufacturing (CIC <sup>††</sup> 1070–3990)	—	—	—	—	199	7.1	11	0.4
Electrical machinery, equipment, and supplies manufacturing, not elsewhere classified (CIC 3490 [includes battery manufacturing])	—	—	—	—	178	244 <sup>§§</sup>	6	8.4
Metal ore mining (CIC 0390)	—	—	—	—	13	—	1	—
Construction (CIC 0770)	—	—	—	—	7	1.2	0	—
Other industry	—	—	—	—	2	0.006	2	0.006

\* California, Hawaii, Iowa, Minnesota, Missouri, Montana, New Mexico, Rhode Island, Wisconsin, and Wyoming. A total of 10,527 females aged 16–44 years were tested by these 10 states.

† Rate per 100,000 female residents aged 16–44 years in reporting states based on U.S. census estimates for 2004.

‡ Rate per 100,000 female workers aged 16–44 years in reporting states based on Bureau of Labor Statistics 2004 Current Population Survey data (available at <http://www.bls.gov/data>).

§ Alabama, Alaska, Arizona, California, Connecticut, Florida, Georgia, Hawaii, Illinois, Indiana, Iowa, Kansas, Kentucky, Maine, Maryland, Massachusetts, Michigan, Minnesota, Missouri, Montana, Nebraska, New Hampshire, New Jersey, New Mexico, New York, North Carolina, Ohio, Oklahoma, Oregon, Pennsylvania, Rhode Island, South Carolina, Texas, Utah, Washington, Wisconsin, and Wyoming.

\*\* Data not available.

†† 2002 Census Industry Code.

§§ Three cases reported from Oklahoma were excluded from the rate calculation because denominator data were not available for the state.

[Return to top.](#)

Use of trade names and commercial sources is for identification only and does not imply endorsement by the U.S. Department of Health and Human Services.

References to non-CDC sites on the Internet are provided as a service to *MMWR* readers and do not constitute or imply endorsement of these organizations or their programs by CDC or the U.S. Department of Health and Human Services. CDC is not responsible for the content of pages found at these sites. URL addresses listed in *MMWR* were current as of the date of publication.

**Disclaimer** All *MMWR* HTML versions of articles are electronic conversions from ASCII text into HTML. This conversion may have resulted in character translation or format errors in the HTML version. Users should not rely on this HTML document, but are referred to the electronic PDF version and/or the original *MMWR* paper copy for the official text, figures, and tables. An original paper copy of this issue can be obtained from the Superintendent of Documents, U.S. Government Printing Office (GPO), Washington, DC 20402-9371; telephone: (202) 512-1800. Contact GPO for current prices.

\*\*Questions or messages regarding errors in formatting should be addressed to [mmwrq@cdc.gov](mailto:mmwrq@cdc.gov).

Date last reviewed: 4/26/2007

[HOME](#) | [ABOUT \*MMWR\*](#) | [MMWR SEARCH](#) | [DOWNLOADS](#) | [RSS](#) | [CONTACT](#)  
[POLICY](#) | [DISCLAIMER](#) | [ACCESSIBILITY](#)

**SAFER • HEALTHIER • PEOPLE™**

**Morbidity and Mortality Weekly Report**  
Centers for Disease Control and Prevention  
1600 Clifton Rd, MailStop E-90, Atlanta, GA  
30333, U.S.A



Department of Health  
and Human Services

## **Narratives of Nine Individuals with a Blood Lead Level of $\geq 50$ $\mu\text{g}/\text{dL}$ in 2007**

### **Work-Related (5)**

#### **Self-Employed Painter (SIC 1721) (1)**

A male in his 40s had blood lead testing performed by his personal physician. His blood lead levels in 2007 ranged from 44 to 71  $\mu\text{g}/\text{dL}$ . He was an exterior house painter and stripped old lead based paint prior to new paint application.

#### **Special Trade Contractors (SIC 1799) (1)**

A male in his 20s had blood lead testing as part of his company medical screening program. His blood lead levels in 2007 ranged from 0 to 87  $\mu\text{g}/\text{dL}$ . He complained of weight loss, frequent pain/soreness in his joints, dizziness, depression, fatigue, sleeplessness, and irritability. He denied any lead-related hobbies. He worked for an environmental company as a water blaster. As part of his job he would wear a respirator for eight hours a day. He was removed from work because of his elevated blood lead level. He was also a cigarette smoker who smoked in the work area and kept his cigarettes in his pocket while working.

#### **Glass Products, Made of Purchased Glass (SIC 3231) (2)**

A male in his 20s worked as stained glass maker for three years. His blood lead levels in 2007 ranged from 46 to 51  $\mu\text{g}/\text{dL}$ . He made glass racks, cut lead strips to fit glass, soldered, and took apart glass windows. He had a significant unintentional weight loss. He also had fatigue, irritability and frequent headaches. He wore a respirator when he was soldering windows. He was also told that his kidneys were not functioning properly. He was taken off working with lead and moved to glass cutting after his lead levels were found to be elevated.

A male in his 20s had infrequent headaches and irritability. His blood lead levels in 2007 ranged from 30 to 50  $\mu\text{g}/\text{dL}$ . He worked for a stained glass company as well as did his own stained glass projects for the last four years. He also spent the past two years remodeling/renovating and painting outside of his regular work. In addition, he did occasional outdoor firearm practice for the last two years. His blood level was checked by his family physician.

#### **Non-Ferrous Foundries (SIC 3366) (1)**

A male in his 40s had blood lead testing as part of a company medical screening, which was begun after a MIOSHA inspection that had been initiated by his elevated blood lead three years earlier. His results in 2007 ranged from 41 to 52  $\mu\text{g}/\text{dL}$ . Blood lead results in 2006 ranged from 53  $\mu\text{g}/\text{dL}$  to 59  $\mu\text{g}/\text{dL}$  and in 2005 ranged from 58 to 71  $\mu\text{g}/\text{dL}$ . His initial blood lead result was 65  $\mu\text{g}/\text{dL}$  in 2004, which was ordered by his personal physician. When interviewed in 2004 he denied having any of the symptoms seen in individuals with lead toxicity. He was not re-interviewed after the high blood leads in 2005, 2006, or 2007. He had no lead-related recreational activities. He worked at a small foundry pouring brass/bronze (5-9% lead) for the past eighteen years. He was a

non-smoker. Eight-hour time-weighted average (TWA) results in 2005 indicated lead exposure levels of 130, 200, 780, 500 and 380 mg/m<sup>3</sup> compared to the MIOSHA permissible exposure limit of 50 mg/m<sup>3</sup>.

### **Firearms (2)**

A male in his 60s worked as a pharmacist. He was involved in competitive shooting for two years and was exposed to lead at the time of reloading. He practiced shooting daily, both in an indoor and outdoor range. He had also been casting bullets weekly for a year. He also had a history of making lead scuba weights 50 years ago, and having shrapnel from wounds in Vietnam. His blood level was checked by his personal physician as a result of his hobbies and past exposure and ranged from 27 to 79 µg/dL in 2007. He was given EDTA as well as an herbal remedy for lowering his lead level.

A male in his 70s had blood lead levels in 2007 ranging from 27 to 51 µg/dL. His source of exposure was related to collecting spent shells from firing ranges and melting them down to make ingots.

### **Gun Shot Wound (1)**

A male in his 40s presented to the emergency room with complaints of stabbing, severe pain in his epigastric region and lower chest and associated encephalopathy. He had been complaining of this pain for the last 3 weeks and had been admitted to the same hospital multiple times during this 3 week period. He had been diagnosed with anemia and erosive gastritis on endoscopy and discharged home on treatment for gastritis. He had a past medical history of hypertension and IV drug use. He also had sustained a gunshot wound in his right leg 2 years ago that had been operated upon and an intramedullary rod placed. He was intubated and placed on a ventilator again at the most recent admission. He was found to have microcytic anemia that was associated with basophilic stippling. Lead levels were done which were 306 µg/dL. No history of exposure to lead at work or home was obtained. An X-ray of his right thigh showed some bullet fragments and the presence of a large callus. He was started on antibiotics and surgery was performed. The bullet fragments were removed and a large infected cyst was found at that site. He was also given chelation therapy with BAL and Ca-disodium-EDTA. His condition gradually improved and his mental status returned to his baseline. His blood lead level gradually came down to 48 µg/dL at the time of discharge although it then rebounded to 57 µg/dL.

### **Remodeling (1)**

A male in his 50s requested blood lead testing from his personal physician. His blood lead levels in 2007 ranged from 37 to 50 µg/dL. He had symptoms of frequent pain/soreness in his joints, muscle weakness, dizziness, fatigue, nervousness, irritability, and difficulty concentrating. He also indicated a loss in hearing. For the past three years, on a weekly basis, he had been involved in remodeling/renovating his house and had been stripping paint. He denied any employment where he might have been exposed to lead. He was also a smoker and indicated that he smoked in the area of the renovations.