

# **2004**

---

## **Annual Report on Blood Lead Levels in Michigan**



# **2004 Annual Report on Blood Lead Levels 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  
Management and Technical Services Division  
P.O. Box 30649  
Lansing, Michigan 48909-8149  
(517) 322-1817

Douglas J. Kalinowski, M.S., C.I.H., Director  
Michigan Occupational Safety and Health Administration

and

Michigan Department of Community Health  
Division of Family and Community Health  
Childhood Lead Poisoning Prevention Project  
3423 North M.L.King, Jr. Blvd.  
P.O. Box 30195  
Lansing, Michigan 48909  
(517) 335-8885

Douglas M. Paterson, Project Director  
Mary A. Scoblic, R.N., M.N., Project Unit Director  
Sharon Hudson, R.N., M.S.N., C.N.M., Project Coordinator

May 2, 2005

# **Part I**

## **Blood Lead Levels Among *Adults* in Michigan**

## Summary:

This is the seventh 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. The first part of the report (pages 1 to 44 and appendices I-V) is about blood lead levels in adults (16 years and older) and the second part (pages 45 to 59) is about the results of blood lead tests in children under the age of six.

In 2004, 15,624 reports were received for 13,140 individuals  $\geq 16$  years of age. Eight hundred sixteen (6.2%) individuals had blood lead levels greater than or equal to 10  $\mu\text{g}/\text{dL}$ ; 155 of those 816 had lead levels greater than or equal to 25  $\mu\text{g}/\text{dL}$  and 9 of the 155 had blood lead levels greater than or equal to 50  $\mu\text{g}/\text{dL}$ .

There were 2,342 more reports (on 1,029 individuals) received in 2004 compared to 2003. Both the total number and percent of individuals with blood lead levels greater than or equal to 10  $\mu\text{g}/\text{dL}$  decreased from 952 (7.9%) in 2003 to 816 (6.2%) in 2004. The number and percent of individuals with blood lead levels greater than or equal to 25  $\mu\text{g}/\text{dL}$  decreased, from 173 (1.4%) in 2003 to 155 (1.2%) in 2004. The number and percent of individuals with blood lead levels greater than or equal to 50  $\mu\text{g}/\text{dL}$  increased slightly from 6 (0.05%) in 2003 to 9 (0.07%) in 2004. This is the sixth year in a row that blood lead levels greater than or equal to 25  $\mu\text{g}/\text{dL}$  decreased from the previous year and the second year in a row that blood leads greater than or equal to 10  $\mu\text{g}/\text{dL}$  decreased from the previous year.

Individuals with blood lead levels greater than or equal to 10  $\mu\text{g}/\text{dL}$  were likely to be men (93.4%) and white (87.9%). Their mean age was 43. They were most likely to live in Wayne (22.6%), Montcalm (8.0%) and Kent (7.4%) counties.

Occupational exposure remains the predominant source of lead exposure in Michigan adults (82% 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 from guns at shooting ranges. Individuals with elevated blood lead from exposure at shooting 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 (10.2% of all cases).

In 2004, inspection reports were finalized on eight companies first identified in 2004 where employees had blood lead levels greater than or equal to 25  $\mu\text{g}/\text{dL}$ . These reports showed that 6 of 8 (75%) were in violation of the lead standard. Evaluation of these inspections has shown them to be effective relative to other types of workplace enforcement inspections and suggests that they play a role in helping to reduce blood lead levels (1).

The seventh year of operation of an adult blood lead surveillance system in Michigan proved successful in continuing to identify a large number of 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: encouraging radiator repair facilities, which use lead, to conduct blood lead testing; 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.

Ongoing surveillance in future years will determine if the favorable trend in lower blood lead levels found from 1998-2004 will continue.

## **Background:**

This is the seventh 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, had been 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. Currently 37 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 tests (BLLs) to the Michigan Department of Community Health (R325.9081-.9087). 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 I). The physician or health provider ordering the blood lead analysis is responsible for completing the patient information (section I), the physician/provider information (section II) and the specimen collection information (section IIa). Upon receipt of the blood sample for lead analysis, the clinical laboratory is responsible for completion of the laboratory information (section III). 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 2004 on children less than six years old is in Part II 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 II lists the ten approved laboratories in Michigan. This number is down from twelve 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. We also interview individuals with blood lead levels ranging from 10 to 24 µg/dL if we cannot identify the source of their lead exposure from the reporting form. A letter is sent to the individual 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 OSHA (MIOSHA) Requirements for Medical Monitoring and Medical Removal**

MIOSHA requirements for medical surveillance (i.e. biological monitoring) and medical removal are identical to Federal OSHA's. 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 at or below 40 µg/dL. See Appendix III for a more detailed description of the requirements.

In the absence of a specific exposure to lead, blood lead levels in the general population are typically below 10 µg/dL (2).

### **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) (3). See Appendix IV for the most recent publication.

## **Results:**

2004 is the seventh 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 2004 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 2004**

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

Between January 1 and December 31, 2004, the State of Michigan received 15,624 blood lead level reports for individuals 16 years of age or older. Because an individual may be tested more than once each year, the 15,624 reports received were for 13,140 individuals (Table 1). The number of individuals tested for blood lead each year has gradually increased (Figure 1). The increase in 1999 and 2000 probably was secondary to better compliance with the new regulation. The increase in more recent years is assumed secondary to increased testing.

The following descriptive statistics are based on the 13,141 individuals reported in 2004, and are based on the highest BLL reported for each of these adults.

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

In 2004, 816 (6.2%) of the 13,140 adults reported had blood lead levels greater than or equal to 10 µg/dL; 155 of those 816 had blood lead levels greater than or equal to 25 µg/dL and 9 of those 155 had blood lead levels greater than or equal to 50 µg/dL (Table 1). A total of 12,324 (93.8%) of the adults reported in 2004 had BLLs less than 10 µg/dL. Individuals with non-work exposure had higher blood leads than individuals with work exposure (Table 1).

There has been a gradual decline in the number of individuals with elevated blood lead (Figure 2).

#### **Gender and Age Distribution**

##### **All Blood Lead Levels**

Approximately, sixty percent of the adults reported to the Registry were male, with females representing forty percent of the reports (Table 2). The age distribution is shown in Table 3. The mean age was 43.

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

For the 816 adults reported to the Registry with blood lead levels greater than or equal to 10  $\mu\text{g/dL}$ , 762 (93.4%) were men and 54 (6.6%) were women (Table 2). The age distribution for these adults was similar to the reports of all BLLs (Table 3). The mean age was 42.

## **Race Distribution**

### **All Blood Lead Levels**

Although laboratories are required to report the patients' race, this information is frequently not completed. Race was missing for 7,685 (58.5%) of the 13,140 adults reported. Where race was known, 4,391 (80.5%) were reported as Caucasian, 873 (16.0%) were reported as African American, 76 (1.4%) were reported as multiracial/other, 65 (1.2%) were reported as Native American, and 50 (0.9%) were reported as Asian/Pacific Islander (Table 4).

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

For adults with blood lead levels greater than or equal to 10  $\mu\text{g/dL}$  where race was indicated, 547 (87.9%) were reported as Caucasian, 51 (8.2%) were reported as African American, 15 (2.4%) were reported as Native American, 6 (1.0%) were reported as multiracial/other, and 3 (0.5%) were reported as Asian/Pacific Islander, (Table 4). Although the percentage of African-Americans with blood leads levels  $\geq 10\mu\text{g/dL}$  decreased as compared to all blood lead levels, African Americans had a greater percentage of the extremely high blood leads  $\geq 60\mu\text{g/dL}$  (Table 14).

## **Geographic Distribution**

County of residence was determined for 9,578 of the 13,140 adults reported to the Registry. They lived in all of Michigan's 83 counties. The largest number of adults reported in 2004 lived in Wayne County (1,949, 20.4%), followed by Kent (1,160, 12.1%) and Oakland (721, 7.5%). County was unknown for 3,562 adults (Figure 3 and Table 5).

Figure 4 and Table 5 show the county of residence of the 739 adults with blood lead levels greater than or equal to 10  $\mu\text{g/dL}$  where county of residence could be determined. The largest number of adults reported with a BLL of 10  $\mu\text{g/dL}$  and greater were from Wayne County (167, 22.6%), followed by Montcalm (59, 8.0%) and Kent (55, 7.4%). County was unknown for 77 adults.

Figure 5 and Table 5 show the county of residence for the 145 adults with blood lead levels greater than or equal to 25  $\mu\text{g/dL}$  where county of residence could be determined. The largest number of adults reported with a BLL of 25  $\mu\text{g/dL}$  and above were from Wayne County (30, 20.7%), followed by Montcalm (17, 11.7%), and Macomb (8, 5.5%),. County was unknown for 10 adults.

Figure 6 and Table 6 show the percentage of adults tested for blood lead within each county with BLLs of 10  $\mu\text{g/dL}$  or greater. Montcalm (59, 48.0%), Clinton (46, 33.8%), and Gratiot (17, 34.0%) counties had the highest percentages of adults with BLLs of 10  $\mu\text{g/dL}$  or greater.



Figure 7 and Table 6 show the percentage of adults tested for blood lead within each county with BLLs of 25 µg/dL or greater. Crawford (1, 14.3%), Montcalm (17, 13.8%) and Cass (2, 9.5%) counties had the highest percentage of adults with BLLs of 25 µg/dL or greater.

Figure 8 and Table 7 show the incidence rates of BLLs of 10 µg/dL and above, by county, for women. There were 51 women reported in 2004 with a BLL of 10 µg/dL or greater where county of residence could be determined. Schoolcraft (28/100,000), Clinton (16/100,000) and Chippewa (7/100,000) had the three highest incidence rates. With source of exposure known, women with elevated blood lead had their exposure from work (14, 41.2%), mostly in transportation equipment (11.8%), special trade construction (11.8%), fabricated metal products (8.8%), business services (2.9%), and public safety (2.9%). Women with elevated blood leads also had non-work exposures mostly from firearms (20.6%), remodeling performed in their homes (17.6%). Source of exposure was unknown for 20 of the 54.

Figure 9 and Table 8 show the incidence rates of BLLs of 10 µg/dL and above, by county, for men. There were 688 men reported in 2004 with a BLL of 10 µg/dL or greater where county of residence could be determined. Montcalm (246/100,000), Clinton (176/100,000) and Ionia (121/100,000) had the three 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 19 times higher than that for women (19/100,000 vs 1/100,000).

## **Source of Exposure**

Table 9 shows the source of exposure of lead for individuals with blood lead levels greater than 10 µg/dL reported in 2004. For 583 (82.3%) individuals, work was the identified source, for the other 17.7% a hobby, mainly related to guns 72 (10.2%) was the source. Home remodeling was the source in 19 individuals (2.7%), and casting was the source in 7 (1.0%) of the individuals. For an additional 89 individuals, we are still investigating the source.

Table 10 shows the occupational sources of lead for individuals reported in 2004. The most frequent reports were on individuals in the manufacturing sector (43.9%), then construction (40.4%) and then Services (6.0%). Less common sources were public administration (4.0%), public transportation and public utilities (3.2%) and wholesale and retail trade (2.1%).

Figure 10 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 2004. These companies included brass/bronze casting operations, radiator repair facilities and indoor firing ranges. Of the 569 individuals with blood lead  $\geq$  10 µg/dL, and exposure occurred at work, 339 (60%) were from these twenty-two companies.

## **Summary of Industrial Hygiene Inspections**

Since the 2003 report, the statewide surveillance system identified 27 companies where MIOSHA had not performed a recent inspection for lead (Table 11). Eight of these companies have now been inspected. Inspections are planned for the other 19 companies. Inspections of these eight companies resulted in 7 of the 8 (87.5%) companies receiving citations for a violation of an occupational health standard (Table 12).

Six of the 8 (75%) companies were issued citations for violations of the lead standard. Violations of the lead standard by industry type is shown in Table 13.

Of the 27 companies identified, thirteen were identified by elevated blood lead reports collected because of a company's medical surveillance program and seven from an individual having the test performed by their personal health care provider. For seven we are unable to determine at this time why the blood lead sample was collected.

## **Case Narratives**

Appendix V contains brief narratives about individuals with blood lead greater than or equal to 25 µg/dL.

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

Between October 15, 1997 and December 31, 2004, there were 1,064 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 1,064 questionnaires completed by telephone. These 1,064 adults were reported to the Registry from October 15, 1997 to December 31, 2004.

Table 14 lists the demographic characteristics of the 1,064 adults with completed questionnaires by highest lead level reported. Most of the completed questionnaires were of males (91.2%), which parallels the gender distribution of the number of lead level reports  $\geq 10$  µg/dL. There was no difference in gender by highest blood lead level. 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.

Table 15 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, muscle weakness, headache, feeling depressed, 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, or reproductive system symptom was associated with a statistically significant increasingly higher levels of blood lead. Table 16 shows the reporting of anemia, kidney disease and high blood pressure by lead level category.

Table 17 presents the type of industry by lead level reported among those interviewed. Overall, 34.2% worked in special trade construction, followed by 23.9% working 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 (foundries). Table 18 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 19 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.

The questionnaire also asks about children in the household, in order to document the potential for and extent of take-home lead. Twenty-nine percent of the adults interviewed reported children age 6 and younger living or spending time in the home (Table 20). Children from 86 of the 304 (31.6%) households where an adult had an elevated lead level and young children lived or frequently visited were tested for blood lead. Among the 86 households where we know the child's blood test results, 33 (40.2%) households had a child with an elevated blood lead level ( $\geq 10 \mu\text{g/dL}$ ). 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.

## **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  $25 \mu\text{g/dL}$  or greater, and a sample of individuals with blood lead levels of  $10\text{--}24 \mu\text{g/dL}$ , 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 the company is identified with a blood lead value of  $25 \mu\text{g/dL}$  or greater.

Michigan is one of 37 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 (3). 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 (4). A further problem is that workers can bring lead home on their clothes and expose children to lead. Forty-one percent of households with children under the age of six where the adult had an elevated blood lead level and the child was tested had an elevated blood level (Table 20). Children can experience serious adverse effects on neurological and intellectual development from lead exposure.

Average blood lead levels in the United States general population range from  $2.1$  to  $3.4 \mu\text{g/dL}$  with  $1.5$  to  $4.6\%$  of adults tested for blood lead having blood lead levels greater than or equal to  $10 \mu\text{g/dL}$  (2). On the average, blood lead levels are higher in the elderly, in men, and in African-Americans and Hispanics. Despite these differences, the mean blood lead levels and the percentage greater than  $10 \mu\text{g/dL}$  for these sub populations are not clinically significantly different (2). A blood lead level greater than or equal to  $10 \mu\text{g/dL}$

is an indication of exposure and increased absorption of lead regardless of age, race and gender. Values above 9 µg/dL indicate exposure to lead beyond that found in the background environment. An effort was made in previous years to have all laboratories to use the same normal ranges. All but Warde Medical Laboratory now uses 10 µg/dL as the upper limit for a "normal" blood lead level.

Symptoms involving the gastrointestinal, musculoskeletal and nervous systems occurred at levels within the allowable MIOSHA and OSHA standards (Table 15). 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. Seventy percent of individuals with blood lead below this level had daily or weekly symptoms.

We have analyzed the symptom data and found that nervous system symptoms began to increase at 25-30 µg/dL, gastrointestinal symptoms at 30-35 µg/dL and musculoskeletal symptoms at 35-40 µg/dL (5). Other recent studies also support the inadequacy of the current occupational standard of 50 µg/dL to protect workers' health. Significant increases in all-cause, circulatory and cardiovascular mortality were reported in the United States among individuals followed up until 1992 who were identified with blood lead levels of 20-29 µg/dL during the years 1976 to 1980 (6). A further study from Taiwan among individuals with chronic renal disease without increased body burdens of lead and blood leads of only 5.3 µg/dL showed that treatment to increase lead excretion improved kidney function and decreased progression to end state renal disease (7). All these studies provide added weight to the inadequacy of the current occupational standard of 50 µg/dL. The American Conference of Governmental Industrial Hygienists has recommended a maximum blood lead of 30 µg/dL. In addition to suggesting the need for a new occupational standard, this data indicates the need to update health care providers of the latest information about the hazards of lead.

In 2004, there were 816 adults reported in Michigan with blood lead levels greater than or equal to 10 µg/dL. Approximately ninety-three percent were men. The mean age was 43. They were predominately white (87.9%). They predominately resided in a band of counties stretching across the state from Muskegon and Oceana to Wayne and Macomb. The counties with the highest percentage of elevated blood leads were counties with metal foundries (Figure 10). The exposure was predominately occupational in origin, occurring during the abrasive blasting to remove paint from outdoor metal structures, during the casting of metal parts, 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 14). 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 leads (8,9). For example, in a study in California 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 (9). On a national basis it was estimated that less than 12% of companies using lead provided blood lead testing for their employees (8). We conducted a survey of 28 Michigan radiator repair facilities and found that only 27% of the companies were providing blood lead testing to their employees, although this is better than the 8% reported from the survey conducted in the late 1980's in California. Fifteen percent indicated they were unaware of the requirement to provide blood lead testing and 42% indicated air lead levels in their

facilities were below levels where such blood lead testing is required. Further follow-up is underway to determine the reliability of these self-reports.

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 at foundries, one at a firing range, one from radiator repair, and one from heavy construction). Non-work sources were: two from contamination of a home using a lead base for leather tooling, one from shooting guns, and one from casting bullets.

An inspection was conducted at eight companies where a worker was reported with a blood lead level  $\geq 25$  µg/dL. Six of eight (75%) of these companies were cited for violations of the lead standard (Table 13). Repeat inspections of these same companies has continued to identify problems (Table 13). Inspections will be continued at all facilities with workers with blood lead levels  $\geq 25$  µg/dL to ensure that employers implement changes to comply with the MIOSHA lead standard.

In its seventh year of operation, the surveillance system for lead proved successful in continuing to identify 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. Reevaluation of the current occupational lead standard should also be considered. Finally, we continue to be encouraged both by the increased compliance of the reporting law, increased testing performed, and by the reduction in elevated blood lead levels (Figure 2). We will continue to monitor for these trends in the year 2005.

## References

1. Rosenman KD, Sims AS, Hogan A, Fialkowski J, Gardiner J. Evaluation of the Effectiveness of Following Up Laboratory Reports of Elevated Blood Leads in Adults. *American Industrial Hygiene Association Journal* 2001; 62: 371-378.
2. Pirkle JL, Kaufmann RB, Brody DJ, Hickman T, Gunter EW, Paschal DC. Exposure of the US Population to Lead, 1991-1994. *Environmental Health Perspectives* 1998; 106: 745-750.
3. Adult Blood Lead Epidemiology and Surveillance. *Morbidity and Mortality Weekly Report*. MMWR. 2002; 51: 1-10.
4. ATSDR. Toxicological Profile for Lead. US Department of Health Human Services. Agency for Toxic Substances and Disease Registry. August 1997.
5. Rosenman KD, Sims AS, Luo Z, Gardiner J. Occurrence of Lead-Related Symptoms Below Current Occupational Safety and Health Allowable Blood Lead Levels. *Journal of Occupational and Environmental Medicine*. 2003; 45: 546-555.
6. Lustberg M, Silbergeld E. Blood Lead Levels and Mortality. *Archives of Internal Medicine* 2002; 162: 2443-2449.
7. Lin JL, Lin-Tan DT, Hsu KH, Yu CC. Environmental Lead Exposure and Progression of Chronic Renal Diseases in Patients without Diabetes. *New England Journal of Medicine* 2003; 348: 277-286.
8. Baser ME. The Development of Registries for Surveillance of Adult Lead Exposure, 1981 to 1992. *American Journal of Public Health*. 1992; 82: 1113-1118.
9. 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 I   | Blood Lead Analysis Reporting   |
| Appendix II  | OSHA Blood Lead Laboratories: Michigan  |
| Appendix III | Summary of Michigan's Lead Standards  |
| Appendix IV  | Morbidity and Mortality Weekly Report (MMWR): Adult Blood Lead Epidemiology and Surveillance-United States, 2002. |
| Appendix V   | Case Narratives   |

**Table 1. Distribution of Highest Blood Lead Levels  
(BLLs) Among Adults and Source of Exposure in Michigan: 2004**

| <u>BLLs (ug/dL)</u> | <b>Work BLLs</b> |                | <b>Non-Work BLLs</b> |                | <b>Source Not Yet Identified</b> |                | <b>All BLLs</b>  |                |
|---------------------|------------------|----------------|----------------------|----------------|----------------------------------|----------------|------------------|----------------|
|                     | <u>Number</u>    | <u>Percent</u> | <u>Number</u>        | <u>Percent</u> | <u>Number</u>                    | <u>Percent</u> | <u>Number</u>    | <u>Percent</u> |
| <10                 | *                | *              | *                    | *              | *                                | *              | 12,324           | 93.8           |
| 10-24               | 484              | 82.9           | 89                   | 71.2           | 88                               | 82.2           | 661              | 5.0            |
| 25-29               | 48               | 8.2            | 17                   | 13.6           | 8                                | 7.5            | 73               | 0.6            |
| 30-39               | 39               | 6.7            | 13                   | 10.4           | 9                                | 8.4            | 61               | 0.5            |
| 40-49               | 8                | 1.4            | 2                    | 1.6            | 2                                | 1.9            | 12               | 0.1            |
| 50-59               | 3                | 0.5            | 2                    | 1.6            | 0                                | --             | 5                | 0.0            |
| ≥ 60                | 2                | 0.3            | 2                    | 1.6            | 0                                | 0.0            | 4                | 0.0            |
| <b>TOTAL</b>        | <b>584</b>       | <b>100.0</b>   | <b>125</b>           | <b>100.0</b>   | <b>107</b>                       | <b>100.0</b>   | <b>13,140 **</b> | <b>100.0</b>   |

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

\*\*In 2004, 15,624 BLL reports were received for 13,140 individuals.



**Table 2. Distribution of Gender Among Adults Tested  
for Blood Lead in Michigan: 2004**

| <b><u>Gender</u></b> | <b>All Blood Lead Level Tests</b> |                       | <b>Blood Lead Levels <math>\geq</math> 10 ug/dL</b> |                       |
|----------------------|-----------------------------------|-----------------------|---|-----------------------|
|                      | <b><u>Number</u></b>              | <b><u>Percent</u></b> | <b><u>Number</u></b>                                | <b><u>Percent</u></b> |
| Male                 | 7,939                             | 60.4                  | 762   | 93.4                  |
| Female               | 5,201                             | 39.6                  | 54  | 6.6                   |
| <b>Total</b>         | <b>13,140</b>                     | <b>100.0</b>          | <b>816</b>  | <b>100.0</b>          |

**Table 3. Distribution of Age Among Adults Tested  
for Blood Lead in Michigan: 2004**

| <u>Age Range</u> | <b>All Blood Lead Level Tests</b> |                | <b>Blood Lead Levels <math>\geq 10</math> ug/dL</b> |                |
|------------------|-----------------------------------|----------------|---|----------------|
|                  | <u>Number</u>                     | <u>Percent</u> | <u>Number</u>                                       | <u>Percent</u> |
| 16-19            | 959                               | 7.3            | 19  | 2.3            |
| 20-29            | 2,465                             | 18.8           | 117   | 14.3           |
| 30-39            | 2,575                             | 19.6           | 188   | 23.0           |
| 40-49            | 3,031                             | 23.1           | 241   | 29.5           |
| 50-59            | 2,169                             | 16.5           | 180   | 22.1           |
| 60-69            | 961                               | 7.3            | 60  | 7.4            |
| 70-79            | 614                               | 4.7            | 8   | 1.0            |
| 80-89            | 322                               | 2.5            | 3   | 0.4            |
| 90-99            | 31                                | 0.2            | 0   | 0.0            |
| 100+             | 13                                | 0.1            | 0   | 0.0            |
| <b>TOTAL</b>     | <b>13,140</b>                     | <b>100.0</b>   | <b>816</b>  | <b>100.0</b>   |

**Table 4. Distribution of Race Among Adults Tested  
for Blood Lead in Michigan: 2004**

| <b><u>Race</u></b>     | <b>All Blood Lead Level Tests</b> |                       | <b>Blood Lead Levels <math>\geq</math> 10 ug/dL</b> |                       |
|------------------------|-----------------------------------|-----------------------|---|-----------------------|
|                        | <b><u>Number</u></b>              | <b><u>Percent</u></b> | <b><u>Number</u></b>                                | <b><u>Percent</u></b> |
| Caucasian              | 4,391                             | 80.5                  | 547   | 87.9                  |
| African American       | 873                               | 16.0                  | 51  | 8.2                   |
| Native American        | 65                                | 1.2                   | 15  | 2.4                   |
| Asian/Pacific Islander | 50                                | 0.9                   | 3   | 0.5                   |
| Multiracial/Other      | 76                                | 1.4                   | 6   | 1.0                   |
| <b>TOTAL</b>           | <b>5,455 *</b>                    | <b>100.0</b>          | <b>622 **</b>                                       | <b>100.0</b>          |

\*Race was unknown for 7,685 additional individuals.

\*\*Race was unknown for 194 additional individuals.

**Table 5. Distribution of Adults with All Blood Lead Levels (BLLs), BLLs  $\geq 10$  ug/dL, and BLLs  $\geq 25$  ug/dL, Michigan by County of Residence: 2004**

| <b>County</b>  | <b>All BLLs</b> |                | <b>BLLs <math>\geq 10</math> ug/dL</b> |                | <b>BLLs <math>\geq 25</math> ug/dL</b> |                |
|----------------|-----------------|----------------|--|----------------|--|----------------|
|                | <b>Number</b>   | <b>Percent</b> | <b>Number</b>                          | <b>Percent</b> | <b>Number</b>                          | <b>Percent</b> |
| Alcona         | 7               | 0.07           | 0                                      | 0.00           | 0                                      | 0.00           |
| Alger          | 14              | 0.15           | 1                                      | 0.14           | 1                                      | 0.69           |
| Allegan        | 72              | 0.75           | 2                                      | 0.27           | 1                                      | 0.69           |
| Alpena         | 21              | 0.22           | 2                                      | 0.27           | 1                                      | 0.69           |
| Antrim         | 20              | 0.21           | 2                                      | 0.27           | 0                                      | 0.00           |
| Arenac         | 18              | 0.19           | 1                                      | 0.14           | 0                                      | 0.00           |
| Baraga         | 19              | 0.20           | 0                                      | 0.00           | 0                                      | 0.00           |
| Barry          | 31              | 0.32           | 1                                      | 0.14           | 1                                      | 0.69           |
| Bay            | 87              | 0.91           | 9                                      | 1.22           | 2                                      | 1.38           |
| Benzie         | 4               | 0.04           | 0                                      | 0.00           | 0                                      | 0.00           |
| Berrien        | 154             | 1.61           | 15                                     | 2.03           | 8                                      | 5.52           |
| Branch         | 13              | 0.14           | 0                                      | 0.00           | 0                                      | 0.00           |
| Calhoun        | 197             | 2.06           | 6                                      | 0.81           | 3                                      | 2.07           |
| Cass           | 21              | 0.22           | 2                                      | 0.27           | 2                                      | 1.38           |
| Charlevoix     | 10              | 0.10           | 2                                      | 0.27           | 0                                      | 0.00           |
| Cheboygan      | 28              | 0.29           | 2                                      | 0.27           | 1                                      | 0.69           |
| Chippewa       | 63              | 0.66           | 5                                      | 0.68           | 1                                      | 0.69           |
| Clare          | 153             | 1.60           | 0                                      | 0.00           | 0                                      | 0.00           |
| Clinton        | 136             | 1.42           | 46                                     | 6.22           | 6                                      | 4.14           |
| Crawford       | 7               | 0.07           | 2                                      | 0.27           | 1                                      | 0.69           |
| Delta          | 35              | 0.37           | 5                                      | 0.68           | 0                                      | 0.00           |
| Dickinson      | 16              | 0.17           | 0                                      | 0.00           | 0                                      | 0.00           |
| Eaton          | 81              | 0.85           | 3                                      | 0.41           | 1                                      | 0.69           |
| Emmet          | 6               | 0.06           | 1                                      | 0.14           | 0                                      | 0.00           |
| Genesee        | 386             | 4.03           | 25                                     | 3.38           | 2                                      | 1.38           |
| Gladwin        | 61              | 0.64           | 3                                      | 0.41           | 0                                      | 0.00           |
| Gogebic        | 7               | 0.07           | 0                                      | 0.00           | 0                                      | 0.00           |
| Grand Traverse | 79              | 0.82           | 8                                      | 1.08           | 2                                      | 1.38           |
| Gratiot        | 50              | 0.52           | 17                                     | 2.30           | 3                                      | 2.07           |
| Hillsdale      | 25              | 0.26           | 0                                      | 0.00           | 0                                      | 0.00           |
| Houghton       | 35              | 0.37           | 0                                      | 0.00           | 0                                      | 0.00           |
| Huron          | 27              | 0.28           | 6                                      | 0.81           | 1                                      | 0.69           |
| Ingham         | 343             | 3.58           | 20                                     | 2.71           | 1                                      | 0.69           |
| Ionia          | 93              | 0.97           | 31                                     | 4.19           | 5                                      | 3.45           |
| Iosco          | 8               | 0.08           | 0                                      | 0.00           | 0                                      | 0.00           |
| Iron           | 7               | 0.07           | 1                                      | 0.14           | 0                                      | 0.00           |
| Isabella       | 47              | 0.49           | 2                                      | 0.27           | 1                                      | 0.69           |
| Jackson        | 111             | 1.16           | 4                                      | 0.54           | 0                                      | 0.00           |
| Kalamazoo      | 184             | 1.92           | 9                                      | 1.22           | 3                                      | 2.07           |
| Kalkaska       | 13              | 0.14           | 0                                      | 0.00           | 0                                      | 0.00           |
| Kent           | 1,160           | 12.11          | 55                                     | 7.44           | 8                                      | 5.52           |
| Keweenaw       | 1               | 0.01           | 0                                      | 0.00           | 0                                      | 0.00           |
| Lake           | 2               | 0.02           | 0                                      | 0.00           | 0                                      | 0.00           |
| Lapeer         | 79              | 0.82           | 6                                      | 0.81           | 1                                      | 0.69           |

**Table 5 Continued. Distribution of Adults with All Blood Lead Levels (BLLs), BLLs  $\geq 10$  ug/dL, and BLLs  $\geq 25$  ug/dL, Michigan by County of Residence: 2004**

| <u>County</u> | <u>All BLLs</u> |                | <u>BLLs <math>\geq 10</math> ug/dL</u> |                | <u>BLLs <math>\geq 25</math> ug/dL</u> |                |
|---------------|-----------------|----------------|--|----------------|--|----------------|
|               | <u>Number</u>   | <u>Percent</u> | <u>Number</u>                          | <u>Percent</u> | <u>Number</u>                          | <u>Percent</u> |
| Leelanau      | 8               | 0.08           | 0                                      | 0.00           | 0                                      | 0.00           |
| Lenawee       | 97              | 1.01           | 7                                      | 0.95           | 3                                      | 2.07           |
| Livingston    | 139             | 1.45           | 9                                      | 1.22           | 0                                      | 0.00           |
| Luce          | 2               | 0.02           | 0                                      | 0.00           | 0                                      | 0.00           |
| Mackinac      | 35              | 0.37           | 2                                      | 0.27           | 0                                      | 0.00           |
| Macomb        | 505             | 5.27           | 48                                     | 6.50           | 8                                      | 5.52           |
| Manistee      | 26              | 0.27           | 1                                      | 0.14           | 0                                      | 0.00           |
| Marquette     | 51              | 0.53           | 1                                      | 0.14           | 1                                      | 0.69           |
| Mason         | 7               | 0.07           | 2                                      | 0.27           | 0                                      | 0.00           |
| Mecosta       | 23              | 0.24           | 0                                      | 0.00           | 0                                      | 0.00           |
| Menominee     | 21              | 0.22           | 0                                      | 0.00           | 0                                      | 0.00           |
| Midland       | 61              | 0.64           | 6                                      | 0.81           | 0                                      | 0.00           |
| Missaukee     | 17              | 0.18           | 0                                      | 0.00           | 0                                      | 0.00           |
| Monroe        | 233             | 2.43           | 9                                      | 1.22           | 1                                      | 0.69           |
| Montcalm      | 123             | 1.28           | 59                                     | 7.98           | 17                                     | 11.72          |
| Montmorency   | 33              | 0.34           | 1                                      | 0.14           | 1                                      | 0.69           |
| Muskegon      | 467             | 4.88           | 26                                     | 3.52           | 3                                      | 2.07           |
| Newaygo       | 34              | 0.35           | 4                                      | 0.54           | 0                                      | 0.00           |
| Oakland       | 721             | 7.53           | 30                                     | 4.06           | 5                                      | 3.45           |
| Oceana        | 14              | 0.15           | 2                                      | 0.27           | 0                                      | 0.00           |
| Ogemaw        | 16              | 0.17           | 0                                      | 0.00           | 0                                      | 0.00           |
| Ontonagon     | 6               | 0.06           | 0                                      | 0.00           | 0                                      | 0.00           |
| Osceola       | 22              | 0.23           | 1                                      | 0.14           | 0                                      | 0.00           |
| Oscoda        | 11              | 0.11           | 0                                      | 0.00           | 0                                      | 0.00           |
| Otsego        | 17              | 0.18           | 0                                      | 0.00           | 0                                      | 0.00           |
| Ottawa        | 140             | 1.46           | 3                                      | 0.41           | 2                                      | 1.38           |
| Presque Isle  | 6               | 0.06           | 0                                      | 0.00           | 0                                      | 0.00           |
| Roscommon     | 36              | 0.38           | 0                                      | 0.00           | 0                                      | 0.00           |
| Saginaw       | 119             | 1.24           | 6                                      | 0.81           | 3                                      | 2.07           |
| Saint Clair   | 168             | 1.75           | 32                                     | 4.33           | 7                                      | 4.83           |
| Saint Joseph  | 29              | 0.30           | 3                                      | 0.41           | 2                                      | 1.38           |
| Sanilac       | 41              | 0.43           | 3                                      | 0.41           | 0                                      | 0.00           |
| Schoolcraft   | 17              | 0.18           | 1                                      | 0.14           | 0                                      | 0.00           |
| Shiawassee    | 52              | 0.54           | 10                                     | 1.35           | 2                                      | 1.38           |
| Tuscola       | 38              | 0.40           | 2                                      | 0.27           | 0                                      | 0.00           |
| Van Buren     | 57              | 0.60           | 2                                      | 0.27           | 2                                      | 1.38           |
| Washtenaw     | 270             | 2.82           | 3                                      | 0.41           | 0                                      | 0.00           |
| Wayne         | 1,949           | 20.35          | 167                                    | 22.60          | 30                                     | 20.69          |
| Wexford       | 36              | 0.38           | 5                                      | 0.68           | 2                                      | 1.38           |
| <b>TOTAL</b>  | <b>9,578 *</b>  | <b>100.00</b>  | <b>739 **</b>                          | <b>100.00</b>  | <b>145 ***</b>                         | <b>100.00</b>  |

\*County was unknown for 3,562 additional adults.

\*\*County was unknown for 77 additional adults.

\*\*\*County was unknown for 10 additional adults.

**Table 6. Percentage of Adults Tested within County  
with Blood Lead Levels (BLLs)  $\geq 10$  ug/dL and  $\geq 25$   
ug/dL, Michigan by County of Residence: 2004**

| <u>County</u>  | <u>All BLLs</u> |                | <u>BLLs <math>\geq 10</math> ug/dL</u> |                | <u>BLLs <math>\geq 25</math> ug/dL</u> |                |
|----------------|-----------------|----------------|--|----------------|--|----------------|
|                | <u>Number</u>   | <u>Percent</u> | <u>Number</u>                          | <u>Percent</u> | <u>Number</u>                          | <u>Percent</u> |
| Alcona         | 7               | 0.07           | 0                                      | 0.00           | 0                                      | 0.00           |
| Alger          | 14              | 0.15           | 1                                      | 7.14           | 1                                      | 7.14           |
| Allegan        | 72              | 0.75           | 2                                      | 2.78           | 1                                      | 1.39           |
| Alpena         | 21              | 0.22           | 2                                      | 9.52           | 1                                      | 4.76           |
| Antrim         | 20              | 0.21           | 2                                      | 10.00          | 0                                      | 0.00           |
| Arenac         | 18              | 0.19           | 1                                      | 5.56           | 0                                      | 0.00           |
| Baraga         | 19              | 0.20           | 0                                      | 0.00           | 0                                      | 0.00           |
| Barry          | 31              | 0.32           | 1                                      | 3.23           | 1                                      | 3.23           |
| Bay            | 87              | 0.91           | 9                                      | 10.34          | 2                                      | 2.30           |
| Benzie         | 4               | 0.04           | 0                                      | 0.00           | 0                                      | 0.00           |
| Berrien        | 154             | 1.61           | 15                                     | 9.74           | 8                                      | 5.19           |
| Branch         | 13              | 0.14           | 0                                      | 0.00           | 0                                      | 0.00           |
| Calhoun        | 197             | 2.06           | 6                                      | 3.05           | 3                                      | 1.52           |
| Cass           | 21              | 0.22           | 2                                      | 9.52           | 2                                      | 9.52           |
| Charlevoix     | 10              | 0.10           | 2                                      | 20.00          | 0                                      | 0.00           |
| Cheboygan      | 28              | 0.29           | 2                                      | 7.14           | 1                                      | 3.57           |
| Chippewa       | 63              | 0.66           | 5                                      | 7.94           | 1                                      | 1.59           |
| Clare          | 153             | 1.60           | 0                                      | 0.00           | 0                                      | 0.00           |
| Clinton        | 136             | 1.42           | 46                                     | 33.82          | 6                                      | 4.41           |
| Crawford       | 7               | 0.07           | 2                                      | 28.57          | 1                                      | 14.29          |
| Delta          | 35              | 0.37           | 5                                      | 14.29          | 0                                      | 0.00           |
| Dickinson      | 16              | 0.17           | 0                                      | 0.00           | 0                                      | 0.00           |
| Eaton          | 81              | 0.85           | 3                                      | 3.70           | 1                                      | 1.23           |
| Emmet          | 6               | 0.06           | 1                                      | 16.67          | 0                                      | 0.00           |
| Genesee        | 386             | 4.03           | 25                                     | 6.48           | 2                                      | 0.52           |
| Gladwin        | 61              | 0.64           | 3                                      | 4.92           | 0                                      | 0.00           |
| Gogebic        | 7               | 0.07           | 0                                      | 0.00           | 0                                      | 0.00           |
| Grand Traverse | 79              | 0.82           | 8                                      | 10.13          | 2                                      | 2.53           |
| Gratiot        | 50              | 0.52           | 17                                     | 34.00          | 3                                      | 6.00           |
| Hillsdale      | 25              | 0.26           | 0                                      | 0.00           | 0                                      | 0.00           |
| Houghton       | 35              | 0.37           | 0                                      | 0.00           | 0                                      | 0.00           |
| Huron          | 27              | 0.28           | 6                                      | 22.22          | 1                                      | 3.70           |
| Ingham         | 343             | 3.58           | 20                                     | 5.83           | 1                                      | 0.29           |
| Ionia          | 93              | 0.97           | 31                                     | 33.33          | 5                                      | 5.38           |
| Iosco          | 8               | 0.08           | 0                                      | 0.00           | 0                                      | 0.00           |
| Iron           | 7               | 0.07           | 1                                      | 14.29          | 0                                      | 0.00           |
| Isabella       | 47              | 0.49           | 2                                      | 4.26           | 1                                      | 2.13           |
| Jackson        | 111             | 1.16           | 4                                      | 3.60           | 0                                      | 0.00           |
| Kalamazoo      | 184             | 1.92           | 9                                      | 4.89           | 3                                      | 1.63           |
| Kalkaska       | 13              | 0.14           | 0                                      | 0.00           | 0                                      | 0.00           |
| Kent           | 1,160           | 12.11          | 55                                     | 4.74           | 8                                      | 0.69           |
| Keweenaw       | 1               | 0.01           | 0                                      | 0.00           | 0                                      | 0.00           |
| Lake           | 2               | 0.02           | 0                                      | 0.00           | 0                                      | 0.00           |
| Lapeer         | 79              | 0.82           | 6                                      | 7.59           | 1                                      | 1.27           |

**Table 6 Continued. Percentage of Adults Tested within County with Blood Lead Levels (BLLs)  $\geq 10$  ug/dL and  $\geq 25$  ug/dL, Michigan by County of Residence: 2004**

| <u>County</u> | <u>All BLLs</u> |                | <u>BLLs <math>\geq 10</math> ug/dL</u> |                | <u>BLLs <math>\geq 25</math> ug/dL</u> |                |
|---------------|-----------------|----------------|--|----------------|--|----------------|
|               | <u>Number</u>   | <u>Percent</u> | <u>Number</u>                          | <u>Percent</u> | <u>Number</u>                          | <u>Percent</u> |
| Leelanau      | 8               | 0.08           | 0                                      | 0.00           | 0                                      | 0.00           |
| Lenawee       | 97              | 1.01           | 7                                      | 7.22           | 3                                      | 3.09           |
| Livingston    | 139             | 1.45           | 9                                      | 6.47           | 0                                      | 0.00           |
| Luce          | 2               | 0.02           | 0                                      | 0.00           | 0                                      | 0.00           |
| Mackinac      | 35              | 0.37           | 2                                      | 5.71           | 0                                      | 0.00           |
| Macomb        | 505             | 5.27           | 48                                     | 9.50           | 8                                      | 1.58           |
| Manistee      | 26              | 0.27           | 1                                      | 3.85           | 0                                      | 0.00           |
| Marquette     | 51              | 0.53           | 1                                      | 1.96           | 1                                      | 1.96           |
| Mason         | 7               | 0.07           | 2                                      | 28.57          | 0                                      | 0.00           |
| Mecosta       | 23              | 0.24           | 0                                      | 0.00           | 0                                      | 0.00           |
| Menominee     | 21              | 0.22           | 0                                      | 0.00           | 0                                      | 0.00           |
| Midland       | 61              | 0.64           | 6                                      | 9.84           | 0                                      | 0.00           |
| Missaukee     | 17              | 0.18           | 0                                      | 0.00           | 0                                      | 0.00           |
| Monroe        | 233             | 2.43           | 9                                      | 3.86           | 1                                      | 0.43           |
| Montcalm      | 123             | 1.28           | 59                                     | 47.97          | 17                                     | 13.82          |
| Montmorency   | 33              | 0.34           | 1                                      | 3.03           | 1                                      | 3.03           |
| Muskegon      | 467             | 4.88           | 26                                     | 5.57           | 3                                      | 0.64           |
| Newaygo       | 34              | 0.35           | 4                                      | 11.76          | 0                                      | 0.00           |
| Oakland       | 721             | 7.53           | 30                                     | 4.16           | 5                                      | 0.69           |
| Oceana        | 14              | 0.15           | 2                                      | 14.29          | 0                                      | 0.00           |
| Ogemaw        | 16              | 0.17           | 0                                      | 0.00           | 0                                      | 0.00           |
| Ontonagon     | 6               | 0.06           | 0                                      | 0.00           | 0                                      | 0.00           |
| Osceola       | 22              | 0.23           | 1                                      | 4.55           | 0                                      | 0.00           |
| Oscoda        | 11              | 0.11           | 0                                      | 0.00           | 0                                      | 0.00           |
| Otsego        | 17              | 0.18           | 0                                      | 0.00           | 0                                      | 0.00           |
| Ottawa        | 140             | 1.46           | 3                                      | 2.14           | 2                                      | 1.43           |
| Presque Isle  | 6               | 0.06           | 0                                      | 0.00           | 0                                      | 0.00           |
| Roscommon     | 36              | 0.38           | 0                                      | 0.00           | 0                                      | 0.00           |
| Saginaw       | 119             | 1.24           | 6                                      | 5.04           | 3                                      | 2.52           |
| Saint Clair   | 168             | 1.75           | 32                                     | 19.05          | 7                                      | 4.17           |
| Saint Joseph  | 29              | 0.30           | 3                                      | 10.34          | 2                                      | 6.90           |
| Sanilac       | 41              | 0.43           | 3                                      | 7.32           | 0                                      | 0.00           |
| Schoolcraft   | 17              | 0.18           | 1                                      | 5.88           | 0                                      | 0.00           |
| Shiawassee    | 52              | 0.54           | 10                                     | 19.23          | 2                                      | 3.85           |
| Tuscola       | 38              | 0.40           | 2                                      | 5.26           | 0                                      | 0.00           |
| Van Buren     | 57              | 0.60           | 2                                      | 3.51           | 2                                      | 3.51           |
| Washtenaw     | 270             | 2.82           | 3                                      | 1.11           | 0                                      | 0.00           |
| Wayne         | 1,949           | 20.35          | 167                                    | 8.57           | 30                                     | 1.54           |
| Wexford       | 36              | 0.38           | 5                                      | 13.89          | 2                                      | 5.56           |
| <b>TOTAL</b>  | <b>9,578 *</b>  | <b>100.00</b>  | <b>739 **</b>                          | <b>7.73</b>    | <b>145 ***</b>                         | <b>1.52</b>    |

\*County was unknown for 3,562 additional adults.

\*\*County was unknown for 77 additional adults.

\*\*\*County was unknown for 10 additional adults.

**Table 7. Annual Incidence of Blood Lead Levels (BLLs)  
 $\geq 10$  ug/dL Among Women in Michigan  
by County of Residence: 2004**

| <u>County</u> | <u>Number<br/>Reported</u> | <u>Michigan<br/>Population Women</u> | <u>Rate per<br/>100,000 women</u> |
|---------------|----------------------------|--------------------------------------|-----------------------------------|
| Bay           | 1                          | 45,111                               | 2                                 |
| Calhoun       | 1                          | 55,391                               | 2                                 |
| Chippewa      | 1                          | 13,554                               | 7                                 |
| Clinton       | 4                          | 24,818                               | 16                                |
| Genesee       | 4                          | 174,273                              | 2                                 |
| Ingham        | 1                          | 116,096                              | 1                                 |
| Kalamazoo     | 1                          | 98,198                               | 1                                 |
| Kent          | 10                         | 221,310                              | 5                                 |
| Livingston    | 1                          | 58,322                               | 2                                 |
| Macomb        | 5                          | 320,054                              | 2                                 |
| Monroe        | 1                          | 56,520                               | 2                                 |
| Oakland       | 4                          | 479,049                              | 1                                 |
| Schoolcraft   | 1                          | 3,582                                | 28                                |
| Tuscola       | 1                          | 22,666                               | 4                                 |
| Wayne         | 15                         | 816,907                              | 2                                 |
| <b>TOTAL</b>  | <b>51 *</b>                | <b>3,939,649 **</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; 2000 US. Census population data.

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



**Table 8. Annual Incidence of Blood Lead Levels (BLLs)  
≥10 ug/dL Among Men in Michigan  
by County of Residence: 2004**

| <u>County</u>  | <u>Number<br/>Reported</u> | <u>Michigan<br/>Population Men</u> | <u>Rate per<br/>100,000 Men</u> | <u>County</u> | <u>Number<br/>Reported</u> | <u>Michigan<br/>Population Men</u> | <u>Rate per<br/>100,000 Men</u> |
|----------------|----------------------------|------------------------------------|---------------------------------|---------------|----------------------------|------------------------------------|---------------------------------|
| Alcona         | 0                          | 4,897                              | 0                               | Keweenaw      | 0                          | 1,015                              | 0                               |
| Alger          | 1                          | 4,432                              | 23                              | Lake          | 0                          | 4,840                              | 0                               |
| Allegan        | 2                          | 38,907                             | 5                               | Lapeer        | 6                          | 33,294                             | 18                              |
| Alpena         | 2                          | 11,940                             | 17                              | Leelanau      | 0                          | 8,199                              | 0                               |
| Antrim         | 2                          | 8,967                              | 22                              | Lenawee       | 7                          | 37,872                             | 18                              |
| Arenac         | 1                          | 7,006                              | 14                              | Livingston    | 8                          | 58,520                             | 14                              |
| Baraga         | 0                          | 3,728                              | 0                               | Luce          | 0                          | 3,267                              | 0                               |
| Barry          | 1                          | 21,439                             | 5                               | Mackinac      | 2                          | 4,768                              | 42                              |
| Bay            | 8                          | 41,323                             | 19                              | Macomb        | 43                         | 298,569                            | 14                              |
| Benzie         | 0                          | 6,221                              | 0                               | Manistee      | 1                          | 9,947                              | 10                              |
| Berrien        | 15                         | 59,386                             | 25                              | Marquette     | 1                          | 26,345                             | 4                               |
| Branch         | 0                          | 17,848                             | 0                               | Mason         | 2                          | 10,866                             | 18                              |
| Calhoun        | 5                          | 50,858                             | 10                              | Mecosta       | 0                          | 16,425                             | 0                               |
| Cass           | 2                          | 19,607                             | 10                              | Menominee     | 0                          | 9,888                              | 0                               |
| Charlevoix     | 2                          | 9,844                              | 20                              | Midland       | 6                          | 30,559                             | 20                              |
| Cheboygan      | 2                          | 10,312                             | 19                              | Missaukee     | 0                          | 5,469                              | 0                               |
| Chippewa       | 4                          | 17,815                             | 22                              | Monroe        | 8                          | 54,135                             | 15                              |
| Clare          | 0                          | 12,012                             | 0                               | Montcalm      | 59                         | 24,010                             | 246                             |
| Clinton        | 42                         | 23,906                             | 176                             | Montmorency   | 1                          | 4,149                              | 24                              |
| Crawford       | 2                          | 5,651                              | 35                              | Muskegon      | 26                         | 62,948                             | 41                              |
| Delta          | 5                          | 14,862                             | 34                              | Newaygo       | 4                          | 17,519                             | 23                              |
| Dickinson      | 0                          | 10,324                             | 0                               | Oakland       | 26                         | 446,356                            | 6                               |
| Eaton          | 3                          | 38,281                             | 8                               | Oceana        | 2                          | 10,111                             | 20                              |
| Emmet          | 1                          | 11,857                             | 8                               | Ogemaw        | 0                          | 8,454                              | 0                               |
| Genesee        | 21                         | 155,127                            | 14                              | Ontonagon     | 0                          | 3,260                              | 0                               |
| Gladwin        | 3                          | 10,160                             | 30                              | Osceola       | 1                          | 8,660                              | 12                              |
| Gogebic        | 0                          | 7,163                              | 0                               | Oscoda        | 0                          | 3,668                              | 0                               |
| Grand Traverse | 8                          | 28,998                             | 28                              | Otsego        | 0                          | 8,778                              | 0                               |
| Gratiot        | 17                         | 17,444                             | 97                              | Ottawa        | 3                          | 86,189                             | 3                               |
| Hillsdale      | 0                          | 17,632                             | 0                               | Presque Isle  | 0                          | 5,854                              | 0                               |
| Houghton       | 0                          | 15,630                             | 0                               | Roscommon     | 0                          | 10,231                             | 0                               |
| Huron          | 6                          | 13,958                             | 43                              | Saginaw       | 6                          | 75,532                             | 8                               |
| Ingham         | 19                         | 105,117                            | 18                              | Saint Clair   | 32                         | 61,051                             | 52                              |
| Ionia          | 31                         | 25,566                             | 121                             | Saint Joseph  | 3                          | 23,088                             | 13                              |
| Iosco          | 0                          | 10,658                             | 0                               | Sanilac       | 3                          | 16,668                             | 18                              |
| Iron           | 1                          | 5,317                              | 19                              | Schoolcraft   | 0                          | 3,540                              | 0                               |
| Isabella       | 2                          | 24,492                             | 8                               | Shiawassee    | 10                         | 26,463                             | 38                              |
| Jackson        | 4                          | 62,265                             | 6                               | Tuscola       | 1                          | 22,068                             | 5                               |
| Kalamazoo      | 8                          | 89,177                             | 9                               | Van Buren     | 2                          | 28,019                             | 7                               |
| Kalkaska       | 0                          | 6,391                              | 0                               | Washtenaw     | 3                          | 127,697                            | 2                               |
| Kent           | 45                         | 208,349                            | 22                              | Wayne         | 152                        | 724,014                            | 21                              |
|                |                            |                                    |                                 | Wexford       | 5                          | 11,349                             | 44                              |
| <b>TOTAL</b>   |                            |                                    |                                 | <b>688 *</b>  | <b>3,688,521 **</b>        | <b>19 ***</b>                      |                                 |

\*County was unknown for 74 additional male adults.

\*\*Total number of men in all 83 counties of Michigan age 16+ years; 2000 US. Census population data.

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

**Table 9. Source of Exposure Among Adults with BLLs  $\geq 10$  ug/dL in Michigan: 2004**

| <b><u>Exposure Source Description</u></b> | <b><u>Number</u></b> | <b><u>Percent</u></b> |
|---|----------------------|-----------------------|
| Work-Related                              | 583                  | 82.3                  |
| Hobby: Firearms                           | 72                   | 10.2                  |
| Remodeling                                | 19                   | 2.7                   |
| Hobby: Casting                            | 7                    | 1.0                   |
| Hobby: Other                              | 4                    | 0.6                   |
| Hobby: Reloader                           | 4                    | 0.6                   |
| Hobby: Sinkers                            | 3                    | 0.4                   |
| Hobby: Unknown                            | 3                    | 0.4                   |
| Gun Shot Wound                            | 3                    | 0.4                   |
| Lead Paint Ingestion                      | 3                    | 0.4                   |
| Other                                     | 2                    | 0.3                   |
| Environment                               | 2                    | 0.3                   |
| Hobby: Stained Glass                      | 2                    | 0.3                   |
| Food                                      | 1                    | 0.1                   |
| <b>TOTAL</b>                              | <b>708 *</b>         | <b>100.0</b>          |

\* Patient interviews were attempted on 448 individuals; no patient interviews were attempted with 261 individuals, instead source was obtained from laboratory reporting form. For 76 additional adults source is pending an interview; for 13 additional adults source is pending medical records review; for 13 additional adults source was inconclusive based on interview; for 6 additional adults source was inconclusive and no patient interview was attempted.

**Table 10. Industries Where Individuals with BLLs  $\geq 10$  ug/dL Were Exposed to Lead in Michigan: 2004**

| <b>Industry (SIC Code)*</b>                               | <b>Work-Exposed<br/>Individuals<br/>(BLL <math>\geq 10</math> ug/dL)</b> |                |
|---|--|----------------|
|   | <b>Number</b>  | <b>Percent</b> |
| <b><i>Construction (15-17)</i></b>                        | <b>230</b>   | <b>40.4</b>    |
| Painting (17)   | 219  |                |
| <b><i>Manufacturing (20-39)</i></b>                       | <b>250</b>   | <b>43.9</b>    |
| Fabricated and Primary Metals (33-34)                     | 202  |                |
| <b><i>Transportation and Public Utilities (40-49)</i></b> | <b>18</b>  | <b>3.2</b>     |
| <b><i>Wholesale and Retail Trade (50-59)</i></b>          | <b>12</b>  | <b>2.1</b>     |
| <b><i>Finance, Insurance and Real Estate (60-67)</i></b>  | <b>2</b>   | <b>0.4</b>     |
| <b><i>Services (70-89)</i></b>                            | <b>34</b>  | <b>6.0</b>     |
| Automotive Repair Services (75)                           | 10   |                |
| <b><i>Public Administration (91-97)</i></b>               | <b>23</b>  | <b>4.0</b>     |
| Justice, Public Order, Safety (92)                        | 9  |                |
| <b>TOTAL</b>  | <b>569**</b>   | <b>100.0</b>   |

\*Standard Industrial Classification.

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

**Table 11. Inspection Status of Twenty-Seven Companies First Identified in 2004 and Sixteen Companies Identified in 2004 that were Previously Inspected Prior to 2004 with an Employee with a Blood Lead Report of  $\geq 25$  ug/dL, Michigan**

| <b><u>Inspection Status</u></b> | <b>Companies First Identified in 2004</b> |                       | <b>Companies Identified in 2004 that were Previously Inspected Prior to 2004</b> |                       |
|---------------------------------|---|-----------------------|--|-----------------------|
|                                 | <b><u>Number</u></b>                      | <b><u>Percent</u></b> | <b><u>Number</u></b>   | <b><u>Percent</u></b> |
| Completed Inspections           | 8 *                                       | 29.6                  | 7  | 43.8                  |
| Scheduled for Inspection        | 19  | 70.4                  | 9  | 56.3                  |
| <b>TOTAL</b>                    | <b>27</b>                                 | <b>100.0</b>          | <b>16</b>  | <b>100.0</b>          |

\*Two enforcement inspections were referred to and completed by OSHA in other states.

**Table 12. Results of Inspections in Eight Companies  
First Identified in 2004 and Seven Companies  
Identified in 2004 that were Previously Inspected  
Prior to 2004 with an Employee with a Blood Lead  
Report of  $\geq 25$  ug/dL, Michigan**

| <b><u>Inspection Results</u></b>               | <b>Companies First<br/>Identified in<br/>2004</b> |                       | <b>Companies<br/>Identified in 2004<br/>that were Previously<br/>Inspected Prior<br/>to 2004</b> |                       |
|--|---|-----------------------|--|-----------------------|
|  | <b><u>Number</u></b>                              | <b><u>Percent</u></b> | <b><u>Number</u></b>   | <b><u>Percent</u></b> |
| Cited for Lead Standard Violation(s) Only      | 2   | 25.0                  | 5  | 71.4                  |
| Cited for Lead Standard and Other Violation(s) | 4   | 50.0                  | 0  | --                    |
| Only Cited for Non-Lead Violation(s)           | 1   | 12.5                  | 0  | --                    |
| Not Cited for any Violation(s)                 | 1   | 12.5                  | 2  | 28.6                  |
| <b>TOTAL</b>                                   | <b>8</b>  | <b>100.0</b>          | <b>7</b>   | <b>100.0</b>          |

**Table 13. Industry Distribution of Eight Companies First Identified in 2004 and Seven Companies Identified in 2004 that were Previously Inspected Prior to 2004 with an Employee with a Blood Lead Report of  $\geq 25$  ug/dL, Michigan**

| Industry (SIC)*                       | Companies<br>First Identified in 2004   |             |           | Companies Identified in 2004<br>that were Previously Inspected<br>Prior to 2004 |             |           |
|---------------------------------------|---|-------------|-----------|---|-------------|-----------|
|                                       | Cited for Violation<br>of Lead Standard |             |           | Cited for Violation<br>of Lead Standard   |             |           |
|                                       | Companies<br>Number                     | Number      | Percent   | Companies<br>Number   | Number      | Percent   |
| Special Trade Construction (17)       | 4                                       | 2           | 50        | 0   | --          | --        |
| Printing and Publishing (27)          | 0                                       | --          | --        | 2   | 2           | 100       |
| Primary and Fabricated Metals (33-34) | 0                                       | --          | --        | 3   | 2           | 67        |
| Wholesale-Durable Goods (50)          | 1                                       | 1           | 100       | 0   | --          | --        |
| Automotive Repair Services (75)       | 1                                       | 1           | 100       | 1   | 0           | --        |
| Recreation (79)                       | 1                                       | 1           | 100       | 1   | 1           | 100       |
| Police (92)                           | 1                                       | 1           | 100       | 0   | --          | --        |
| <b>TOTAL</b>                          | <b>8</b>                                | <b>6 **</b> | <b>75</b> | <b>7</b>  | <b>5 **</b> | <b>71</b> |

\*Standard Industrial Classification

\*\*Two facilities were not cited in violation of the Lead Standard.

**Table 14. Demographic Characteristics of Michigan Adults with Blood Lead Levels (BLLs) of  $\geq 10$   $\mu\text{g/dL}$  in 2004, Interviewed from 10-15-1997 to 01-31-2005, by Highest Reported Blood Lead Level ( $\mu\text{g/dL}$ )**

| <b>Demographic Characteristics</b> | <b>10-24 <math>\mu\text{g/dL}</math></b> |                | <b>25-29 <math>\mu\text{g/dL}</math></b> |                | <b>30-39 <math>\mu\text{g/dL}</math></b> |                | <b>40-49 <math>\mu\text{g/dL}</math></b> |                | <b>50-59 <math>\mu\text{g/dL}</math></b> |                | <b><math>\geq 60</math> <math>\mu\text{g/dL}</math></b> |                | <b>TOTAL</b>  |                |
|------------------------------------|--|----------------|--|----------------|--|----------------|--|----------------|--|----------------|---|----------------|---------------|----------------|
|                                    | <b>Number</b>                            | <b>Percent</b> | <b>Number</b>                            | <b>Percent</b> | <b>Number</b>                            | <b>Percent</b> | <b>Number</b>                            | <b>Percent</b> | <b>Number</b>                            | <b>Percent</b> | <b>Number</b>   | <b>Percent</b> | <b>Number</b> | <b>Percent</b> |
| Male                               | 435                                      | (88.4)         | 175                                      | (91.6)         | 241                                      | (94.9)         | 77                                       | (92.8)         | 31                                       | (96.9)         | 11  | (84.6)         | 970           | (91.1)         |
| Female                             | 57                                       | (11.6)         | 16                                       | ( 8.4)         | 13                                       | ( 5.1)         | 6  | ( 7.2)         | 1  | ( 3.1)         | 1   | ( 8.3)         | 94            | ( 8.8)         |
| Hispanic Origin                    | 25                                       | ( 5.4)         | 6  | ( 3.3)         | 5  | ( 2.1)         | 9  | (11.3)         | 1  | ( 3.2)         | 0   | --             | 46            | ( 4.5)         |
| Caucasian                          | 406                                      | (84.1)         | 168                                      | (88.4)         | 221                                      | (87.7)         | 71                                       | (85.5)         | 29                                       | (90.6)         | 9   | (75.0)         | 904           | (85.9)         |
| African American                   | 50                                       | (10.4)         | 10                                       | ( 5.3)         | 18                                       | ( 7.1)         | 6  | ( 7.2)         | 3  | ( 9.4)         | 3   | (23.1)         | 90            | ( 8.5)         |
| Asian/Pacific Islander             | 3  | ( 0.6)         | 1  | ( 0.5)         | 2  | ( 0.8)         | 0  | --             | 0  | --             | 0   | --             | 6             | ( 0.6)         |
| Native American/Alaskan            | 4  | ( 0.8)         | 4  | ( 2.1)         | 8  | ( 3.2)         | 0  | --             | 0  | --             | 0   | --             | 16            | ( 1.5)         |
| Other                              | 20                                       | ( 4.1)         | 7  | ( 3.7)         | 3  | ( 1.2)         | 6  | ( 7.2)         | 0  | --             | 0   | --             | 36            | ( 3.4)         |
| Average Age                        | 47                                       | n=492          | 47                                       | n=191          | 46                                       | n=254          | 49                                       | n=83           | 49                                       | n=32           | 42  | n=12           | 47            | n=1064         |
| Ever Smoked                        | 314                                      | (65.8)         | 136                                      | (73.5)         | 170                                      | (72.6)         | 56                                       | (72.7)         | 23                                       | (82.1)         | 8   | (66.7)         | 707           | (69.8)*        |
| Now Smoke**                        | 155                                      | (48.4)         | 77                                       | (56.2)         | 121                                      | (69.9)         | 40                                       | (70.2)         | 19                                       | (82.6)         | 6   | (75.0)         | 418           | (58.2)*        |

\*P= < 0.05 for linear trend.

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

**Table 15. Symptoms of Michigan Adults with Blood Lead Levels (BLLs)  
of  $\geq 10$   $\mu\text{g/dL}$  in 2004, Interviewed from 10-15-1997 to 01-31-2005,  
by Highest Reported Blood Lead Level ( $\mu\text{g/dL}$ )**

| <u>Symptoms</u>            | <u>10-24 <math>\mu\text{g/dL}</math></u> |                | <u>25-29 <math>\mu\text{g/dL}</math></u> |                | <u>30-39 <math>\mu\text{g/dL}</math></u> |                | <u>40-49 <math>\mu\text{g/dL}</math></u> |                | <u>50-59 <math>\mu\text{g/dL}</math></u> |                | <u><math>\geq 60</math> <math>\mu\text{g/dL}</math></u> |                | <u>TOTAL</u>  |                |
|----------------------------|--|----------------|--|----------------|--|----------------|--|----------------|--|----------------|---|----------------|---------------|----------------|
|                            | <u>Number</u>                            | <u>Percent</u> | <u>Number</u>                            | <u>Percent</u> | <u>Number</u>                            | <u>Percent</u> | <u>Number</u>                            | <u>Percent</u> | <u>Number</u>                            | <u>Percent</u> | <u>Number</u>   | <u>Percent</u> | <u>Number</u> | <u>Percent</u> |
| <b>GASTRO-INTESTINAL</b>   |  |                |  |                |  |                |  |                |  |                |   |                |               |                |
| Lost 10+ lbs without diet  | 46                                       | ( 9.6)         | 14                                       | ( 7.6)         | 32                                       | (12.9)         | 19                                       | (23.2)         | 6  | (20.0)         | 3   | (27.3)         | 120           | (11.6)*        |
| Continued loss of appetite | 58                                       | (12.0)         | 18                                       | ( 9.6)         | 36                                       | (14.3)         | 18                                       | (22.0)         | 7  | (22.6)         | 3   | (25.0)         | 140           | (13.3)*        |
| Pains in belly             | 90                                       | (18.5)         | 19                                       | (10.1)         | 40                                       | (16.1)         | 22                                       | (26.5)         | 9  | (29.0)         | 3   | (25.0)         | 183           | (17.4)         |
| <b>MUSCULOSKELETAL</b>     |  |                |  |                |  |                |  |                |  |                |   |                |               |                |
| Frequent pain/soreness     | 184                                      | (38.2)         | 65                                       | (34.8)         | 93                                       | (37.2)         | 44                                       | (54.3)         | 14                                       | (45.2)         | 7   | (58.3)         | 407           | (39.0)*        |
| Muscle weakness            | 120                                      | (25.1)         | 26                                       | (13.9)         | 48                                       | (19.5)         | 31                                       | (38.3)         | 12                                       | (38.7)         | 7   | (58.3)         | 244           | (23.6)*        |
| <b>NERVOUS</b>             |  |                |  |                |  |                |  |                |  |                |   |                |               |                |
| Headaches                  | 88                                       | (18.1)         | 25                                       | (13.2)         | 54                                       | (21.4)         | 23                                       | (27.7)         | 9  | (28.1)         | 5   | (41.7)         | 204           | (19.3)*        |
| Dizziness                  | 53                                       | (11.0)         | 14                                       | ( 7.4)         | 16                                       | ( 6.5)         | 12                                       | (14.6)         | 4  | (12.9)         | 5   | (41.7)         | 104           | ( 9.9)         |
| Depressed                  | 77                                       | (16.0)         | 21                                       | (11.3)         | 36                                       | (14.6)         | 13                                       | (16.0)         | 10                                       | (31.3)         | 6   | (50.0)         | 163           | (15.7)         |
| Tired                      | 212                                      | (44.1)         | 61                                       | (32.3)         | 121                                      | (48.4)         | 50                                       | (61.0)         | 19                                       | (59.4)         | 8   | (66.7)         | 471           | (45.0)*        |
| Nervous                    | 79                                       | (16.5)         | 19                                       | (10.2)         | 40                                       | (16.3)         | 20                                       | (24.1)         | 10                                       | (32.3)         | 6   | (50.0)         | 174           | (16.8)*        |
| Waking up at night         | 150                                      | (31.1)         | 40                                       | (21.2)         | 84                                       | (33.7)         | 32                                       | (39.0)         | 15                                       | (46.9)         | 5   | (45.5)         | 326           | (31.2)*        |
| Nightmares                 | 34                                       | ( 7.0)         | 3  | ( 1.6)         | 10                                       | ( 4.1)         | 5  | ( 6.2)         | 4  | (12.9)         | 3   | (25.0)         | 59            | ( 5.7)         |
| Irritable                  | 109                                      | (22.7)         | 44                                       | (23.7)         | 68                                       | (27.4)         | 28                                       | (34.1)         | 13                                       | (41.9)         | 7   | (58.3)         | 269           | (25.9)*        |
| Unable to concentrate      | 87                                       | (18.1)         | 22                                       | (11.8)         | 49                                       | (19.5)         | 15                                       | (18.8)         | 9  | (28.1)         | 4   | (33.3)         | 186           | (17.8)         |
| <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     | 25                                       | ( 5.2)         | 12                                       | ( 6.5)         | 12                                       | ( 5.0)         | 1  | ( 1.3)         | 0  | --             | 1   | (10.0)         | 51            | ( 5.0)         |
| Gastro-Intestinal Symptoms | 128                                      | (26.2)         | 33                                       | (17.4)         | 65                                       | (25.7)         | 34                                       | (41.0)         | 14                                       | (43.8)         | 6   | (50.0)         | 280           | (26.5)*        |
| Musculoskeletal Symptoms   | 206                                      | (42.5)         | 68                                       | (36.2)         | 101                                      | (40.4)         | 49                                       | (59.8)         | 16                                       | (51.6)         | 8   | (66.7)         | 448           | (42.7)*        |
| Nervous Symptoms           | 302                                      | (62.1)         | 94                                       | (49.5)         | 162                                      | (64.3)         | 58                                       | (69.9)         | 24                                       | (75.0)         | 8   | (66.7)         | 648           | (61.4)         |
| Reproductive Symptoms      | 29                                       | (42.6)         | 14                                       | (20.3)         | 19                                       | (14.7)         | 4  | (10.0)         | 2  | (10.5)         | 1   | (14.3)         | 69            | (20.8)*        |
| Any Symptoms               | 345                                      | (70.7)         | 117                                      | (61.6)         | 172                                      | (68.0)         | 67                                       | (80.7)         | 27                                       | (84.4)         | 9   | (75.0)         | 737           | (69.7)         |
| Average Number Symptoms    | 2.9                                      | n=488          | 2.1                                      | n=190          | 2.9                                      | n=253          | 4.0                                      | n=83           | 4.5                                      | n=32           | 6.1   | n=12           | 2.9           | n=1058         |

\*P= < 0.05 for linear trend.



**Table 16. Lead Related Health Conditions of Michigan Adults with Blood Lead Levels (BLLs) of  $\geq 10$   $\mu\text{g}/\text{dL}$  in 2004, Interviewed from 10-15-1997 to 01-31-2005, by Highest Reported Blood Lead Level ( $\mu\text{g}/\text{dL}$ )**

| <u>Lead Related Disease</u> | <u>10-24 <math>\mu\text{g}/\text{dL}</math></u> |                | <u>25-29 <math>\mu\text{g}/\text{dL}</math></u> |                | <u>30-39 <math>\mu\text{g}/\text{dL}</math></u> |                | <u>40-49 <math>\mu\text{g}/\text{dL}</math></u> |                | <u>50-59 <math>\mu\text{g}/\text{dL}</math></u> |                | <u><math>\geq 60</math> <math>\mu\text{g}/\text{dL}</math></u> |                | <u>TOTAL</u>  |                |
|-----------------------------|---|----------------|---|----------------|---|----------------|---|----------------|---|----------------|--|----------------|---------------|----------------|
|                             | <u>Number</u>                                   | <u>Percent</u> | <u>Number</u>                                   | <u>Percent</u> | <u>Number</u>                                   | <u>Percent</u> | <u>Number</u>                                   | <u>Percent</u> | <u>Number</u>                                   | <u>Percent</u> | <u>Number</u>  | <u>Percent</u> | <u>Number</u> | <u>Percent</u> |
| Anemia                      | 33  | ( 7.0)         | 4   | ( 2.2)         | 10  | ( 4.1)         | 6   | ( 7.6)         | 2   | ( 6.5)         | 1  | (10.0)         | 56            | ( 5.5)         |
| Kidney Disease              | 13  | ( 2.7)         | 1   | ( 0.5)         | 5   | ( 2.0)         | 2   | ( 2.4)         | 1   | ( 3.2)         | 0  | --             | 22            | ( 2.1)         |
| High Blood Pressure         | 27  | ( 5.6)         | 10  | ( 5.3)         | 27  | (10.9)         | 12  | (15.4)         | 4   | (13.3)         | 1  | ( 9.1)         | 81            | ( 7.8)*        |

\*P= < 0.05 for linear trend.

**Table 17. Industry of Michigan Adults with Blood Lead Levels (BLLs) of  $\geq 10$   $\mu\text{g/dL}$  in 2004,  
Interviewed from 10-15-1997 to 01-31-2005, by Highest Reported Blood Lead Level ( $\mu\text{g/dL}$ )**

| <u>Standard Industrial Classification</u> | <u>10-24 <math>\mu\text{g/dL}</math></u> |                | <u>25-29 <math>\mu\text{g/dL}</math></u> |                | <u>30-39 <math>\mu\text{g/dL}</math></u> |                | <u>40-49 <math>\mu\text{g/dL}</math></u> |                | <u>50-59 <math>\mu\text{g/dL}</math></u> |                | <u><math>\geq 60</math> <math>\mu\text{g/dL}</math></u> |                | <u>TOTAL</u>  |                |
|---|--|----------------|--|----------------|--|----------------|--|----------------|--|----------------|---|----------------|---------------|----------------|
|   | <u>Number</u>                            | <u>Percent</u> | <u>Number</u>                            | <u>Percent</u> | <u>Number</u>                            | <u>Percent</u> | <u>Number</u>                            | <u>Percent</u> | <u>Number</u>                            | <u>Percent</u> | <u>Number</u>   | <u>Percent</u> | <u>Number</u> | <u>Percent</u> |
| Construction, Building (15)               | 1  | ( 0.3)         | 1  | ( 0.6)         | 0  | --             | 0  | --             | 0  | --             | 0   | --             | 2             | ( 0.3)         |
| Construction, Heavy (16)                  | 9  | ( 3.1)         | 1  | ( 0.6)         | 2  | ( 1.0)         | 0  | --             | 0  | --             | 0   | --             | 12            | ( 1.6)         |
| Special Trade Construction (17)           | 108                                      | (37.0)         | 37                                       | (24.0)         | 70                                       | (33.5)         | 26                                       | (42.6)         | 12                                       | (44.4)         | 5   | (45.5)         | 258           | (34.2)         |
| Food and Kindred Products (20)            | 0  | --             | 1  | ( 0.6)         | 0  | --             | 0  | --             | 0  | --             | 0   | --             | 1             | ( 0.1)         |
| Lumber and Wood (24)                      | 1  | ( 0.3)         | 0  | --             | 0  | --             | 0  | --             | 0  | --             | 0   | --             | 1             | ( 0.1)         |
| Furniture and Fixtures (25)               | 1  | ( 0.3)         | 0  | --             | 0  | --             | 0  | --             | 0  | --             | 0   | --             | 1             | ( 0.1)         |
| Printing and Publishing (27)              | 1  | ( 0.3)         | 0  | --             | 1  | ( 0.5)         | 0  | --             | 0  | --             | 0   | --             | 2             | ( 0.3)         |
| Stone/Clay/Glass (32)                     | 4  | ( 1.4)         | 3  | ( 1.9)         | 4  | ( 1.9)         | 2  | ( 3.3)         | 0  | --             | 0   | --             | 13            | ( 1.7)         |
| Primary Metals Industry (33)              | 20                                       | ( 6.8)         | 49                                       | (31.8)         | 80                                       | (38.3)         | 20                                       | (32.8)         | 8  | (29.6)         | 3   | (27.3)         | 180           | (23.9)         |
| Fabricated Metal Products (34)            | 15                                       | ( 5.1)         | 16                                       | (10.4)         | 17                                       | ( 8.1)         | 5  | ( 8.2)         | 0  | --             | 0   | --             | 53            | ( 7.0)         |
| Industrial, Commercial Machinery (35)     | 5  | ( 1.7)         | 3  | ( 1.9)         | 5  | ( 2.4)         | 1  | ( 1.6)         | 2  | ( 7.4)         | 1   | ( 9.1)         | 17            | ( 2.3)         |
| Electronics (36)                          | 11                                       | ( 3.8)         | 1  | ( 0.6)         | 0  | --             | 0  | --             | 0  | --             | 0   | --             | 12            | ( 1.6)         |
| Transportation Equipment (37)             | 11                                       | ( 3.8)         | 3  | ( 1.9)         | 3  | ( 1.4)         | 2  | ( 3.3)         | 1  | ( 3.7)         | 0   | --             | 20            | ( 2.7)         |
| Measuring, Analyzing, Crtl Instr. (38)    | 1  | ( 0.3)         | 0  | --             | 0  | --             | 0  | --             | 0  | --             | 0   | --             | 1             | ( 0.1)         |
| Misc. Manufacturing Industries (39)       | 2  | ( 0.7)         | 1  | ( 0.6)         | 0  | --             | 0  | --             | 0  | --             | 0   | --             | 3             | ( 0.4)         |
| Railroad Transportation (40)              | 1  | ( 0.3)         | 3  | ( 1.9)         | 3  | ( 1.4)         | 0  | --             | 0  | --             | 0   | --             | 7             | ( 0.9)         |
| Motor Freight Trans, Warehousing (42)     | 1  | ( 0.3)         | 0  | --             | 0  | --             | 0  | --             | 0  | --             | 0   | --             | 1             | ( 0.1)         |
| Water Transportation (44)                 | 1  | ( 0.1)         | 0  | --             | 0  | --             | 0  | --             | 0  | --             | 0   | --             | 1             | ( 0.1)         |
| Trans., Electric, Gas & San. Svcs. (49)   | 12                                       | ( 4.1)         | 4  | ( 2.6)         | 2  | ( 1.0)         | 1  | ( 1.6)         | 0  | --             | 0   | --             | 19            | ( 2.5)         |
| Wholesale-Durable Goods (50)              | 3  | ( 1.0)         | 1  | ( 0.6)         | 1  | ( 0.5)         | 0  | --             | 0  | --             | 0   | --             | 5             | ( 0.7)         |
| Building Materials, Hardware (52)         | 1  | ( 0.3)         | 0  | --             | 0  | --             | 0  | --             | 0  | --             | 0   | --             | 1             | ( 0.1)         |
| Automotive Dealers, Gas (55)              | 0  | --             | 3  | ( 1.9)         | 1  | ( 0.5)         | 0  | --             | 0  | --             | 0   | --             | 4             | ( 0.5)         |
| Other Retail Trade (59)                   | 3  | ( 1.0)         | 0  | --             | 1  | ( 0.5)         | 0  | --             | 0  | --             | 0   | --             | 4             | ( 0.5)         |
| Depository Institutions (60)              | 1  | ( 0.3)         | 0  | --             | 0  | --             | 0  | --             | 0  | --             | 0   | --             | 1             | ( 0.1)         |
| Finance, Insurance, Real Estate (65)      | 1  | ( 0.3)         | 0  | --             | 0  | --             | 0  | --             | 0  | --             | 0   | --             | 1             | ( 0.1)         |
| Business Services (73)                    | 3  | ( 1.0)         | 0  | --             | 0  | --             | 0  | --             | 0  | --             | 0   | --             | 3             | ( 0.4)         |
| Automotive Repair Services (75)           | 15                                       | ( 5.1)         | 7  | ( 4.5)         | 5  | ( 2.4)         | 4  | ( 6.6)         | 2  | ( 7.4)         | 0   | --             | 33            | ( 4.4)         |
| Misc. Repair Services (76)                | 4  | ( 1.4)         | 1  | ( 0.6)         | 3  | ( 1.4)         | 0  | --             | 0  | --             | 0   | --             | 8             | ( 1.1)         |
| Amusement and Recreation (79)             | 10                                       | ( 3.4)         | 5  | ( 3.2)         | 2  | ( 1.0)         | 0  | --             | 2  | ( 7.4)         | 2   | (18.2)         | 21            | ( 2.8)         |
| Health Services (80)                      | 1  | ( 0.3)         | 0  | --             | 0  | --             | 0  | --             | 0  | --             | 0   | --             | 1             | ( 0.1)         |
| Educational Services (82)                 | 8  | ( 2.7)         | 3  | ( 1.9)         | 1  | ( 0.5)         | 0  | --             | 0  | --             | 0   | --             | 12            | ( 1.6)         |
| Museum, Art Galleries (84)                | 1  | ( 0.3)         | 1  | ( 0.6)         | 0  | --             | 0  | --             | 0  | --             | 0   | --             | 2             | ( 0.3)         |
| Engineering Services (87)                 | 10                                       | ( 3.4)         | 2  | ( 1.3)         | 2  | ( 1.0)         | 0  | --             | 0  | --             | 0   | --             | 14            | ( 1.9)         |
| Services, NEC (89)                        | 2  | ( 0.7)         | 0  | --             | 0  | --             | 0  | --             | 0  | --             | 0   | --             | 2             | ( 0.3)         |
| General Government (91)                   | 1  | ( 0.3)         | 0  | --             | 0  | --             | 0  | --             | 0  | --             | 0   | --             | 1             | ( 0.1)         |
| Justice, Public Order, Safety (92)        | 17                                       | ( 5.8)         | 7  | ( 4.5)         | 5  | ( 2.4)         | 0  | --             | 0  | --             | 0   | --             | 29            | ( 3.8)         |
| Human Resources (94)                      | 0  | --             | 0  | --             | 1  | ( 0.5)         | 0  | --             | 0  | --             | 0   | --             | 1             | ( 0.1)         |
| Admin Of Environmental Quality (95)       | 1  | ( 0.3)         | 0  | --             | 0  | --             | 0  | --             | 0  | --             | 0   | --             | 1             | ( 0.1)         |
| Admin Of Economic Programs (96)           | 3  | ( 1.0)         | 1  | ( 0.6)         | 0  | --             | 0  | --             | 0  | --             | 0   | --             | 4             | ( 0.5)         |
| National Security, Int'l Affairs (97)     | 2  | ( 0.7)         | 0  | --             | 0  | --             | 0  | --             | 0  | --             | 0   | --             | 2             | ( 0.3)         |
| <b>TOTAL</b>                              | <b>292</b>                               | <b>(100)</b>   | <b>154</b>                               | <b>(100)</b>   | <b>209</b>                               | <b>(100)</b>   | <b>61</b>                                | <b>(100)</b>   | <b>27</b>                                | <b>(100)</b>   | <b>11</b>   | <b>(100)</b>   | <b>754</b>    | <b>(100)</b>   |

**Table 18. Number of Years Worked of Michigan Adults with Blood Lead Levels (BLLs) of  $\geq 10$   $\mu\text{g/dL}$  in 2004, Interviewed from 10-15-1997 to 01-31-2005, by Highest Reported Blood Lead Level ( $\mu\text{g/dL}$ )**

| <u>Number of<br/>Years Worked</u> | <u>10-24 <math>\mu\text{g/dL}</math></u> |                | <u>25-29 <math>\mu\text{g/dL}</math></u> |                | <u>30-39 <math>\mu\text{g/dL}</math></u> |                | <u>40-49 <math>\mu\text{g/dL}</math></u> |                | <u>50-59 <math>\mu\text{g/dL}</math></u> |                | <u><math>\geq 60</math> <math>\mu\text{g/dL}</math></u> |                | <u>TOTAL</u>  |                |
|-----------------------------------|--|----------------|--|----------------|--|----------------|--|----------------|--|----------------|---|----------------|---------------|----------------|
|                                   | <u>Number</u>                            | <u>Percent</u> | <u>Number</u>                            | <u>Percent</u> | <u>Number</u>                            | <u>Percent</u> | <u>Number</u>                            | <u>Percent</u> | <u>Number</u>                            | <u>Percent</u> | <u>Number</u>   | <u>Percent</u> | <u>Number</u> | <u>Percent</u> |
| $\leq 5$                          | 160                                      | (53.7)         | 95                                       | (62.9)         | 111                                      | (52.1)         | 34                                       | (55.7)         | 13                                       | (50.0)         | 7   | (63.6)         | 420           | (55.3)         |
| 6 – 10                            | 44                                       | (14.8)         | 27                                       | (17.9)         | 34                                       | (16.0)         | 8  | (13.1)         | 8  | (30.8)         | 2   | (18.2)         | 123           | (16.2)         |
| 11 – 20                           | 56                                       | (18.8)         | 19                                       | (12.6)         | 36                                       | (16.9)         | 10                                       | (16.4)         | 3  | (11.5)         | 1   | ( 9.1)         | 125           | (16.4)         |
| 21 – 30                           | 25                                       | ( 8.4)         | 9  | ( 6.0)         | 27                                       | (12.7)         | 2  | ( 3.3)         | 1  | ( 3.8)         | 1   | ( 9.1)         | 65            | ( 8.6)         |
| $\geq 31$                         | 13                                       | ( 4.4)         | 1  | ( 0.7)         | 5  | ( 2.3)         | 7  | (11.5)         | 1  | ( 3.8)         | 0   | --             | 27            | ( 3.6)         |

**Table 19. Working Conditions Reported by Michigan Adults with Blood Lead Levels (BLLs) of  $\geq 10$   $\mu\text{g/dL}$  in 2004, Interviewed from 10-15-1997 to 01-31-2005, by Highest Reported Blood Lead Level ( $\mu\text{g/dL}$ )**

| <u>Working Conditions</u>                    | <u>10-24 <math>\mu\text{g/dL}</math></u> |                | <u>25-29 <math>\mu\text{g/dL}</math></u> |                | <u>30-39 <math>\mu\text{g/dL}</math></u> |                | <u>40-49 <math>\mu\text{g/dL}</math></u> |                | <u>50-59 <math>\mu\text{g/dL}</math></u> |                | <u><math>\geq 60</math> <math>\mu\text{g/dL}</math></u> |                | <u>TOTAL</u>  |                |
|--|--|----------------|--|----------------|--|----------------|--|----------------|--|----------------|---|----------------|---------------|----------------|
|  | <u>Number</u>                            | <u>Percent</u> | <u>Number</u>                            | <u>Percent</u> | <u>Number</u>                            | <u>Percent</u> | <u>Number</u>                            | <u>Percent</u> | <u>Number</u>                            | <u>Percent</u> | <u>Number</u>   | <u>Percent</u> | <u>Number</u> | <u>Percent</u> |
| Separate lockers: dirty and clean*           | 157                                      | (54.7)         | 107                                      | (70.9)         | 144                                      | (69.9)         | 33                                       | (55.0)         | 17                                       | (60.7)         | 3   | (30.0)         | 461           | (62.1)         |
| Work clothes laundered: work*                | 102                                      | (36.2)         | 90                                       | (60.4)         | 120                                      | (57.7)         | 27                                       | (45.0)         | 11                                       | (39.3)         | 2   | (20.0)         | 352           | (47.8)*        |
| Shower facility*                             | 150                                      | (52.3)         | 96                                       | (64.0)         | 150                                      | (72.1)         | 29                                       | (47.5)         | 12                                       | (44.4)         | 4   | (40.0)         | 441           | (59.4)         |
| Lunch room*                                  | 177                                      | (62.5)         | 106                                      | (71.1)         | 163                                      | (78.7)         | 34                                       | (55.7)         | 14                                       | (51.9)         | 4   | (40.0)         | 498           | (67.6)         |
| Clean off dust and wash hands before eating* | 268                                      | (93.4)         | 134                                      | (89.3)         | 192                                      | (91.4)         | 51                                       | (86.4)         | 24                                       | (85.7)         | 9   | (90.0)         | 678           | (91.1)         |
| Eat in lunchroom*                            | 117                                      | (58.5)         | 85                                       | (70.8)         | 108                                      | (61.4)         | 27                                       | (51.9)         | 8  | (36.4)         | 3   | (37.5)         | 348           | (60.2)         |
| Wear respirator*                             | 179                                      | (61.5)         | 105                                      | (70.0)         | 160                                      | (75.8)         | 48                                       | (80.0)         | 18                                       | (64.3)         | 9   | (90.0)         | 519           | (69.2)*        |
| Smoke in work area**                         | 96                                       | (61.5)         | 48                                       | (63.2)         | 74                                       | (63.2)         | 16                                       | (41.0)         | 9  | (47.4)         | 4   | (66.7)         | 247           | (59.8)         |
| Keep cigarettes in pocket while working**    | 71                                       | (46.4)         | 31                                       | (40.3)         | 59                                       | (50.9)         | 14                                       | (35.9)         | 6  | (31.6)         | 3   | (50.0)         | 184           | (44.9)         |
| Exposed to Lead now*                         | 164                                      | (57.7)         | 90                                       | (61.6)         | 137                                      | (66.5)         | 32                                       | (57.1)         | 17                                       | (68.0)         | 2   | (20.0)         | 442           | (60.8)         |
| Removal from job*                            | 15                                       | ( 5.2)         | 12                                       | ( 7.9)         | 29                                       | (13.8)         | 15                                       | (25.4)         | 8  | (28.6)         | 4   | (40.0)         | 83            | (11.1)*        |

\*Based on positive questionnaire responses.

\*\*Based on negative questionnaire responses.

**Table 20. Number of Households with Children (6 or under) Potentially Exposed to Take-Home Lead from Michigan Adults with Blood Lead Levels (BLLs) of  $\geq 10$   $\mu\text{g}/\text{dL}$  in 2004, Interviewed from 10-15-1997 to 01-31-2005, by Highest Reported Blood Lead Level ( $\mu\text{g}/\text{dL}$ )**

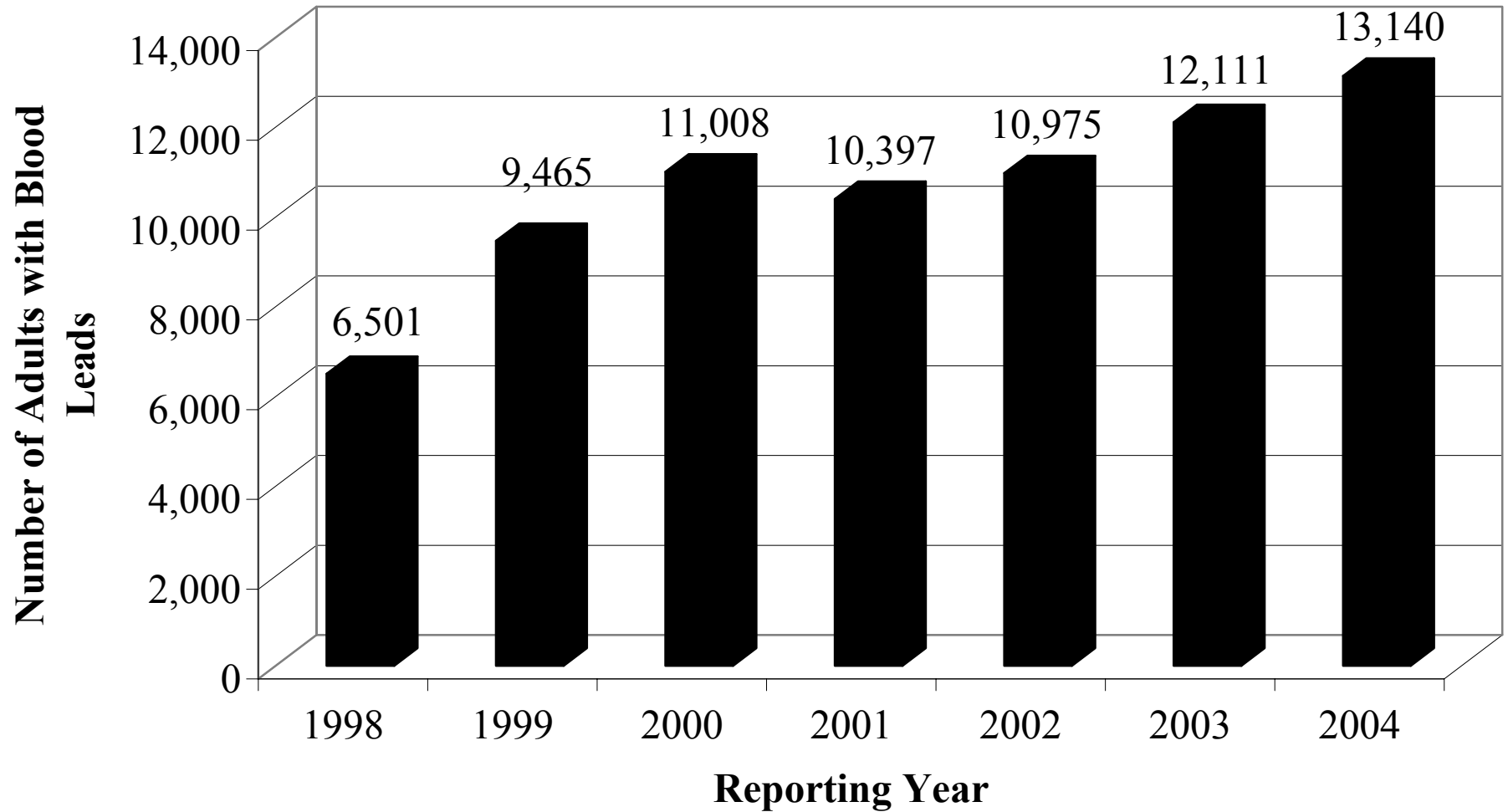
| <u>Description of Households</u>                          | <u>10-24 <math>\mu\text{g}/\text{dL}</math></u> |                | <u>25-29 <math>\mu\text{g}/\text{dL}</math></u> |                | <u>30-39 <math>\mu\text{g}/\text{dL}</math></u> |                | <u>40-49 <math>\mu\text{g}/\text{dL}</math></u> |                | <u>50-59 <math>\mu\text{g}/\text{dL}</math></u> |                | <u><math>\geq 60</math> <math>\mu\text{g}/\text{dL}</math></u> |                | <u>TOTAL</u>  |                |
|---|---|----------------|---|----------------|---|----------------|---|----------------|---|----------------|--|----------------|---------------|----------------|
|   | <u>Number</u>                                   | <u>Percent</u> | <u>Number</u>                                   | <u>Percent</u> | <u>Number</u>                                   | <u>Percent</u> | <u>Number</u>                                   | <u>Percent</u> | <u>Number</u>                                   | <u>Percent</u> | <u>Number</u>  | <u>Percent</u> | <u>Number</u> | <u>Percent</u> |
| Households with Children living or spending time in house | 129   | (26.7)*        | 57  | (30.2)         | 80  | (31.6)         | 23  | (28.0)         | 11  | (34.4)         | 3  | (25.0)         | 303           | (28.8)         |
| Households with Children tested for Lead                  | 41  | (37.3)**       | 12  | (22.2)         | 17  | (22.7)         | 10  | (52.6)         | 4   | (36.4)         | 2  | (66.7)         | 86            | (31.6)         |
| Households where Children had elevated Lead levels        | 16  | (43.2)***      | 3   | (27.3)         | 8   | (40.0)         | 4   | (44.4)         | 1   | (33.3)         | 1  | (50.0)         | 33            | (40.2)         |

\* Among individuals within blood lead category, percentage of their households with children living or spending time in house.

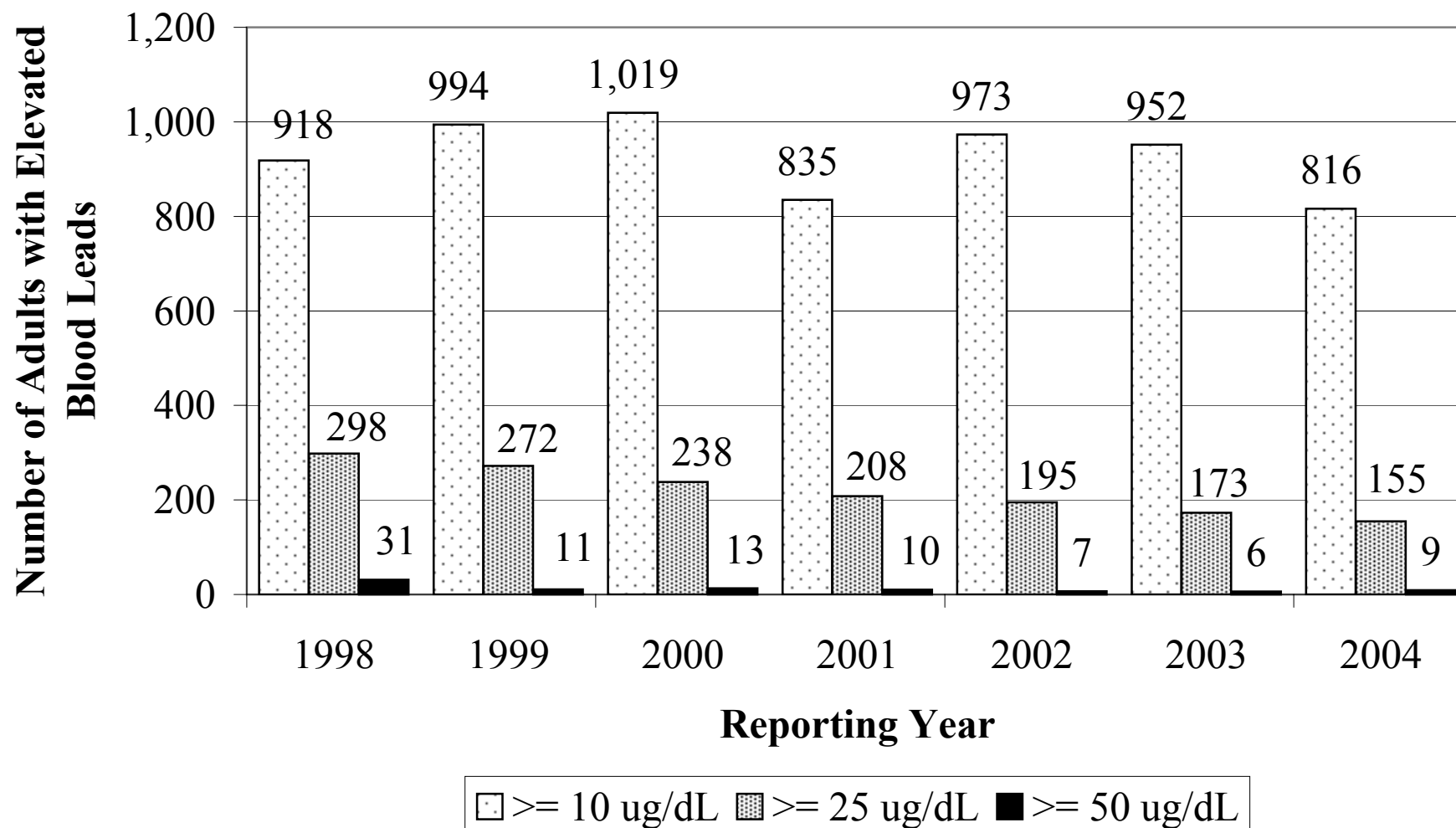
\*\* Among individuals within blood lead category, percentage of households with children living or spending time in house where the children were tested for lead. Because of missing data the denominator may be less than the number with children living or spending time in house in the first row of the 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 than the number tested for lead in the second row of the table.

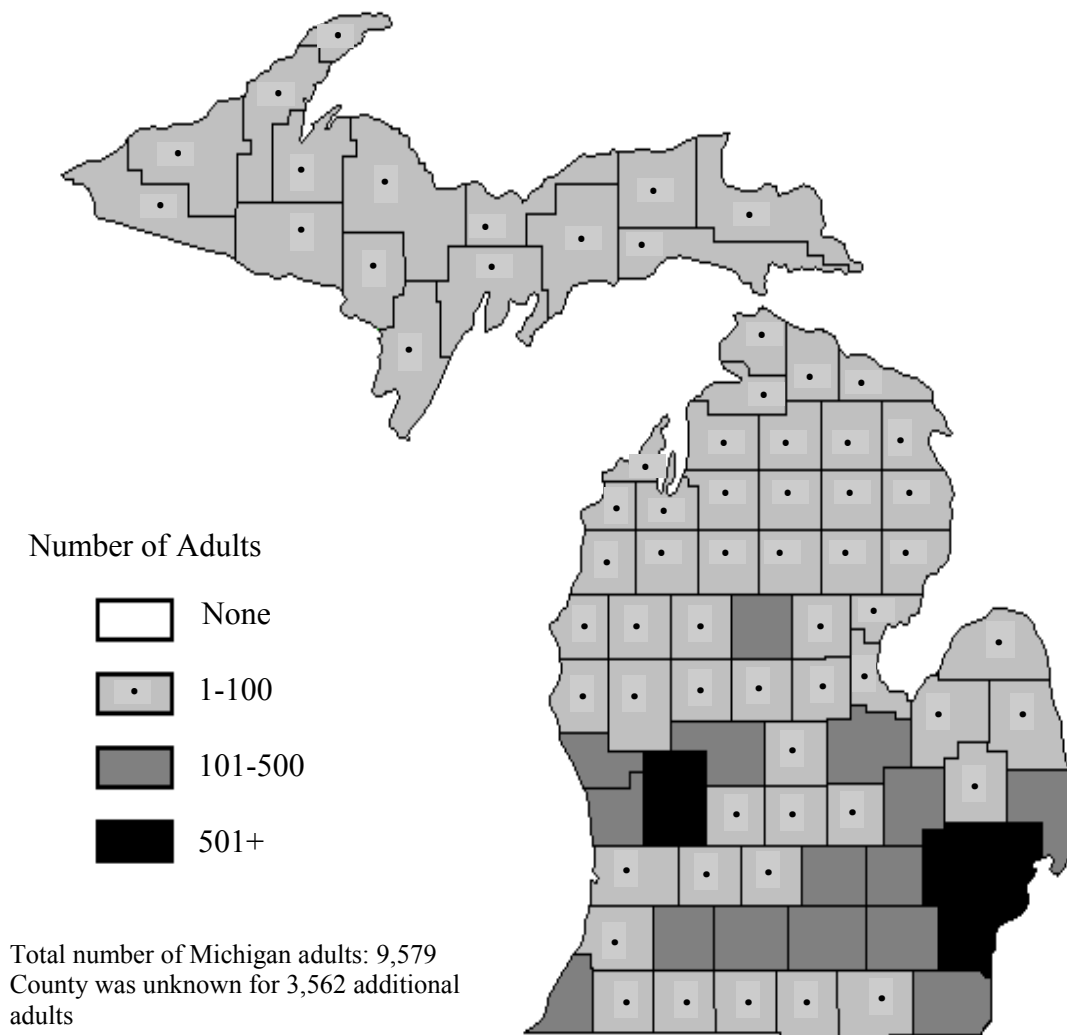
**Figure 1. Number of Adults Tested for Blood Lead,  
Michigan: 1998-2004**



**Figure 2. Number of Adults with Blood Lead Levels  $\geq 10$  ug/dL,  $\geq 25$  ug/dL and  $\geq 50$  ug/dL, Michigan: 1998-2004**



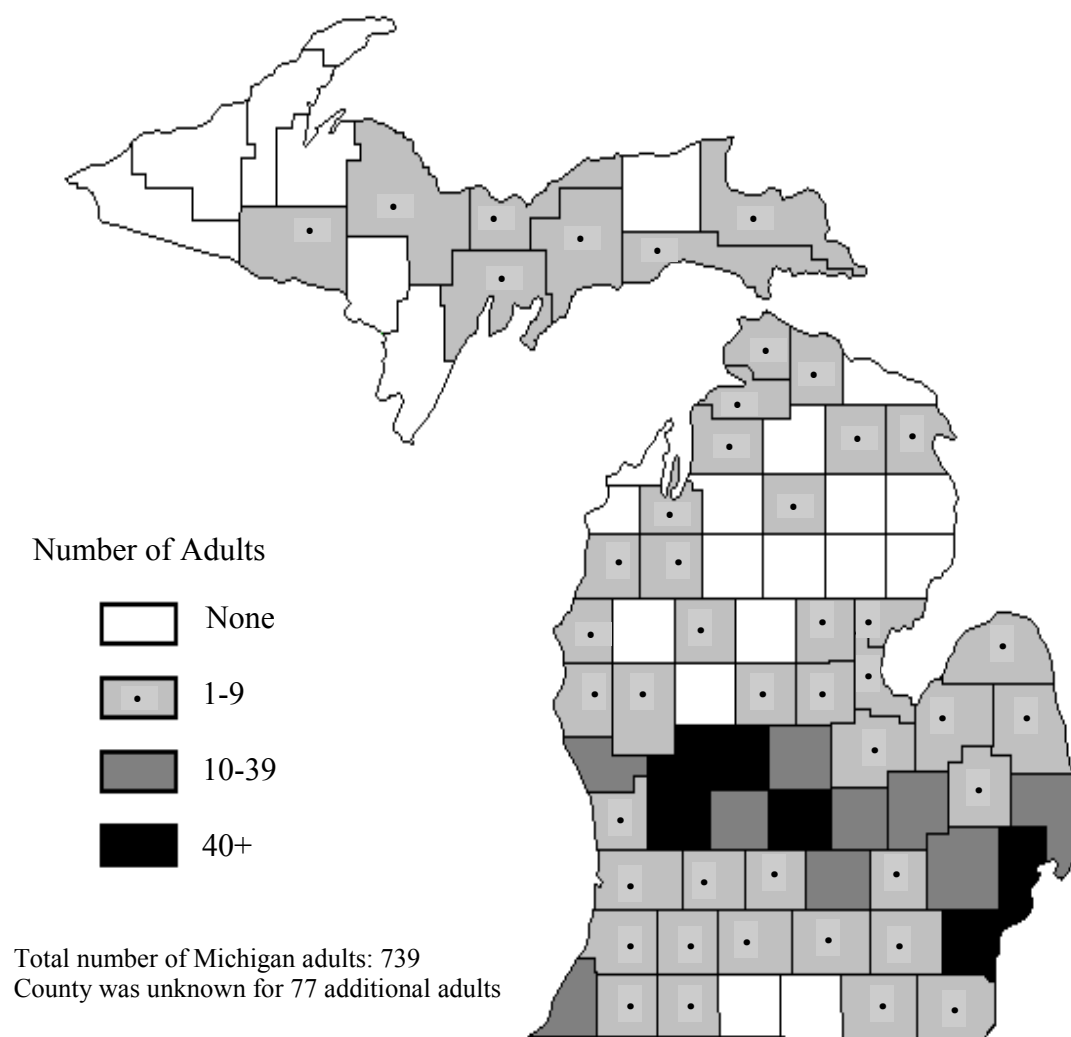
**Figure 3. Distribution of Adults Tested for Blood Lead in Michigan by County of Residence: 2004**



**Kent** and **Wayne** counties had the highest number of adults reported, with 1,160 and 1,949, respectively.

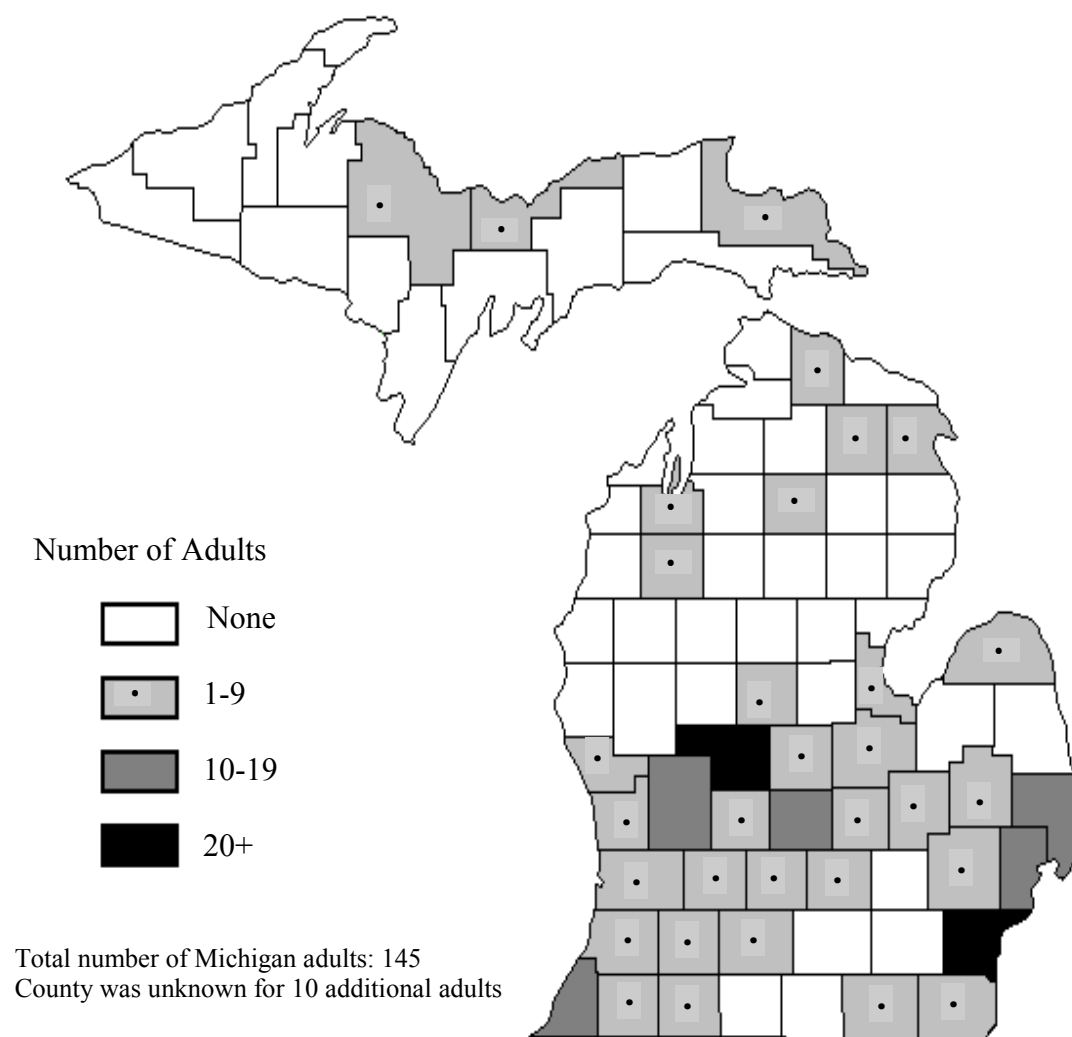


**Figure 4. Distribution of Adults with Blood Lead Levels (BLLs)  $\geq 10$  ug/dL in Michigan by County of Residence: 2004**



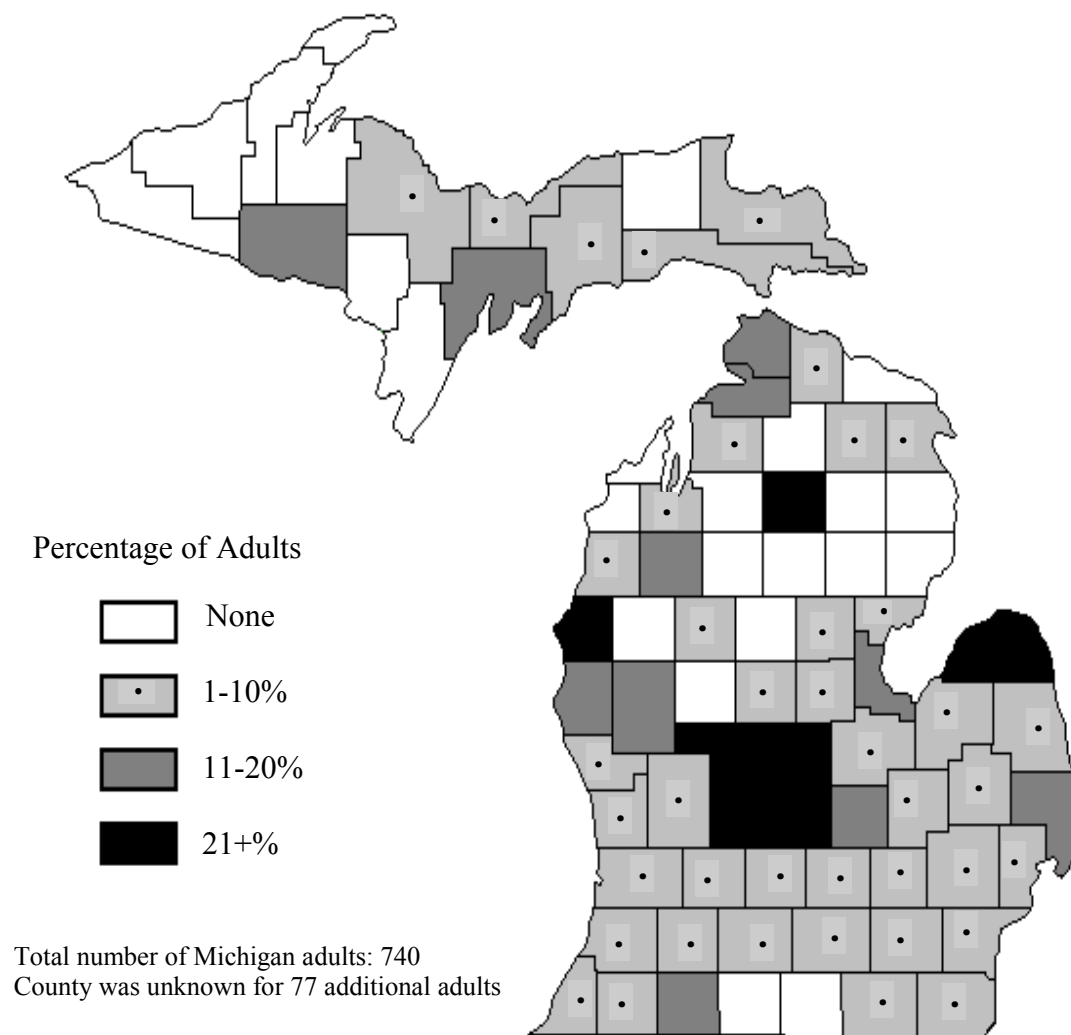
**Montcalm** and **Wayne** counties had the highest number of adults with blood lead levels of 10 ug/dL or greater reported, with 59 and 167, respectively.

**Figure 5. Distribution of Adults with Blood Lead Levels (BLLs)  $\geq 25$  ug/dL in Michigan by County of Residence: 2004**



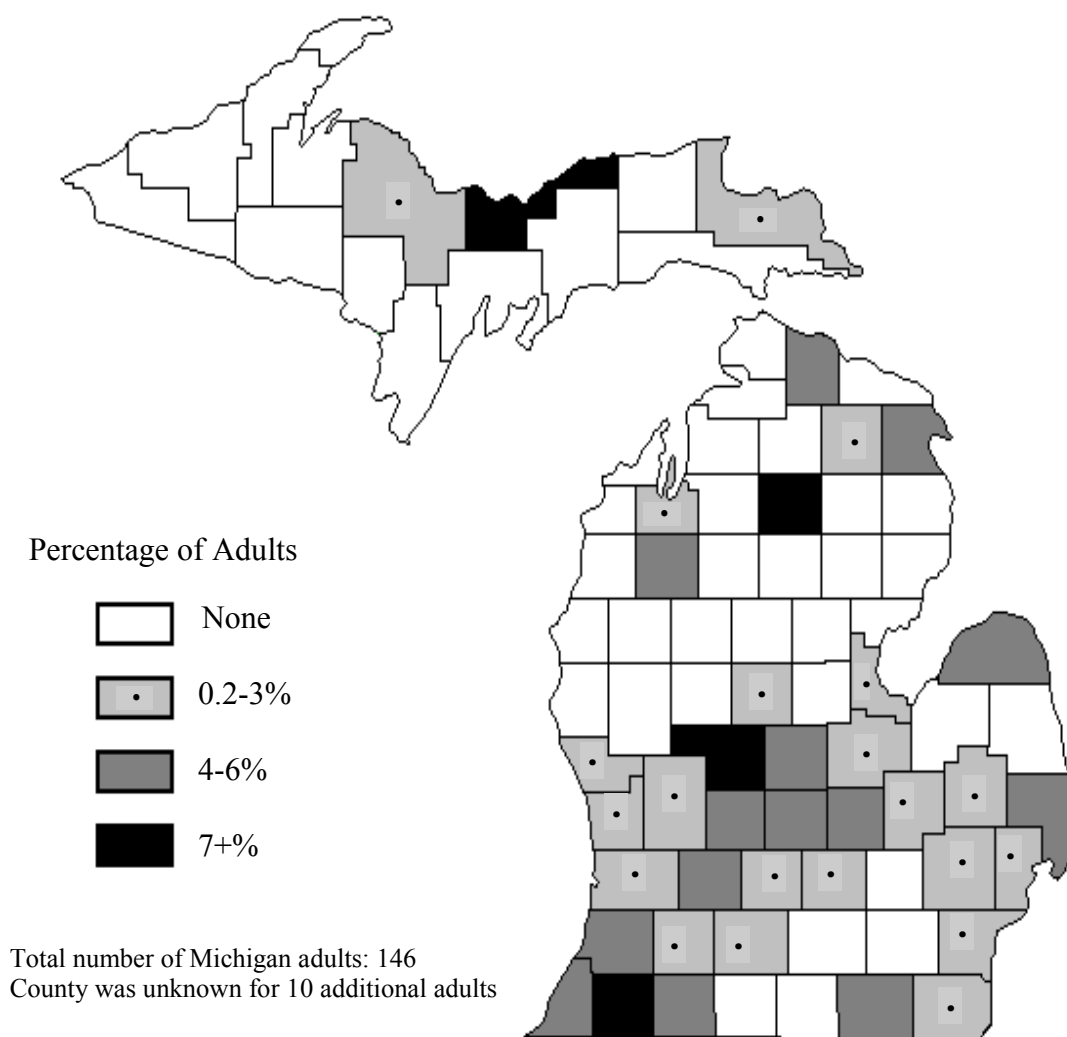
**Montcalm** and **Wayne** counties had the highest number of adults with blood lead levels of 25 ug/dL or greater reported, with 17 and 30 adults, respectively.

**Figure 6. Percentage of Adults with Blood Lead Levels (BLLs)  $\geq 10$  ug/dL in Michigan by County of Residence: 2004\***



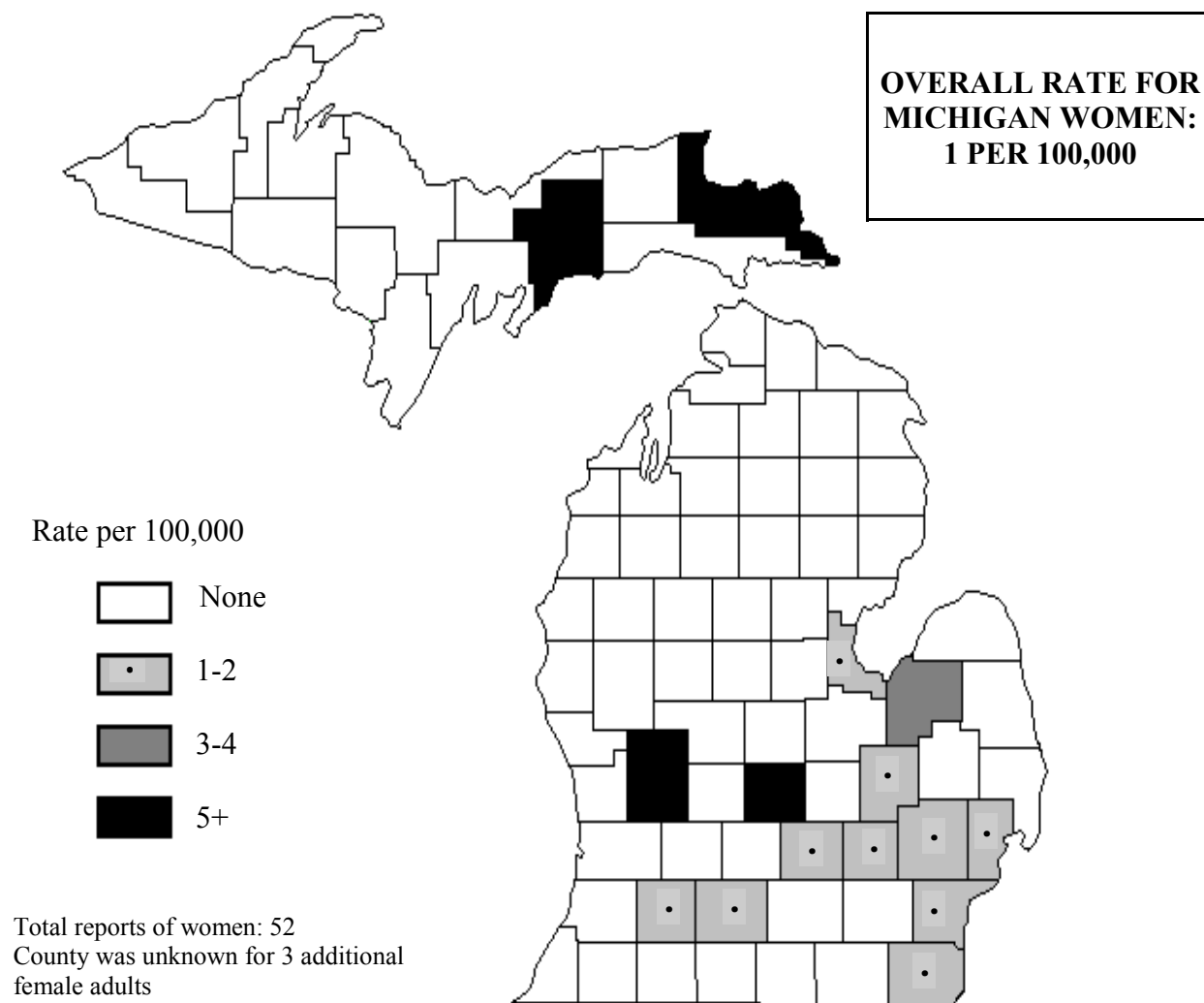
\*Denominator used was the total number of adults tested for blood lead within each county.

**Figure 7. Percentage of Adults with Blood Lead Levels (BLLs)  $\geq 25$  ug/dL in Michigan by County of Residence: 2004\***



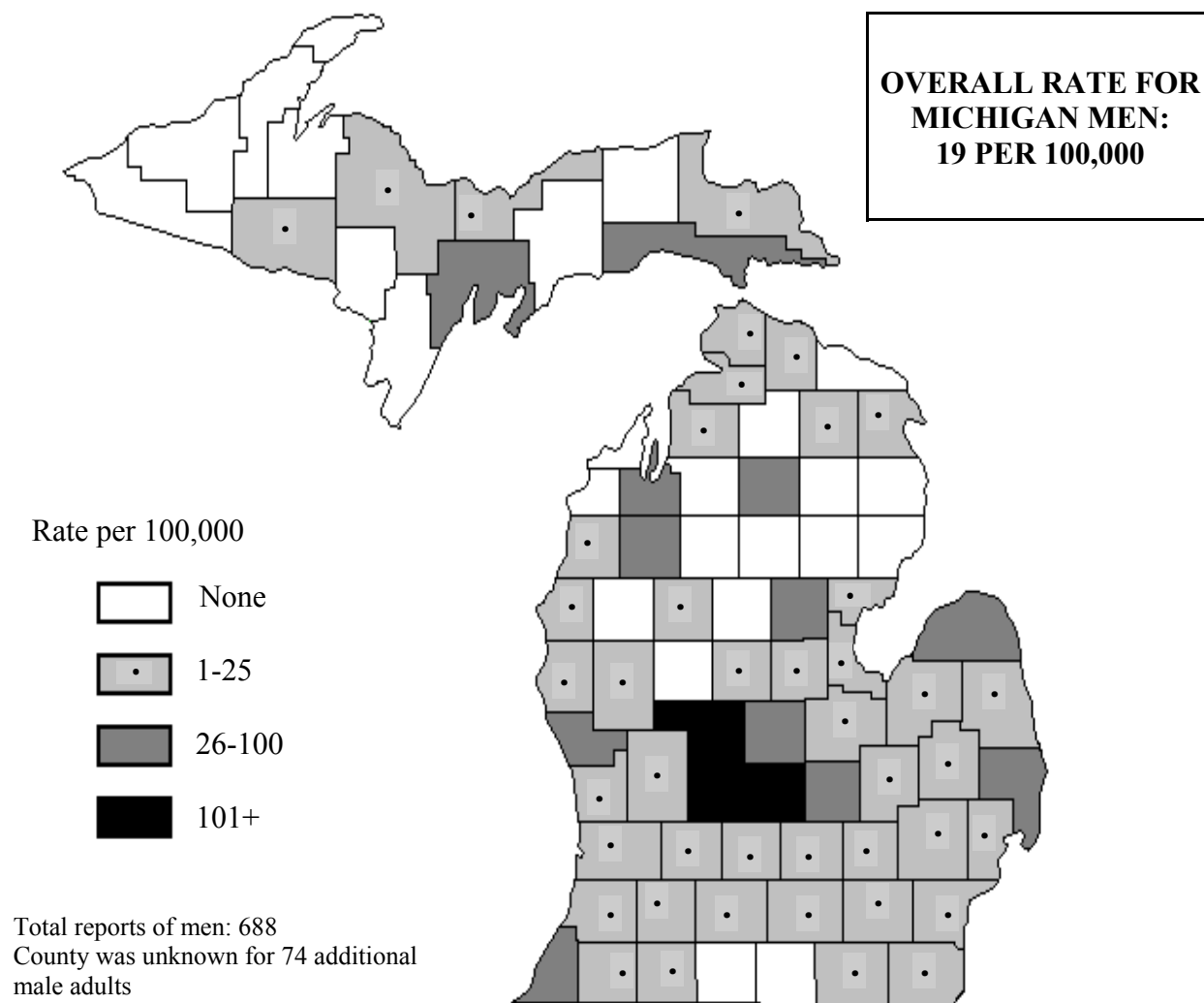
\*Denominator used was the total number of adults tested for blood lead within each county.

**Figure 8. Annual Incidence of Blood Lead Levels (BLLs)  $\geq 10$  ug/dL Among Women in Michigan by County of Residence: 2004\***



\*Rate per 100,000 women age 16+; denominator is the 2000 US. Census population data.

**Figure 9. Annual Incidence of Blood Lead Levels (BLLs)  $\geq 10$  ug/dL Among Men in Michigan by County of Residence: 2004\***



\*Rate per 100,000 men age 16+; denominator is the 2000 US. Census population data.

Number of Companies

- None
- 1
- 2
- 3+

Total number of companies: 22

## **Part II**

# **Blood Lead Levels Among *Children* in Michigan**



## Childhood Lead Poisoning Prevention Program Michigan Department Of Community Health 2004 Annual Report

### **Overview:**

The Childhood Lead Poisoning Prevention Program (CLPPP), located in the Michigan Department of Community Health, focuses its activities on children younger than six years of age, their families, pregnant women, health care providers, and child health advocates in their communities.

The Centers for Disease Control and Prevention (CDC) has provided funding for lead poisoning related activities in Michigan since 1992. The State of Michigan provides a modest amount of funding (from General Funds), and the federal Maternal Child Health Block Grant (Title V) also provides some funding for the program. Michigan continues to be one of the top ten states in the country for numbers of children who are lead poisoned. The primary source of lead exposure for Michigan children is lead-based paint in pre-1978 housing. Deteriorating lead-based paint---flaking, chipping, peeling, or simply dust from multiple coats of paint on impact surfaces---creates an often invisible hazard on windowsills, floors, porches, and in the “drip-lines” around the outside of a home. Soil in driveways and yards adjacent to streets and highways may also be a source of invisible lead exposure.

Young children ingest lead dust through developmentally appropriate hand-to-mouth behaviors. As the central nervous system is undergoing a period of rapid and critical growth in early childhood, and because children (as compared with adults) absorb a greater proportion of the lead that they consume, the effects on a child’s nervous system, hearing, vision, cognitive development and behavior can be devastating. For the most part it is also irreversible. Long-term effects of lead poisoning reduce a child’s potential in school, work, health and human relationships. Thus, long-term effects of lead poisoning impact the whole community.

A statewide surveillance system, is the basis for the Statewide Testing/Screening Plan, which is reviewed by the CLPPP staff and approved by the Lead Advisory Committee annually. Since 1997, the CLPPP has maintained a registry of all children with a Michigan address who have had a blood lead test. Participation in reporting of test results to the registry is mandatory, as required by Michigan Administrative Rules (333.5111 and 325.78 and 330.3101 of the Michigan Compiled Laws). The registry forms the “backbone” of the statewide surveillance system.

The CLPPP assures that the health care provider for each child tested and the local public health agency for the child’s area of residency is notified of blood lead test results, so that management of the child’s lead exposure source can begin. Local health departments (LHDs) vary in their capacity to provide an environmental investigation. EBLL (elevated blood lead level) investigations must be conducted by a state-certified Lead Inspector/Risk Assessor, and although the environmental investigation completed for a Medicaid-enrolled child can be reimbursed by Medicaid, the reimbursement rate, as well as competition for the environmental health staffs’

time, do not encourage the LHDs to pursue lead professional training for their staff members. Managed care plans and commercial insurance companies do not pay for lead hazard identification.

Providing professional education and training, current health education materials as well as education for the general public are other regular CLPPP activities. Response to both internal and external requests for data to direct local plans and activities represents a significant demand for the data staff. CLPPP staff also continues to monitor policy development (both internal and external to the Department) that potentially affects the lead program, and collaborates with housing authorities, rental property owners and other community groups to provide safe housing for children.

Partners in these efforts include the MDCH Trace Metals Laboratory, local public health departments, and other agencies throughout the state with shared interests: Department of Education, Department of Licensing and Economic Growth, Michigan State Housing Development Authority, Department of Environmental Quality, Family Independence Agency (now Department of Human Services), WIC (Women, Infants and Children food supplement program), Early On, Head Start and Early Head Start.

CLPPP also provides funding to nine regions, or clusters of local health departments, with a Regional Coordinator identified in each. This represents a new strategy to accomplish three program goals: 1) to increase blood lead testing, with particular emphasis on thirteen targeted communities; 2) to assure that case management occurs for all children with venous blood lead levels  $\geq 20\text{ug/dL}$ ; and 3) to encourage and promote primary prevention (of childhood lead poisoning), with emphasis, once again, on reaching families in pre-1978 housing where young children or pregnant women reside. The Regional Coordinators develop local relationships and offer professional information and technical support to the lead contact person in each health department in her/his region. In collaboration with that individual and the health department leadership, planning for increasing testing, case management and primary prevention activities in that county take place. The Regional Coordinator provides oversight for comprehensive case management and care coordination; responsibility for service, however, still belongs to the local health department. If the community has the political will to develop a community coalition around the issue of lead poisoning/child health, the Regional Coordinator is available to provide assistance in beginning that project. Approximately half of the nine Regional Coordinators are also certified Lead Inspector/Risk Assessors; in counties where no certified inspector exists, the Regional Coordinator may also complete a lead inspection when a child with lead poisoning is identified.

The federal Centers for Medicare and Medicaid Services (CMS) requires blood lead testing of **all** Medicaid-eligible children at the ages of one and two years. That federal requirement cannot be waived. If a Medicaid-eligible child is between the ages of three and six years and has never had a blood lead test, he/she is required to have at least one test during those years. The CDC, utilizing data collected in the national Childhood Blood Lead Surveillance System, has reported that more than 80% of children with blood lead levels equal to or greater than  $20\text{ug/dL}$  are Medicaid-enrolled children. Of all children with blood lead levels of  $10\text{ug/dL}$  or greater, more than half are Medicaid-enrolled.

## 2004:

During the year ending December 31, 2004, 125,417 children in Michigan received first blood lead tests. This represents an increase in testing of more than 25,000 children (as compared with 2003); nonetheless that testing number accounts for only 15.4% of Michigan children younger than age six years. To put this number in perspective: approximately half of Michigan children are Medicaid-eligible/enrolled, and the federal Centers for Medicare and Medicaid requires that all of their insured be tested at the ages of one and two years. The undertesting performance of health care providers, while improving, remains apparent. Increasing testing numbers, especially in “target” communities, remains one of CLPPP’s primary goals.

### *“Missed opportunities”:*

Testing data analysis as reported by Medical Services Administration (MSA, or Michigan Medicaid) identifies that if Medicaid health care providers ordered and completed a blood lead test on all appropriate-aged children with whom they actually have a physical “encounter” in their office, the new legislative mandate (Public Act 55) of 80% of Medicaid-enrolled children receiving a blood lead test would already be reached.

Among the tested children, there were 3,126 with elevated blood lead levels; this is an EBL rate, for the state of Michigan, of 2.5%. (National EBL rate is now approximately 2%.)

While children younger than six years of age are CLPPP’s focus, special emphasis is placed on testing appropriate children at the ages of one and two years, when creeping and hand-to-mouth behaviors begin, and then peak. Slightly more than half (66,669) of children tested in 2004 were in that age group. This number represents 24.9% of one and two year olds. Among this cohort, 1,695 children had elevated blood lead levels ( $\geq 10\mu\text{g/dL}$ ). This yields an elevated blood lead level (EBLL) rate of 2.6%.

The number of children with dangerously high blood lead levels ( $\geq 40\mu\text{g/dL}$ ) in 2004 was 52; of those children, 33 had BLLs  $\geq 45\mu\text{g/dL}$ . Children with blood lead levels in this range require hospital treatment, often numerous times, to even begin to lower their BLLs. Except in the situation of a single, near-catastrophic, exposure to lead (e.g., child drinks pottery glaze), children with BLLs in this range have had chronic, low level exposure to a lead source over a lengthy period of time. Reducing the child’s BLL is a process that takes place over a year or more. The damage is **irreversible**.

MDCH CLPPP, along with their colleagues in Medical Services Administration (Medicaid), closely monitor provider compliance with testing requirements. Beginning in March 2004, enhanced monitoring of testing performance by the Medicaid managed care organizations (“the plans”) and fee-for-service providers resulted in a monthly (vs. quarterly) data report to all Medicaid providers depicting testing numbers for the prior month by age of child, by plan, by provider type (i.e., fee-for-service vs. health plan; all are also available at [www.michigan.gov/leadsafe](http://www.michigan.gov/leadsafe)). When tabulated, results indicate that all providers regularly “miss opportunities” for lead testing when conducting child health visits.

Medicaid has also facilitated testing by local public health agencies by allowing the health departments to bill Medicaid directly when tests are provided. Some of the WIC clinics (Women, Infants and Children, a nutrition enhancement program), realizing that children eligible for the supplemental food program are also among the group at risk for lead poisoning, have extended their clinic staff to collection of blood samples for lead testing as they collect their required “re-certification” blood testing for hemoglobin level (anemia screen). This results in “one-stop-shopping” for the family at risk.

The Governor and the Michigan Legislature were very active in 2004, passing **six** lead bills. All of the bills were signed by the Governor between April and December, resulting in significant visibility and “tools” for use by lead poisoning professionals and communities. They are:

1. Mandatory electronic reporting by labs of blood lead test results to the state lead registry (effective October 2005). This increases the timeliness and reduces errors in results reporting.
2. Recipients of Medicaid payments must be “substantially in compliance” w/ federal requirements by lead testing 80% (or more) of their Medicaid-enrolled children (by October 2007) as a condition of continued participation in and funding from Medicaid.
3. Establish a commission to study lead poisoning and review and evaluate the state’s lead poisoning prevention programs.
4. Identify agencies and groups to serve as voting members on the commission (see #3). Appointments to the commission are being named by the Governor, with legislative approval required.
5. Require development and maintenance of a “lead-safe housing registry” for rental properties built before 1978.
6. Identify violations and penalties for rental property owners who “knowingly rent” housing with lead hazards to families with minor children.

#### **During 2004, MDCH CLPPP:**

- Was active in the release in November, 2004, of the priority recommendations (seven) for the Governor and the full report of the Governor’s Task Force to Eliminate Childhood Lead Poisoning, with over one hundred strategies and recommendations identified. (See the complete report at [www.michigan.gov/leadsafe](http://www.michigan.gov/leadsafe), or at [www.hud.gov](http://www.hud.gov))
- In collaboration with the Department’s Steering Committee, began the Lead Initiative Master Work Plan, sorting the recommendations from the report (see above) into nine objectives and activities and identifying responsibility and timelines for the various components.
- Wrote and submitted a grant proposal, for continuing funding from the CDC, for childhood lead poisoning related activities in the state.
- CLPPP, working with and through it’s Regional Coordinators, is
  1. Assuring case management services for children in all Michigan counties/communities with BLLs  $\geq 20$  ug/dL;

2. Increasing blood lead testing rates, with primary focus on the targeted communities;
  3. Providing/encouraging primary prevention activities in all Michigan counties, with special emphasis on the targeted communities; also in Michigan day care facilities, etc.
- Observed a modest increase in number of children lead-tested, as reported to our registry. In some areas of the state, providers have implemented the use of alternate collection and/or testing strategies to make testing accessible to the children/families in their practices. Use of a microanalyzer (LeadCare machine), as well as utilizing filter paper for collection with atomic furnace for analysis are alternatives that are in practice. Regardless, all blood lead tests completed on an individual with a Michigan address are reported to the lead registry.

There are 19,000 children in Michigan whose blood lead level (5-9ug/dL) indicates that an exposure to lead has taken place, but the blood lead level is not yet at the CDC's "level of concern." This number identifies that we have an appropriate opportunity for early intervention/primary prevention of childhood lead poisoning on a very large scale. When both environmental and health information are given to the affected family, exposure can be controlled and/or eliminated before the child's blood lead level reaches the level of concern.

There is new and ongoing research, published or released in 2003, indicating that blood lead levels less than 10ug/dL have a measurable impact on the IQ of a child. These findings (and the research is ongoing) reinforce the assertion that there is **NO** "safe" blood lead level for children.

In summary, the main focus areas for the Childhood Lead Poisoning Prevention Program at the State of Michigan in the 2004-2005 grant year has been:

- Increasing numbers of children tested, at the appropriate ages, and particularly in the "target communities;"
- Providing primary prevention outreach for children younger than six years of age, and for pregnant women;
- Assuring that comprehensive case management for children with BLLs  $\geq$  20ug/dL takes place throughout the state.

**FUTURE** plans (FY 2005) for CLPPP and the Lead Hazard Remediation Program (LHRP):

- Provide funding for and work with a team of consultants from National Center for Healthy Housing/Healthy Housing Solutions, to develop local coalitions in Flint, Hamtramck, and Highland Park and to assist those coalitions with grant writing in order to build local capacity for primary prevention of lead poisoning.
- Provide funding for and work with a team of consultants from Get the Lead Out!/Grand Rapids to develop (Benton Harbor) and/or enhance (Muskegon) local community coalitions and provide technical assistance with grant writing in order to build local capacity for primary prevention activities.

- Develop a Lead-Safe Housing Registry for rental properties built before 1978 which pass inspection or have had abatement work completed.
- Provide staff support and logistics for the State Lead Commission.
- Provide a staff Remediation Ombudsman to consult with individuals and communities attempting to identify funding sources for remediation or interim controls, as appropriate (based on funding availability).
- Make an additional \$250,000 available for remediation.
- Fund and assist in development of materials for a public awareness campaign for parents (comparable to the very effective immunization public awareness campaign).
- Provide funding for grant writing consultants to assist Calhoun County and City of Lansing with writing of HUD grants (due this spring).
- Enhance capacity in Ingham County (Ingham, Jackson, Washtenaw, Lenawee), Kalamazoo County (Battle Creek, Kalamazoo, Benton Harbor) and Oakland County (Oakland, Macomb, Livingston) for comprehensive case management of children with blood lead levels of 20.

**Table 1. 2004 CHILDHOOD LEAD POISONING INFORMATION SHEET - Children One and Two Years of Age**  
**Including Children with Blood Lead Levels between 5 and 9 µg/dL, a target population for Primary Prevention efforts**

| County         | %Pre-1950 Housing* | Children 1 & 2 years of age* | Children 1 & 2 years of age, Tested for Lead |          | Children with Blood Lead Levels ≥ 5 µg/dL |                                   |   |                           |                           |                         |   | County           | %Pre-1950 Housing* | Children Under Age 6* | Children < Age 6, Tested for Lead |          | Children with Blood Lead Levels ≥ 5 µg/dL |                                   |   |                           |                           |                         |   |
|----------------|--------------------|------------------------------|--|----------|---|-----------------------------------|---|---------------------------|---------------------------|-------------------------|---|------------------|--------------------|-----------------------|-----------------------------------|----------|---|-----------------------------------|---|---------------------------|---------------------------|-------------------------|---|
|                |                    |                              | Number of Children Tested                    | % Tested | % with BLL ≥ 5 µg/dL                      | % EBLL (≥ 10 µg/dL venous only)** | 5 to 9 µg/dL (capillary, venous or unknown) | 10-14 µg/dL (venous only) | 15-19 µg/dL (venous only) | 20+ µg/dL (venous only) | Capillary ≥ 10 µg/dL, not confirmed by venous |                  |                    |                       | Number of Children Tested         | % Tested | % with BLL ≥ 5 µg/dL                      | % EBLL (≥ 10 µg/dL venous only)** | 5 to 9 µg/dL (capillary, venous or unknown) | 10-14 µg/dL (venous only) | 15-19 µg/dL (venous only) | 20+ µg/dL (venous only) | Capillary ≥ 10 µg/dL, not confirmed by venous |
| Alcona         | 21.0               | 224                          | 45   | 20.1     | 2.2                                       | 0.0                               | 1   | 0                         | 0                         | 0                       | 0   | Lake             | 15.1               | 250                   | 66                                | 26.4     | 15.2                                      | 0.0                               | 10  | 0                         | 0                         | 0                       | 0   |
| Alger          | 32.6               | 166                          | 72   | 43.4     | 9.7                                       | 0.0                               | 6   | 0                         | 0                         | 0                       | 1   | Lapeer           | 22.2               | 2,356                 | 280                               | 11.9     | 11.8                                      | 0.7                               | 31  | 1                         | 0                         | 1                       | 0   |
| Allegan        | 27.4               | 2,978                        | 563  | 18.9     | 10.8                                      | 0.4                               | 55  | 1                         | 0                         | 1                       | 4   | Leelanau         | 22.0               | 430                   | 45                                | 10.5     | 20.0                                      | 0.0                               | 9   | 0                         | 0                         | 0                       | 0   |
| Alpena         | 28.6               | 687                          | 193  | 28.1     | 14.0                                      | 1.6                               | 23  | 2                         | 1                         | 0                       | 1   | Lenawee          | 38.6               | 2,420                 | 586                               | 24.2     | 51.0                                      | 2.6                               | 284   | 11                        | 3                         | 1                       | 0   |
| Antrim         | 22.6               | 533                          | 40   | 7.5      | 20.0                                      | 0.0                               | 8   | 0                         | 0                         | 0                       | 0   | Livingston       | 13.7               | 4,482                 | 242                               | 5.4      | 2.5                                       | 0.0                               | 6   | 0                         | 0                         | 0                       | 0   |
| Arenac         | 20.6               | 348                          | 79   | 22.7     | 10.1                                      | 0.0                               | 7   | 0                         | 0                         | 0                       | 1   | Luce             | 30.0               | 135                   | 46                                | 34.1     | 23.9                                      | 0.0                               | 9   | 0                         | 0                         | 0                       | 2   |
| Baraga         | 34.9               | 210                          | 36   | 17.1     | 13.9                                      | 0.0                               | 4   | 0                         | 0                         | 0                       | 1   | Mackinac         | 28.1               | 205                   | 91                                | 44.4     | 23.1                                      | 0.0                               | 21  | 0                         | 0                         | 0                       | 0   |
| Barry          | 29.4               | 1,475                        | 434  | 29.4     | 12.2                                      | 0.5                               | 48  | 0                         | 2                         | 0                       | 3   | Macomb           | 10.9               | 20,271                | 3,654                             | 18.0     | 5.0                                       | 0.4                               | 163   | 10                        | 3                         | 3                       | 3   |
| Bay            | 37.1               | 2,690                        | 629  | 23.4     | 17.5                                      | 1.4                               | 99  | 6                         | 1                         | 2                       | 2   | Manistee         | 35.9               | 532                   | 140                               | 26.3     | 15.7                                      | 0.0                               | 22  | 0                         | 0                         | 0                       | 0   |
| Benzie         | 27.3               | 408                          | 56   | 13.7     | 14.3                                      | 0.0                               | 8   | 0                         | 0                         | 0                       | 0   | Marquette        | 32.6               | 1,307                 | 241                               | 18.4     | 10.8                                      | 0.0                               | 25  | 0                         | 0                         | 0                       | 1   |
| Berrien        | 32.7               | 4,169                        | 1,222  | 29.3     | 17.3                                      | 2.3                               | 178   | 20                        | 5                         | 3                       | 6   | Mason            | 31.1               | 619                   | 135                               | 21.8     | 17.0                                      | 1.5                               | 21  | 2                         | 0                         | 0                       | 0   |
| Branch         | 36.5               | 1,158                        | 357  | 30.8     | 16.8                                      | 1.1                               | 51  | 3                         | 1                         | 0                       | 5   | Mecosta          | 22.0               | 981                   | 248                               | 25.3     | 4.0                                       | 0.4                               | 9   | 1                         | 0                         | 0                       | 0   |
| Calhoun        | 36.4               | 3,534                        | 1,521  | 43.0     | 11.3                                      | 1.5                               | 142   | 11                        | 5                         | 7                       | 7   | Menominee        | 38.4               | 603                   | 185                               | 30.7     | 15.1                                      | 1.1                               | 25  | 1                         | 0                         | 1                       | 1   |
| Cass           | 30.4               | 1,212                        | 266  | 21.9     | 13.5                                      | 2.3                               | 30  | 6                         | 0                         | 0                       | 0   | Midland          | 16.9               | 2,167                 | 240                               | 11.1     | 7.9                                       | 0.4                               | 18  | 1                         | 0                         | 0                       | 0   |
| Charlevoix     | 25.7               | 676                          | 62   | 9.2      | 12.9                                      | 1.6                               | 7   | 1                         | 0                         | 0                       | 0   | Missaukee        | 20.6               | 380                   | 43                                | 11.3     | 14.0                                      | 0.0                               | 6   | 0                         | 0                         | 0                       | 0   |
| Cheboygan      | 21.7               | 638                          | 120  | 18.8     | 11.7                                      | 0.0                               | 14  | 0                         | 0                         | 0                       | 0   | Monroe           | 28.3               | 3,898                 | 812                               | 20.8     | 16.7                                      | 0.5                               | 132   | 0                         | 3                         | 1                       | 0   |
| Chippewa       | 28.4               | 819                          | 214  | 26.1     | 12.6                                      | 0.5                               | 25  | 1                         | 0                         | 0                       | 1   | Montcalm         | 28.1               | 1,601                 | 326                               | 20.4     | 5.2                                       | 0.6                               | 15  | 1                         | 1                         | 0                       | 0   |
| Clare          | 13.1               | 742                          | 102  | 13.7     | 5.9                                       | 0.0                               | 6   | 0                         | 0                         | 0                       | 0   | Montmorency      | 18.4               | 192                   | 49                                | 25.5     | 8.2                                       | 0.0                               | 4   | 0                         | 0                         | 0                       | 0   |
| Clinton        | 28.7               | 1,755                        | 157  | 8.9      | 6.4                                       | 1.3                               | 7   | 2                         | 0                         | 0                       | 1   | Muskegon         | 29.8               | 4,670                 | 1,767                             | 37.8     | 18.1                                      | 3.0                               | 258   | 35                        | 8                         | 9                       | 10  |
| Crawford       | 19.6               | 295                          | 57   | 19.3     | 8.8                                       | 0.0                               | 5   | 0                         | 0                         | 0                       | 0   | Newaygo          | 22.7               | 1,336                 | 377                               | 28.2     | 8.0                                       | 0.0                               | 29  | 0                         | 0                         | 0                       | 1   |
| Delta          | 37.7               | 841                          | 332  | 39.5     | 17.2                                      | 0.9                               | 51  | 3                         | 0                         | 0                       | 3   | Oakland          | 15.9               | 31,861                | 5,095                             | 16.0     | 7.3                                       | 0.7                               | 333   | 29                        | 2                         | 5                       | 4   |
| Dickinson      | 41.6               | 598                          | 77   | 12.9     | 2.6                                       | 0.0                               | 2   | 0                         | 0                         | 0                       | 0   | Oceana           | 26.8               | 697                   | 319                               | 45.8     | 7.8                                       | 0.6                               | 22  | 0                         | 2                         | 0                       | 1   |
| Eaton          | 23.4               | 2,558                        | 720  | 28.1     | 9.7                                       | 0.6                               | 64  | 3                         | 1                         | 0                       | 2   | Ogemaw           | 18.3               | 432                   | 84                                | 19.4     | 8.3                                       | 0.0                               | 7   | 0                         | 0                         | 0                       | 0   |
| Emmet          | 27.7               | 756                          | 39   | 5.2      | 10.3                                      | 0.0                               | 4   | 0                         | 0                         | 0                       | 0   | Ontonagon        | 43.4               | 125                   | 15                                | 12.0     | 6.7                                       | 0.0                               | 1   | 0                         | 0                         | 0                       | 0   |
| Genesee        | 22.8               | 12,624                       | 3,056  | 24.2     | 7.2                                       | 0.7                               | 195   | 13                        | 6                         | 3                       | 4   | Osceola          | 24.2               | 604                   | 135                               | 22.4     | 5.2                                       | 1.5                               | 5   | 1                         | 1                         | 0                       | 0   |
| Gladwin        | 13.7               | 555                          | 44   | 7.9      | 9.1                                       | 0.0                               | 4   | 0                         | 0                         | 0                       | 0   | Oscoda           | 18.3               | 190                   | 26                                | 13.7     | 7.7                                       | 0.0                               | 2   | 0                         | 0                         | 0                       | 0   |
| Gogebic        | 54.1               | 294                          | 44   | 15.0     | 6.8                                       | 2.3                               | 2   | 0                         | 1                         | 0                       | 0   | Otsego           | 12.6               | 586                   | 28                                | 4.8      | 3.6                                       | 0.0                               | 1   | 0                         | 0                         | 0                       | 0   |
| Grand Traverse | 17.8               | 1,908                        | 77   | 4.0      | 3.9                                       | 0.0                               | 3   | 0                         | 0                         | 0                       | 0   | Ottawa           | 18.0               | 7,321                 | 1,026                             | 14.0     | 10.7                                      | 0.8                               | 97  | 5                         | 2                         | 1                       | 5   |
| Gratiot        | 39.8               | 1,000                        | 222  | 22.2     | 8.1                                       | 0.0                               | 18  | 0                         | 0                         | 0                       | 0   | Presque Isle     | 27.6               | 277                   | 78                                | 28.2     | 23.1                                      | 0.0                               | 16  | 0                         | 0                         | 0                       | 2   |
| Hillsdale      | 39.0               | 1,209                        | 322  | 26.6     | 23.3                                      | 1.6                               | 69  | 2                         | 1                         | 2                       | 1   | Roscommon        | 16.1               | 447                   | 38                                | 8.5      | 2.6                                       | 0.0                               | 1   | 0                         | 0                         | 0                       | 0   |
| Houghton       | 54.8               | 776                          | 178  | 22.9     | 10.1                                      | 1.1                               | 16  | 1                         | 1                         | 0                       | 0   | Saginaw          | 29.3               | 5,709                 | 1,781                             | 31.2     | 18.3                                      | 1.9                               | 274   | 21                        | 10                        | 2                       | 19  |
| Huron          | 33.5               | 793                          | 160  | 20.2     | 11.9                                      | 0.0                               | 18  | 0                         | 0                         | 0                       | 1   | St Clair         | 29.6               | 4,355                 | 888                               | 20.4     | 9.3                                       | 0.8                               | 74  | 5                         | 2                         | 0                       | 2   |
| Ingham         | 25.9               | 7,137                        | 1,377  | 19.3     | 14.1                                      | 1.3                               | 162   | 15                        | 3                         | 0                       | 14  | St Joseph        | 34.8               | 1,727                 | 601                               | 34.8     | 13.5                                      | 1.3                               | 72  | 6                         | 1                         | 1                       | 1   |
| Ionia          | 37.9               | 1,704                        | 317  | 18.6     | 8.8                                       | 1.0                               | 23  | 2                         | 1                         | 0                       | 2   | Sanilac          | 34.7               | 1,165                 | 233                               | 20.0     | 12.4                                      | 0.4                               | 26  | 0                         | 0                         | 1                       | 2   |
| Iosco          | 19.8               | 535                          | 75   | 14.0     | 12.0                                      | 1.3                               | 8   | 0                         | 1                         | 0                       | 0   | Schoolcraft      | 33.1               | 215                   | 88                                | 40.9     | 15.9                                      | 0.0                               | 14  | 0                         | 0                         | 0                       | 0   |
| Iron           | 44.5               | 225                          | 31   | 13.8     | 12.9                                      | 0.0                               | 4   | 0                         | 0                         | 0                       | 0   | Shiawassee       | 35.9               | 1,939                 | 366                               | 18.9     | 6.8                                       | 1.1                               | 21  | 3                         | 0                         | 1                       | 0   |
| Isabella       | 19.2               | 1,321                        | 193  | 14.6     | 2.6                                       | 0.0                               | 5   | 0                         | 0                         | 0                       | 0   | Tuscola          | 32.8               | 1,410                 | 323                               | 22.9     | 10.5                                      | 0.0                               | 34  | 0                         | 0                         | 0                       | 0   |
| Jackson        | 35.7               | 4,112                        | 1,033  | 25.1     | 22.4                                      | 2.3                               | 197   | 17                        | 2                         | 4                       | 11  | Van Buren        | 29.4               | 2,047                 | 517                               | 25.3     | 9.9                                       | 0.6                               | 44  | 2                         | 1                         | 0                       | 4   |
| Kalamazoo      | 24.6               | 6,175                        | 1,558  | 25.2     | 13.1                                      | 1.8                               | 170   | 22                        | 4                         | 2                       | 6   | Washtenaw        | 19.3               | 8,086                 | 1,067                             | 13.2     | 4.3                                       | 0.3                               | 43  | 3                         | 0                         | 0                       | 0   |
| Kalkaska       | 15.2               | 408                          | 54   | 13.2     | 16.7                                      | 1.9                               | 8   | 1                         | 0                         | 0                       | 0   | Wayne ex Det     | 24.0               | 30,284                | 6,266                             | 20.7     | 11.0                                      | 1.8                               | 556   | 68                        | 20                        | 24                      | 21  |
| Kent           | 26.8               | 17,768                       | 7,033  | 39.6     | 27.9                                      | 2.5                               | 1,633                                       | 106                       | 34                        | 35                      | 155   | Wexford          | 26.2               | 740                   | 121                               | 16.4     | 9.9                                       | 1.7                               | 10  | 2                         | 0                         | 0                       | 0   |
| Keweenaw       | 54.9               | 39                           | 13   | 33.3     | 0.0                                       | 0.0                               | 0   | 0                         | 0                         | 0                       | 0   | Detroit, City of | 56.0               | 30,307                | 14,821                            | 48.9     | 34.6                                      | 6.9                               | 3,942                                       | 654                       | 181                       | 175                     | 180   |
| MICHIGAN       |                    |                              |  |          |   |                                   |   |                           |                           |                         |   |                  | 27.0               | 267,412               | 66,669                            | 24.9     | 18.4                                      | 2.6                               | 10,072                                      | 1,100                     | 310                       | 285                     | 491   |

\* U.S. Census Bureau, Census 2000

\*\* %EBLL is calculated as follows: Number of Children w/EBLL divided by (Number of Children Tested minus Children w/elevated 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 2005

**Table 2. 2004 CHILDHOOD LEAD EXPOSURE INFORMATION SHEET - Children less than Six Years of Age**  
**Including Children with Blood Lead Levels between 5 and 9 µg/dL, a target population for Primary Prevention efforts**

|                |                    |                       | Children < Age 6,<br>Tested for Lead in 2004 |          | Children with Blood Lead Levels ≥ 5 µg/dL |                                   |   |                           |                           |                         |   |                  |                    |                       | Children < Age 6,<br>Tested for Lead in 2004 |          | Children with Blood Lead Levels ≥ 5 µg/dL |                                   |   |                           |                           |                         |   |  |  |
|----------------|--------------------|-----------------------|--|----------|---|-----------------------------------|---|---------------------------|---------------------------|-------------------------|---|------------------|--------------------|-----------------------|--|----------|---|-----------------------------------|---|---------------------------|---------------------------|-------------------------|---|--|--|
| County         | %Pre-1950 Housing* | Children Under Age 6* | Number of Children Tested                    | % Tested | % with BLL ≥ 5 µg/dL                      | % EBLL (≥ 10 µg/dL venous only)** | 5 to 9 µg/dL (capillary, venous or unknown) | 10-14 µg/dL (venous only) | 15-19 µg/dL (venous only) | 20+ µg/dL (venous only) | Capillary ≥ 10 µg/dL, not confirmed by venous | County           | %Pre-1950 Housing* | Children Under Age 6* | Number of Children Tested                    | % Tested | % with BLL ≥ 5 µg/dL                      | % EBLL (≥ 10 µg/dL venous only)** | 5 to 9 µg/dL (capillary, venous or unknown) | 10-14 µg/dL (venous only) | 15-19 µg/dL (venous only) | 20+ µg/dL (venous only) | Capillary ≥ 10 µg/dL, not confirmed by venous |  |  |
| Alcona         | 21.0               | 630                   | 77   | 12.2     | 2.6                                       | 0.0                               | 2   | 0                         | 0                         | 0                       | 0   | Lake             | 15.1               | 718                   | 113  | 15.7     | 15.9                                      | 0.0                               | 18  | 0                         | 0                         | 0                       | 0   |  |  |
| Alger          | 32.6               | 562                   | 83   | 14.8     | 8.4                                       | 0.0                               | 6   | 0                         | 0                         | 0                       | 1   | Lapeer           | 22.2               | 7,217                 | 587  | 8.1      | 9.0                                       | 0.7                               | 49  | 2                         | 0                         | 2                       | 0   |  |  |
| Allegan        | 27.4               | 9,272                 | 1,044  | 11.3     | 10.1                                      | 0.6                               | 95  | 2                         | 1                         | 3                       | 4   | Leelanau         | 22.0               | 1,328                 | 64   | 4.8      | 15.6                                      | 0.0                               | 10  | 0                         | 0                         | 0                       | 0   |  |  |
| Alpena         | 28.6               | 2,118                 | 332  | 15.7     | 11.4                                      | 0.9                               | 33  | 2                         | 1                         | 0                       | 2   | Lenawee          | 38.6               | 7,564                 | 944  | 12.5     | 48.8                                      | 2.2                               | 440   | 15                        | 3                         | 3                       | 0   |  |  |
| Antrim         | 22.6               | 1,625                 | 111  | 6.8      | 12.6                                      | 0.0                               | 14  | 0                         | 0                         | 0                       | 0   | Livingston       | 13.7               | 13,800                | 538  | 3.9      | 2.3                                       | 0.2                               | 11  | 0                         | 0                         | 1                       | 0   |  |  |
| Arenac         | 20.6               | 1,124                 | 164  | 14.6     | 18.3                                      | 1.9                               | 22  | 3                         | 0                         | 0                       | 5   | Luce             | 30.0               | 438                   | 54   | 12.3     | 24.1                                      | 0.0                               | 11  | 0                         | 0                         | 0                       | 2   |  |  |
| Baraga         | 34.9               | 590                   | 100  | 16.9     | 12.0                                      | 0.0                               | 10  | 0                         | 0                         | 0                       | 2   | Mackinac         | 28.1               | 708                   | 118  | 16.7     | 21.2                                      | 0.0                               | 25  | 0                         | 0                         | 0                       | 0   |  |  |
| Barry          | 29.4               | 4,606                 | 628  | 13.6     | 9.7                                       | 0.3                               | 56  | 0                         | 2                         | 0                       | 3   | Macomb           | 10.9               | 61,805                | 5,782  | 9.4      | 5.3                                       | 0.4                               | 282   | 14                        | 3                         | 5                       | 5   |  |  |
| Bay            | 37.1               | 8,126                 | 959  | 11.8     | 17.0                                      | 1.4                               | 148   | 9                         | 1                         | 3                       | 2   | Manistee         | 35.9               | 1,616                 | 239  | 14.8     | 15.4                                      | 0.8                               | 35  | 1                         | 1                         | 0                       | 0   |  |  |
| Benzie         | 27.3               | 1,135                 | 99   | 8.7      | 12.1                                      | 0.0                               | 12  | 0                         | 0                         | 0                       | 0   | Marquette        | 32.6               | 3,985                 | 355  | 8.9      | 8.7                                       | 0.3                               | 30  | 1                         | 0                         | 0                       | 0   |  |  |
| Berrien        | 32.7               | 12,820                | 2,412  | 18.8     | 17.5                                      | 2.6                               | 350   | 39                        | 12                        | 12                      | 10  | Mason            | 31.1               | 1,902                 | 206  | 10.8     | 17.0                                      | 1.5                               | 31  | 3                         | 0                         | 0                       | 1   |  |  |
| Branch         | 36.5               | 3,484                 | 816  | 23.4     | 19.0                                      | 0.9                               | 137   | 5                         | 2                         | 0                       | 11  | Mecosta          | 22.0               | 2,892                 | 408  | 14.1     | 4.4                                       | 0.5                               | 15  | 1                         | 1                         | 0                       | 1   |  |  |
| Calhoun        | 36.4               | 10,945                | 2,759  | 25.2     | 10.6                                      | 1.2                               | 246   | 17                        | 7                         | 8                       | 14  | Menominee        | 38.4               | 1,783                 | 265  | 14.9     | 12.8                                      | 1.1                               | 30  | 1                         | 1                         | 1                       | 1   |  |  |
| Cass           | 30.4               | 3,818                 | 495  | 13.0     | 12.5                                      | 1.6                               | 54  | 6                         | 1                         | 1                       | 0   | Midland          | 16.9               | 6,572                 | 402  | 6.1      | 6.2                                       | 0.7                               | 22  | 2                         | 1                         | 0                       | 0   |  |  |
| Charlevoix     | 25.7               | 2,052                 | 119  | 5.8      | 10.9                                      | 0.8                               | 12  | 1                         | 0                         | 0                       | 0   | Missaukee        | 20.6               | 1,143                 | 71   | 6.2      | 14.1                                      | 0.0                               | 10  | 0                         | 0                         | 0                       | 0   |  |  |
| Cheboygan      | 21.7               | 1,893                 | 219  | 11.6     | 9.6                                       | 0.0                               | 20  | 0                         | 0                         | 0                       | 1   | Monroe           | 28.3               | 11,757                | 1,246  | 10.6     | 15.2                                      | 0.6                               | 183   | 3                         | 3                         | 1                       | 0   |  |  |
| Chippewa       | 28.4               | 2,500                 | 358  | 14.3     | 10.6                                      | 0.6                               | 34  | 2                         | 0                         | 0                       | 2   | Montcalm         | 28.1               | 4,888                 | 472  | 9.7      | 5.1                                       | 0.4                               | 22  | 1                         | 1                         | 0                       | 0   |  |  |
| Clare          | 13.1               | 2,236                 | 218  | 9.7      | 6.4                                       | 0.0                               | 14  | 0                         | 0                         | 0                       | 0   | Montmorency      | 18.4               | 544                   | 82   | 15.1     | 8.8                                       | 1.5                               | 6   | 1                         | 0                         | 0                       | 0   |  |  |
| Clinton        | 28.7               | 5,436                 | 320  | 5.9      | 4.7                                       | 1.3                               | 10  | 4                         | 0                         | 0                       | 1   | Muskegon         | 29.8               | 14,215                | 3,306  | 23.3     | 19.3                                      | 3.0                               | 527   | 56                        | 24                        | 18                      | 13  |  |  |
| Crawford       | 19.6               | 949                   | 72   | 7.6      | 8.3                                       | 0.0                               | 6   | 0                         | 0                         | 0                       | 0   | Newaygo          | 22.7               | 4,014                 | 586  | 14.6     | 7.7                                       | 0.2                               | 43  | 1                         | 0                         | 0                       | 1   |  |  |
| Delta          | 37.7               | 2,530                 | 428  | 16.9     | 16.1                                      | 1.2                               | 61  | 5                         | 0                         | 0                       | 3   | Oakland          | 15.9               | 97,281                | 9,219  | 9.5      | 6.9                                       | 0.7                               | 565   | 43                        | 6                         | 12                      | 6   |  |  |
| Dickinson      | 41.6               | 1,871                 | 146  | 7.8      | 2.1                                       | 0.0                               | 3   | 0                         | 0                         | 0                       | 0   | Oceana           | 26.8               | 2,092                 | 614  | 29.3     | 7.5                                       | 0.5                               | 42  | 1                         | 2                         | 0                       | 1   |  |  |
| Eaton          | 23.4               | 7,980                 | 1,068  | 13.4     | 8.4                                       | 0.4                               | 83  | 3                         | 1                         | 0                       | 3   | Ogemaw           | 18.3               | 1,384                 | 179  | 12.9     | 7.6                                       | 0.3                               | 12  | 1                         | 0                         | 0                       | 1   |  |  |
| Emmet          | 27.7               | 2,366                 | 79   | 3.3      | 7.6                                       | 0.0                               | 6   | 0                         | 0                         | 0                       | 0   | Ontonagon        | 43.4               | 419                   | 36   | 8.6      | 5.6                                       | 0.0                               | 2   | 0                         | 0                         | 0                       | 0   |  |  |
| Genesee        | 22.8               | 38,236                | 5,812  | 15.2     | 7.0                                       | 1.1                               | 338   | 47                        | 9                         | 8                       | 4   | Osceola          | 24.2               | 1,754                 | 229  | 13.1     | 5.2                                       | 0.8                               | 10  | 1                         | 1                         | 0                       | 0   |  |  |
| Gladwin        | 13.7               | 1,733                 | 148  | 8.5      | 4.7                                       | 0.7                               | 6   | 1                         | 0                         | 0                       | 0   | Oscoda           | 18.3               | 608                   | 47   | 7.7      | 12.8                                      | 0.0                               | 6   | 0                         | 0                         | 0                       | 0   |  |  |
| Gogebic        | 54.1               | 973                   | 93   | 9.6      | 5.4                                       | 2.2                               | 3   | 0                         | 2                         | 0                       | 0   | Otsego           | 12.6               | 1,759                 | 81   | 4.6      | 2.5                                       | 0.0                               | 2   | 0                         | 0                         | 0                       | 0   |  |  |
| Grand Traverse | 17.8               | 5,733                 | 217  | 3.8      | 4.6                                       | 0.5                               | 9   | 1                         | 0                         | 0                       | 0   | Ottawa           | 18.0               | 21,940                | 1,804  | 8.2      | 11.1                                      | 0.7                               | 182   | 8                         | 4                         | 1                       | 5   |  |  |
| Gratiot        | 39.8               | 3,012                 | 341  | 11.3     | 7.0                                       | 0.3                               | 23  | 1                         | 0                         | 0                       | 0   | Presque Isle     | 27.6               | 832                   | 140  | 16.8     | 17.1                                      | 0.0                               | 22  | 0                         | 0                         | 0                       | 2   |  |  |
| Hillsdale      | 39.0               | 3,628                 | 605  | 16.7     | 17.4                                      | 0.8                               | 99  | 2                         | 1                         | 2                       | 1   | Roscommon        | 16.1               | 1,368                 | 89   | 6.5      | 3.5                                       | 1.3                               | 2   | 1                         | 0                         | 0                       | 0   |  |  |
| Houghton       | 54.8               | 2,348                 | 385  | 16.4     | 11.9                                      | 1.0                               | 41  | 2                         | 1                         | 1                       | 1   | Saginaw          | 29.3               | 17,275                | 3,317  | 19.2     | 18.0                                      | 1.7                               | 509   | 35                        | 17                        | 3                       | 34  |  |  |
| Huron          | 33.5               | 2,447                 | 285  | 11.6     | 9.5                                       | 0.0                               | 26  | 0                         | 0                         | 0                       | 1   | St Clair         | 29.6               | 13,360                | 1,512  | 11.3     | 8.0                                       | 0.9                               | 106   | 8                         | 3                         | 2                       | 2   |  |  |
| Ingham         | 25.9               | 21,259                | 2,480  | 11.7     | 13.8                                      | 1.3                               | 285   | 26                        | 4                         | 3                       | 23  | St Joseph        | 34.8               | 5,389                 | 1,057  | 19.6     | 11.9                                      | 1.1                               | 112   | 7                         | 3                         | 2                       | 2   |  |  |
| Ionia          | 37.9               | 5,111                 | 503  | 9.8      | 10.3                                      | 1.0                               | 45  | 4                         | 1                         | 0                       | 2   | Sanilac          | 34.7               | 3,506                 | 457  | 13.0     | 11.9                                      | 0.3                               | 50  | 0                         | 0                         | 1                       | 3   |  |  |
| Iosco          | 19.8               | 1,577                 | 172  | 10.9     | 6.4                                       | 0.6                               | 10  | 0                         | 1                         | 0                       | 0   | Schoolcraft      | 33.1               | 615                   | 104  | 16.9     | 16.3                                      | 0.0                               | 17  | 0                         | 0                         | 0                       | 0   |  |  |
| Iron           | 44.5               | 677                   | 45   | 6.6      | 8.9                                       | 0.0                               | 4   | 0                         | 0                         | 0                       | 0   | Shiawassee       | 35.9               | 5,914                 | 747  | 12.6     | 5.4                                       | 0.5                               | 36  | 3                         | 0                         | 1                       | 0   |  |  |
| Isabella       | 19.2               | 3,945                 | 384  | 9.7      | 1.8                                       | 0.5                               | 5   | 1                         | 0                         | 1                       | 0   | Tuscola          | 32.8               | 4,310                 | 607  | 14.1     | 10.2                                      | 0.2                               | 61  | 1                         | 0                         | 0                       | 0   |  |  |
| Jackson        | 35.7               | 12,586                | 1,775  | 14.1     | 22.8                                      | 1.7                               | 354   | 23                        | 2                         | 5                       | 21  | Van Buren        | 29.4               | 6,243                 | 980  | 15.7     | 10.2                                      | 0.4                               | 91  | 2                         | 2                         | 0                       | 5   |  |  |
| Kalamazoo      | 24.6               | 18,597                | 2,436  | 13.1     | 12.7                                      | 1.6                               | 263   | 29                        | 7                         | 4                       | 7   | Washtenaw        | 19.3               | 24,173                | 2,062  | 8.5      | 4.0                                       | 0.5                               | 72  | 9                         | 0                         | 1                       | 0   |  |  |
| Kalkaska       | 15.2               | 1,306                 | 95   | 7.3      | 14.7                                      | 2.1                               | 12  | 1                         | 1                         | 0                       | 0   | Wayne ex Det     | 24.0               | 92,253                | 13,103                                       | 14.2     | 10.2                                      | 1.5                               | 1,092                                       | 127                       | 34                        | 40                      | 45  |  |  |
| Kent           | 26.8               | 53,436                | 11,108                                       | 20.8     | 28.7                                      | 2.4                               | 2,721                                       | 154                       | 55                        | 53                      | 206   | Wexford          | 26.2               | 2,377                 | 214  | 9.0      | 7.0                                       | 0.9                               | 13  | 2                         | 0                         | 0                       | 0   |  |  |
| Keweenaw       | 54.9               | 127                   | 18   | 14.2     | 0.0                                       | 0.0                               | 0   | 0                         | 0                         | 0                       | 0   | Detroit, City of | 56.0               | 93,365                | 32,973                                       | 35.3     | 33.3                                      | 6.0                               | 8,672                                       | 1,319                     | 335                       | 311                     | 357   |  |  |
|                |                    |                       |  |          |   |                                   |   |                           |                           |                         |   | MICHIGAN         | 27.0               | 814,505               | 125,417                                      | 15.4     | 18.4                                      | 2.5                               | 19,154                                      | 2,060                     | 557                       | 509                     | 817   |  |  |

\* U.S. Census Bureau, Census 2000

\*\* %EBLL is calculated as follows: Number of Children w/EBLL divided by (Number of Children Tested minus Children w/elevated 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 2005



**Table 3. Childhood Lead Poisoning Prevention - Michigan Targeted Communities**  
**Children less than six years of age, Tested in Calendar Year 2004**

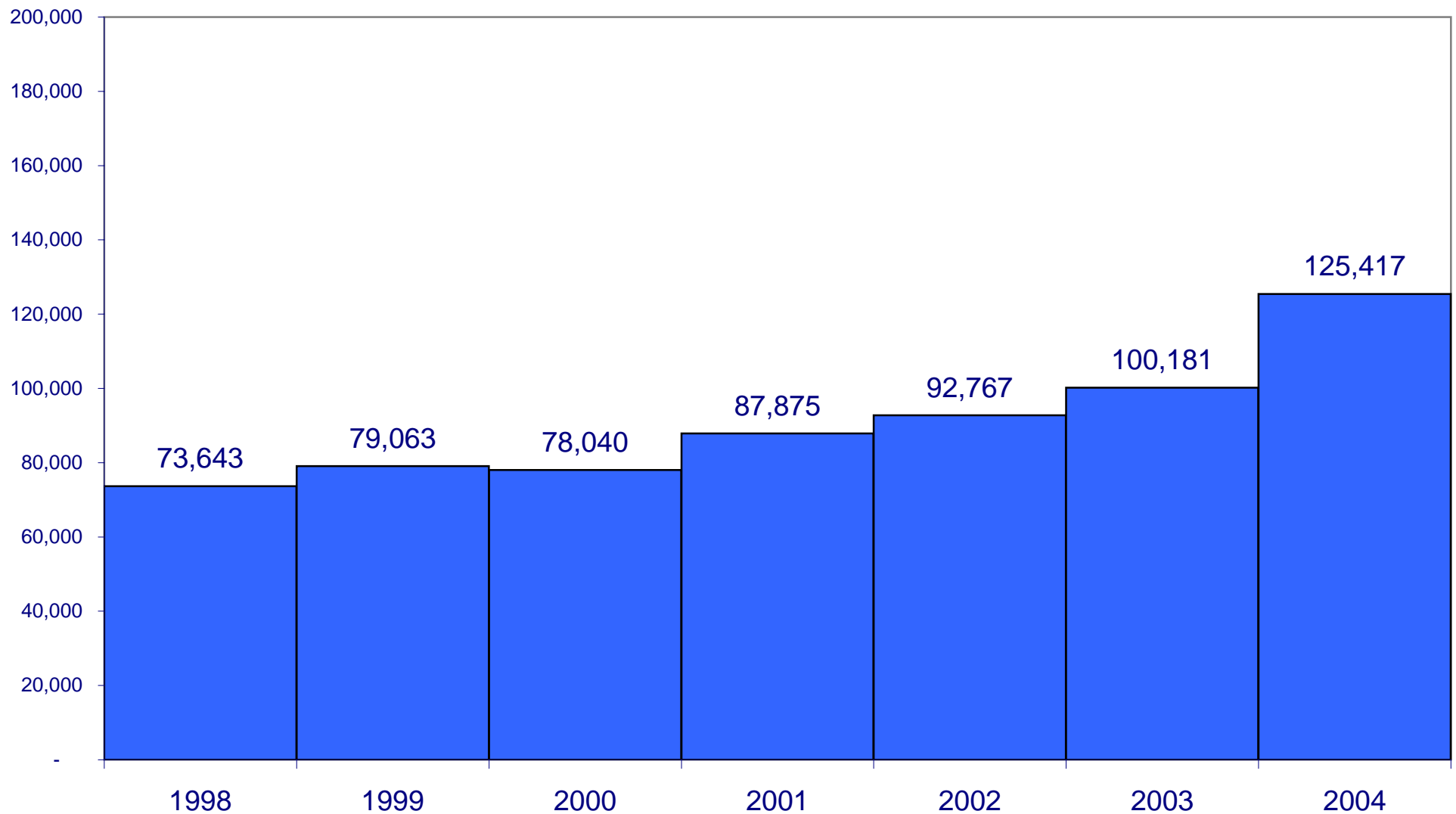
| Place         | %Pre-1950 Housing* | Children Under Age 6* | Children < Age 6, Tested for Lead |          | Children with Blood Lead Levels >= 5 ug/dL |   |   |                           |                         |  |
|---------------|--------------------|-----------------------|-----------------------------------|----------|--|---|---|---------------------------|-------------------------|--|
|               |                    |                       | Number of Children Tested         | % Tested | % with BLL >= 5 ug/dL                      | % 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) | Capillary >= 10, not confirmed by venous |
| Battle Creek  | 42.3               | 4694                  | 1244                              | 26.5     | 15.4                                       | 2.2   | 160   | 22                        | 5                       | 5  |
| Benton Harbor | 47.8               | 1406                  | 599                               | 42.6     | 37.1                                       | 7.6   | 174   | 39                        | 6                       | 3  |
| Detroit       | 56.1               | 93365                 | 32973                             | 35.3     | 33.3                                       | 6.0   | 8672  | 1654                      | 311                     | 357                                      |
| Flint         | 40.9               | 13458                 | 2331                              | 17.3     | 12.7                                       | 2.5   | 235   | 50                        | 8                       | 3  |
| Grand Rapids  | 48.9               | 19354                 | 6893                              | 35.6     | 37.8                                       | 2.9   | 2223  | 144                       | 48                      | 191                                      |
| Hamtramck     | 75.8               | 2153                  | 919                               | 42.7     | 34.6                                       | 5.9   | 251   | 41                        | 12                      | 14                                       |
| Highland Park | 62.4               | 1572                  | 647                               | 41.2     | 51.6                                       | 14.1  | 235   | 72                        | 18                      | 9  |
| Jackson       | 65.9               | 3920                  | 820                               | 20.9     | 33.2                                       | 3.3   | 233   | 22                        | 5                       | 12                                       |
| Kalamazoo     | 40.0               | 5662                  | 970                               | 17.1     | 20.3                                       | 3.1   | 161   | 27                        | 3                       | 6  |
| Lansing       | 35.8               | 11566                 | 1716                              | 14.8     | 17.3                                       | 1.9   | 245   | 29                        | 3                       | 20                                       |
| Muskegon      | 50.0               | 3648                  | 1130                              | 31.0     | 31.6                                       | 5.7   | 287   | 48                        | 16                      | 6  |
| Pontiac       | 35.2               | 7119                  | 1967                              | 27.6     | 13.5                                       | 1.5   | 233   | 20                        | 9                       | 4  |
| Saginaw       | 54.4               | 6437                  | 1807                              | 28.1     | 25.8                                       | 2.8   | 383   | 47                        | 3                       | 33                                       |

\*2000 census

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

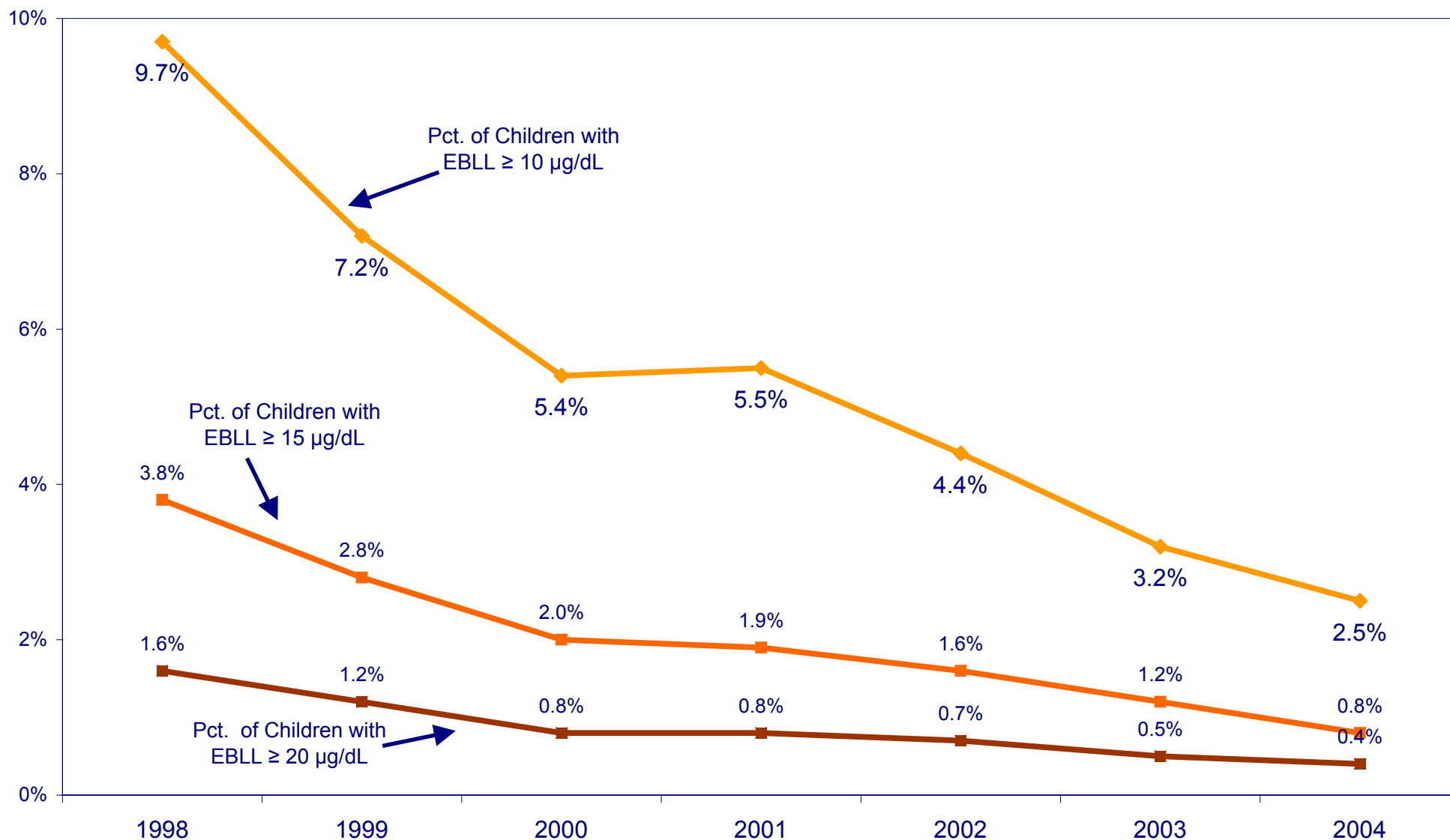
March 2005

# Figure 1. Blood Lead Testing in Michigan Children under Age Six, 1998 - 2004



Source: MDCH Childhood Lead Poisoning Prevention Program statewide database  
March 2005

# Figure 2. Elevated Blood Lead Levels (EBLL) in Michigan Children under Age Six, 1998 - 2004



Source: MDCH Childhood Lead Poisoning Prevention Program statewide database  
March 2005

# Figure 3. Pre-1950 Housing in Michigan

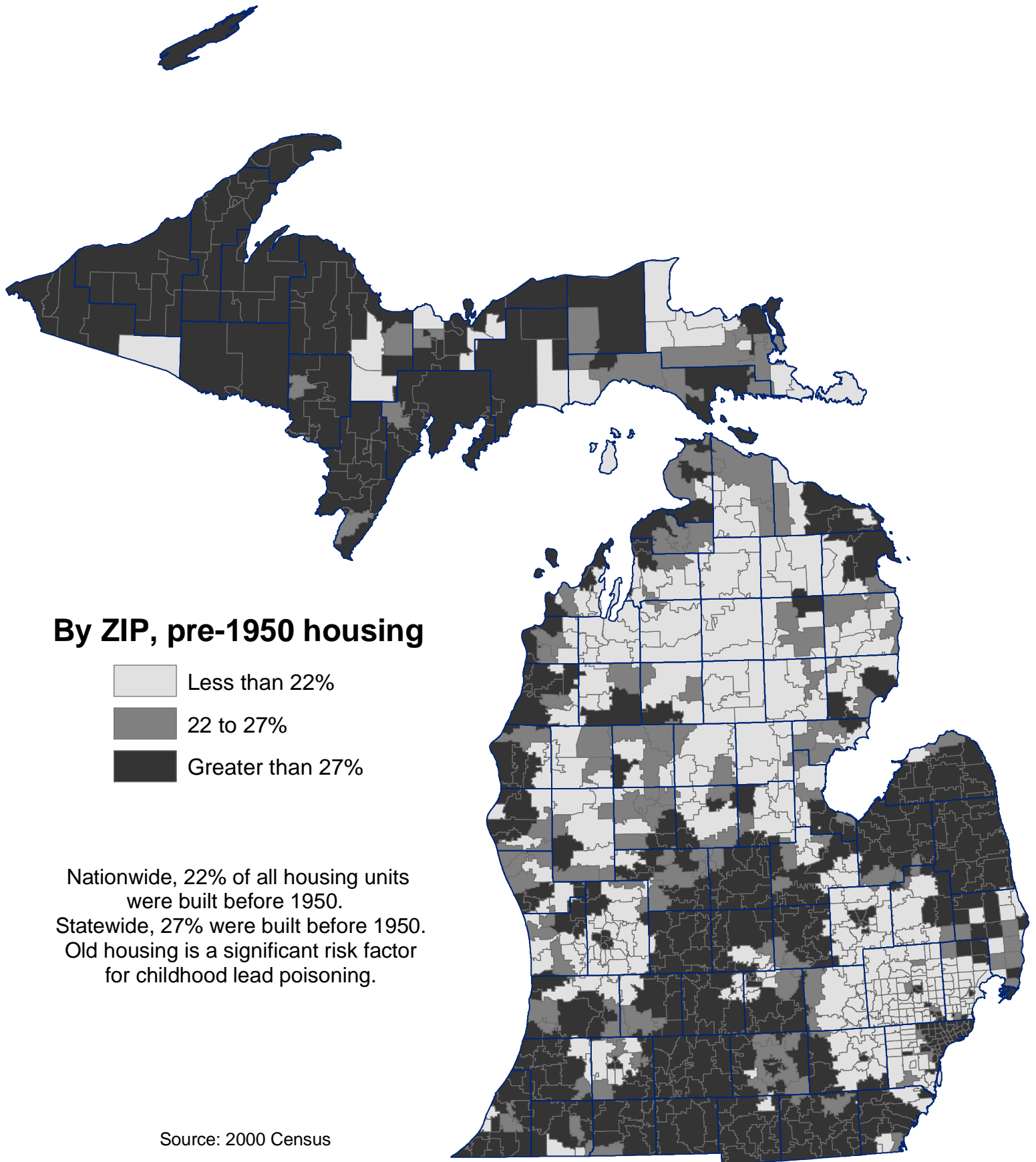
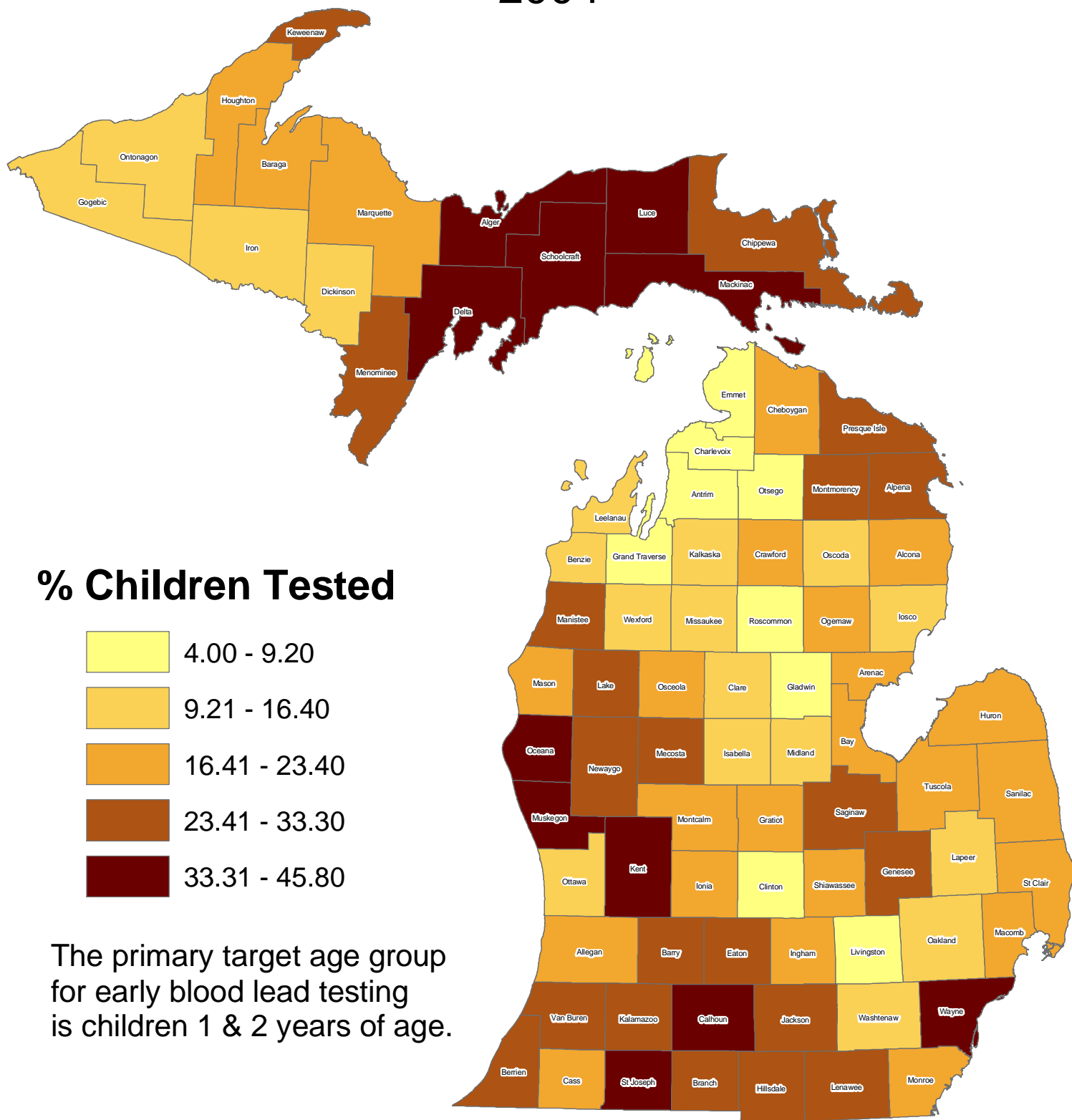


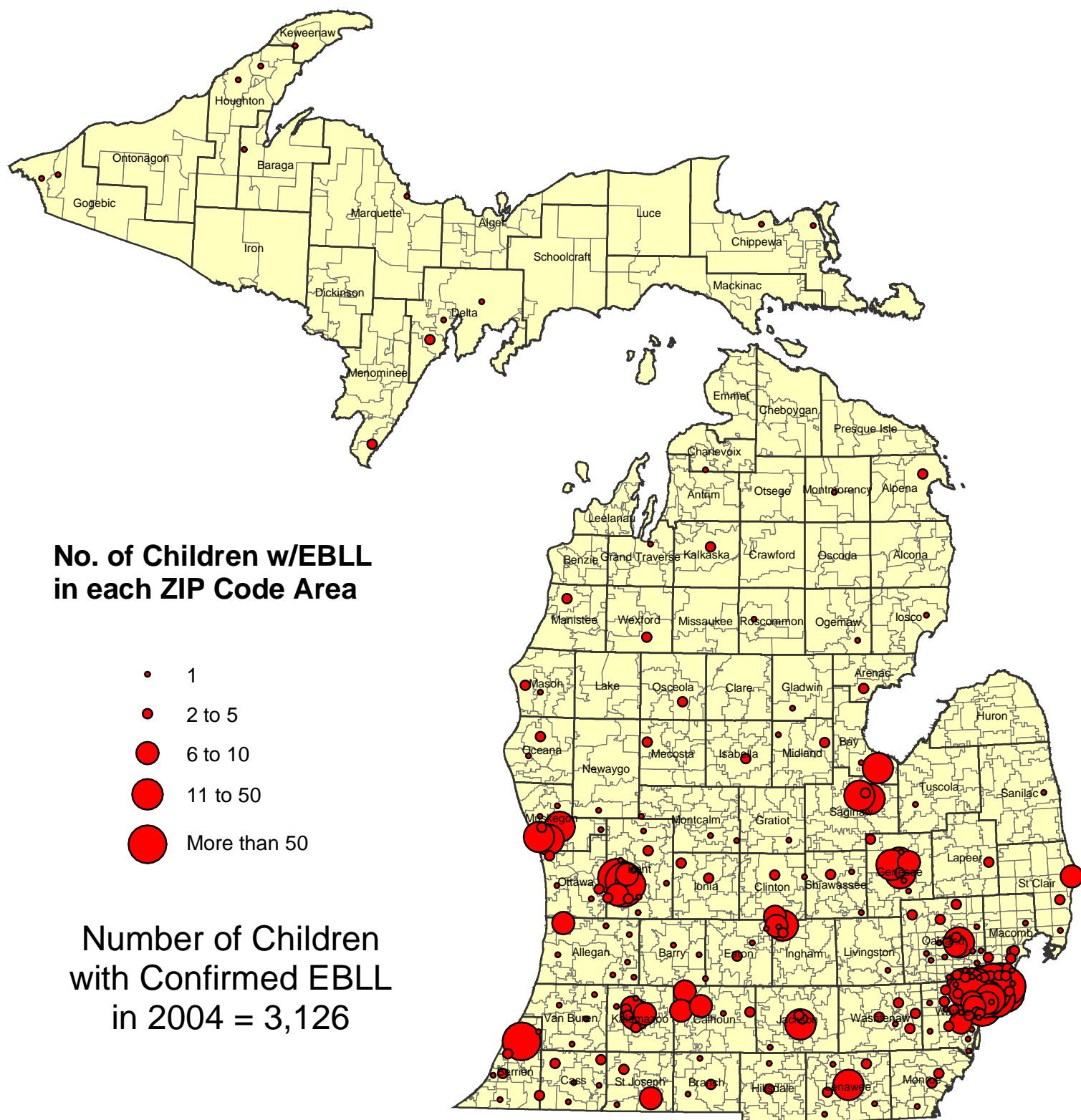
Figure 4. Pct. of Children 1 & 2 years of age  
Tested for Lead Poisoning  
2004



Sources: MDCH CLPPP statewide database  
& 2000 Census

March 2005

# Figure 5. Children less than Six years of age with Confirmed Elevated Blood Lead Levels (EBLL) 2004



Sources: MDCH CLPPP statewide database

March 2005

# APPENDIX I

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:



(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

*To be completed by Parent/Guardian or Patient*  
**PLEASE PRINT**

# APPENDIX II

## OSHA BLOOD LEAD LABORATORIES\*: MICHIGAN

| <b>Laboratory Name</b>                  | <b>City</b>   | <b>County</b> |
|---|---------------|---------------|
| Comprehensive Health Services Inc       | 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                | Ann Arbor     | Washtenaw     |

\*OSHA approved blood lead laboratories as of March 11, 2005. For a complete listing of OSHA approved blood lead laboratories, visit the OSHA web site at [www.osha.gov/SLTC/bloodlead/index.html](http://www.osha.gov/SLTC/bloodlead/index.html)

# APPENDIX III

## 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., R325.51971 - 325.51958). That standard was most recently amended in February, 1998. 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), employees 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:

- 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 3 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.

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), 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.

# APPENDIX IV



July 9, 2004 / 53(26);578-582

# Adult Blood Lead Epidemiology and Surveillance --- United States, 2002

CDC's state-based Adult Blood Lead Epidemiology and Surveillance (ABLES) program tracks laboratory-reported blood lead levels (BLLs) in adults. A national health objective for 2010 is to reduce to zero the number of adults with BLLs  $\geq 25$   $\mu\text{g/dL}$  (objective no. 20-07) (1). A second key ABLES measurement is BLLs  $\geq 40$   $\mu\text{g/dL}$ , the level under which the Occupational Safety and Health Administration allows workers to return to work after being removed with an elevated BLL, and the level under which an annual medical evaluation of health effects related to lead exposure is required (2,3). The most recent ABLES report provided data collected during 1994--2001 (4). This report presents ABLES data for 2002, the first year that individual rather than summary data were collected. The 2002 data indicate that approximately 95% of adult lead exposures were occupational, 94% of those exposed were male, and 91% were aged 25--64 years. The findings also indicated that the national decline in the number of adults with elevated BLLs continued in 2002; however, even greater prevention activities, particularly in work environments, will be necessary to achieve the 2010 health objective.

## Nationwide Magnitude and Trend

During 2002, a total of 10,658 adults from 35 states were reported with BLLs  $\geq 25$   $\mu\text{g/dL}$  (Figure 1). During 2001, a total of 9,943 adults from 23 states were reported with BLLs  $\geq 25$   $\mu\text{g/dL}$  (4). To compare yearly totals, the numbers of adults with elevated BLLs from each state were divided by the state's annual employed population aged  $\geq 16$  years to determine an annual state rate (5). The mean of the state rates in each year was then calculated to derive the average state rate. The average state rate for 2002 was 10.1 per 100,000 employed population, representing an 18% decrease from 2001 (12.3 per 100,000 employed population) (Figure 2) (4). Of the 10,658 adults with BLLs  $\geq 25$   $\mu\text{g/dL}$  in 2002, a total of 1.7 per 100,000 employed population (1,854) were reported with BLLs  $\geq 40$   $\mu\text{g/dL}$ , a 37% decrease compared with the 2.7 per 100,000 employed population (2,009) that were reported in 2001\* (4).

## Occupational Sources of Exposure

In 2002, ABLES began to collect individual data rather than summary data. These individual data for adults with BLLs  $\geq 25$   $\mu\text{g/dL}$  included Standard Industrial Classification (SIC) codes for the industries in which they worked and information regarding nonoccupational exposures. Twenty-seven of the 35 ABLES states provided SIC codes for 6,540 adults. These 27 states reported an additional 1,257 adults for whom SIC codes were unknown or unavailable. By industrial sector, among the 6,540 adults, 58% (3,771) were exposed in the manufacturing industry; 22% (1,458) in the construction industry; 8% (524) in mining; 7% (450) in the wholesale and retail trades; 3% (209) in the service industry; and 2% (128) in transportation and public utilities; finance, insurance, and real estate; or public administration. A further breakdown of occupational exposure is provided by using the 10 SIC codes with the most exposed workers (Table).

## Nonoccupational Sources of Exposure

The same 27 states that provided SIC codes also provided exposure sources for 338 adults whose lead exposures were determined to be nonoccupational. This group represented 5% of the 6,878 (6,540 occupational plus 338 nonoccupational) adults with BLLs  $\geq 25$   $\mu\text{g}/\text{dL}$ . By state, percentages of nonoccupational exposures ranged from  $\geq 15\%$  in Connecticut, Maine, Maryland, Michigan, and Utah to  $< 1\%$  in Hawaii, Iowa, Montana, Nebraska, and Wisconsin. Among the 338 persons exposed to nonoccupational sources, 23% (78) were exposed from shooting firearms, 19% (65) from remodeling or renovation activities, 13% (45) from hobbies (e.g., casting, ceramics, and stained glass), 11% (36) from retained bullets or gunshot wounds, 7% (26) from pica, and 4% (13) from ingesting lead-contaminated food or liquids or nontraditional medicines.

### Distribution by State

For adults with BLLs  $\geq 25$   $\mu\text{g}/\text{dL}$ , with the exception of Alabama, states reporting prevalence rates of  $\geq 10$  per 100,000 employed population are clustered in the Midwest and lower Northeast ([Figure 1](#)). Rates ranged from a high of 46.9 per 100,000 employed population for Kansas to 0.8 for Arizona. Eighteen of the 23 states that reported BLLs in both 2001 and 2002 reported lower rates in 2002. The annual state rates of adults with BLLs  $\geq 40$   $\mu\text{g}/\text{dL}$  ranged from a high of 7.4 per 100,000 employed population for Alabama to no reported cases for Montana and Wyoming. Eighteen of the 23 states that reported in both 2001 and 2002 reported lower rates in 2002 for adults with BLLs  $\geq 40$   $\mu\text{g}/\text{dL}$ .

**Reported by:** *RJ Roscoe, MS, JR Graydon, Div of Surveillance, Hazard Evaluations, and Field Studies, National Institute for Occupational Safety and Health, CDC.*

### Editorial Note:

ABLES data for 2002 indicated that the nationwide rates of elevated BLLs in adults decreased, continuing their decline since 1994 ([Figure 2](#)). The decrease in rates could have resulted from improved prevention measures and also changes in employment patterns (e.g., decline in manufacturing jobs). The 2002 ABLES data provide nationwide information on individual adults for the first time; these data are expected to become more complete as reporting states become more experienced with the new individual reporting requirements.

The findings in this report are subject to at least two limitations. First, inconsistencies exist in the numerators used to calculate the rates. The number of adults with elevated BLLs reported by ABLES states is underreported because 1) not all employers provide BLL testing to all lead-exposed workers and 2) certain laboratories might not report all tests. In addition, these factors can vary among the 35 ABLES states. Second, using the employed population as denominator has the advantage of excluding unemployed adults, most of whom have little or no risk for lead exposure. However, because the distribution of jobs that include lead exposure varies among the ABLES states, caution should be exercised in comparing rates among states. Additional information regarding interpretation of specific state ABLES data is available at <http://www.cdc.gov/niosh/ables.html>.

Despite improvements in control of lead exposures, this hazard remains an occupational health problem in the United States. CDC's ABLES program continues to enhance surveillance for this preventable condition by increasing the number of participating states and by identifying the sources of persistent overexposures, helping states focus their intervention, education, and prevention activities.

### Acknowledgments

This report is based in part on the contributions of ABLES coordinators in Alabama, Arizona, California, Connecticut, Florida, Georgia, Hawaii, Illinois, 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.

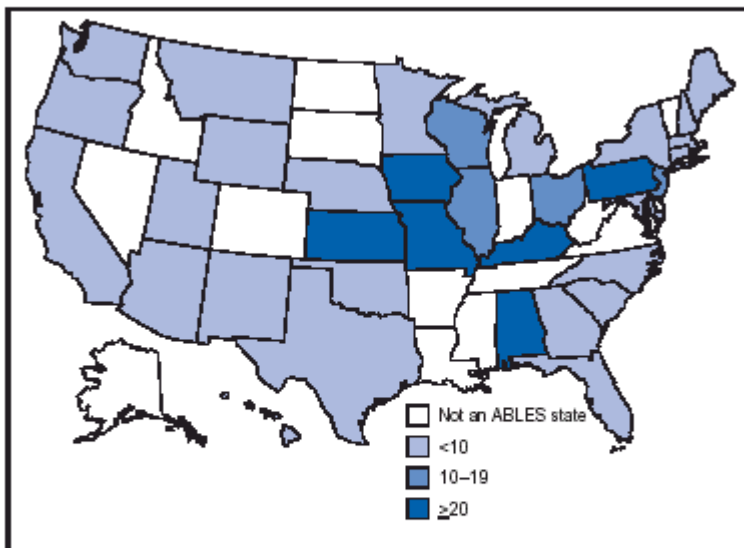
### References

1. U.S. Department of Health and Human Services. Healthy People 2010, 2nd ed. Understanding and Improving Health and Objectives for Improving Health (2 vols.). Washington, DC: U.S. Department of Health and Human Services, 2000.
2. U.S. Department of Labor, Occupational Safety and Health Administration. Final standard; occupational exposure to lead. Federal Register 1978;43:52952--3014 [29 CFR § 1910.1025].
3. U.S. Department of Labor, Occupational Safety and Health Administration. Lead exposure in construction--interim rule. Federal Register 1993;58:26590--26649 [29 CFR § 1926.62]
4. [CDC. Adult Blood Lead Epidemiology and Surveillance---United States, 1998--2001. In: CDC Surveillance Summaries, December 13, 2002. MMWR 2002;51\(No. SS-11\)](#)
5. U.S. Department of Labor, Bureau of Labor Statistics. Annual average estimates from the Current Population Survey.

\* Rates differ slightly from those previously published (4) because the employed populations have been updated by the Bureau of Labor Statistics' Current Population Survey (5).

**Figure 1**

**FIGURE 1. Rate\* of adult blood lead levels  $\geq 25 \mu\text{g/dL}$ , by state — Adult Blood Lead Epidemiology and Surveillance program†, United States, 2002**



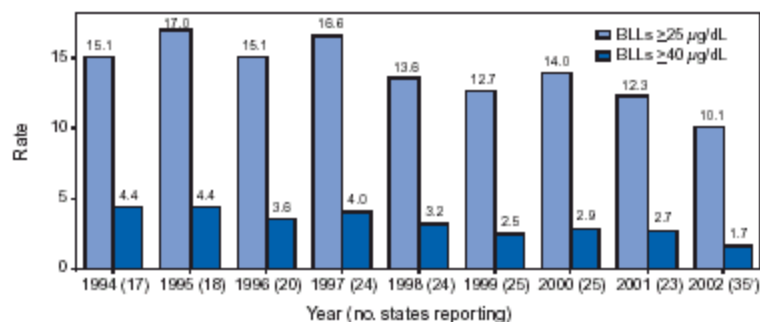
\*Per 100,000 employed persons aged  $\geq 16$  years, according to the Bureau of Labor Statistics' Current Population Survey.

†Alabama, Arizona, California, Connecticut, Florida, Georgia, Hawaii, Illinois, 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.

[Return to top.](#)

**Figure 2**

**FIGURE 2. Average state rate\* of adult elevated blood lead levels (BLLs), by year — Adult Blood Lead Epidemiology and Surveillance program†, United States, 1994–2002**



\* Per 100,000 employed persons aged ≥16 years, according to the Bureau of Labor Statistics' Current Population Survey. The average is determined by first calculating individual state rates for each year, and then calculating the average.

† Alabama, Arizona, California, Connecticut, Florida, Georgia, Hawaii, Illinois, 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.

[Return to top.](#)

## Table

**TABLE. Number of workers with elevated blood lead levels (BLLs), by industry — Adult Blood Lead Epidemiology and Surveillance (ABLES) program\*, 2002**

| Industry (Standard Industrial Classification [sic])  | ≥25 µg/dL | ≥40 µg/dL |
|--|-----------|-----------|
| Manufacture of storage batteries (SIC 3691)  | 1,494     | 141       |
| Painting, paperhanging, and decorating (SIC 1721)  | 863       | 236       |
| Mining of lead and zinc ores (SIC 1031)  | 522       | 70        |
| Secondary smelting (SIC 3341)  | 384       | 63        |
| Wholesale distribution of electrical apparatus and equipment, wiring supplies, and construction materials (SIC 5063) | 351       | 55        |
| Manufacture of primary batteries (SIC 3692)  | 209       | 15        |
| Bridge tunnel and elevated highway construction (SIC 1622)   | 149       | 16        |
| Special trade contractors (e.g., lead abatement workers) (SIC 1799)  | 144       | 33        |
| Primary smelting (SIC 3339)  | 121       | 17        |
| Auto repair shops (e.g., radiator repair) (SIC 7539)   | 106       | 24        |

\* A total of 27 of 35 ABLES states reported; eight states (Alabama, Arizona, Georgia, Kentucky, North Carolina, Pennsylvania, Rhode Island, and Wyoming) did not track BLLs by SIC code.

[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).**

Page converted: 7/7/2004

[Print Help](#)

[MMWR Home](#) | [MMWR Search](#) | [Help](#) | [Contact Us](#)

[CDC Home](#) | [Search](#) | [Health Topics A-Z](#)

This page last reviewed 7/7/2004

[Centers for Disease Control and Prevention](#)  
*Morbidity and Mortality Weekly Report*

# APPENDIX V



# **Narratives of Nine Individuals with a Blood Lead Level of $\geq 50$ $\mu\text{g}/\text{dL}$ in 2004**

## **Non-Work, Hobby: Firearms (1)**

A male in his late 50s requested a blood lead test from his physician because fellow gun hobbyists had elevated blood lead levels; his result was 58  $\mu\text{g}/\text{dL}$  (previous results in earlier years ranged from 33 to 46  $\mu\text{g}/\text{dL}$ ). He reported being a firearms enthusiast, participating in indoor and outdoor firearms activities for the past thirty years. He reported no lead-related health symptoms. He was an ex-smoker. There were no children under the age of six in his home. He was sent educational materials on lead hazards at indoor firing ranges.

## **Non-Work, Hobby: Casting (1)**

A male in his 40s requested a blood lead test from his physician. Multiple tests during 2004 showed results ranging from 19 to 59  $\mu\text{g}/\text{dL}$ . He reported weekly outdoor use of firearms for the past twenty-five years. He also reported casting his own bullets on a weekly basis for the past five years; an activity that he performed in the garage of his house. He reported no lead-related health symptoms. He was a current smoker. There were no children under the age of six in his home.

## **Non-Work, Hobby: Other (2)**

A female in her 50s had a blood lead test ordered after her internist noticed basophilic stippling on a laboratory report. Her result was 190  $\mu\text{g}/\text{dL}$ . She reported weight loss, decreased appetite, abdominal colic with constipation, pain in joints, muscle weakness, headaches, dizziness, depression, exhaustion, nervousness, waking up at night, irritability and difficulty concentrating. She reported that she had “felt sick” for nearly two years, during which time she was under medical care and was noted to be anemic. She denied any lead-related hobbies or work activities. Individuals living in her household included a spouse, a son in his 20s and a minor daughter. All household members were tested and all results were elevated, ranging from 25 to 81  $\mu\text{g}/\text{dL}$ ; her son was 81  $\mu\text{g}/\text{dL}$ . All family members were questioned and denied any lead-related hobbies or work activities. Samples from an opened bottle of Italian seasoning in the home was found to contain 0.17% lead. The FDA was brought in to assist, samples of the unopened bottles of the spice from the store and the wholesaler were negative for lead; it was concluded that the contamination occurred in the home. The county health department conducted a home investigation and revealed elevated levels of lead in the basement. Further questioning of the family revealed the most likely source of lead exposure to be from leather tooling work using a block of lead as the backstop for the leather punches. The index case received oral chelation and her blood lead has dropped to the 30’s  $\mu\text{g}/\text{dL}$ . The son had no lead-related health symptoms, his levels, without chelation, are now in the 20’s  $\mu\text{g}/\text{dL}$ . The spouse and daughter’s dropped to less than 20  $\mu\text{g}/\text{dL}$  without chelation.

## **Work**

### ***Heavy Construction (1)***

A male in his 40s requested a blood lead test from his physician. Multiple tests during 2004 showed results ranging from 14 to 95  $\mu\text{g}/\text{dL}$ . He reported weight loss, abdominal colic, pain in joints, muscle weakness, headaches, dizziness, depression, exhaustion, nervousness, nightmares, irritability, and difficulty concentrating. He denied any lead-related recreational activities. He worked in heavy construction as a torch cutter for a bridge demolition company for the past six years. He reported that the company did not have separate lockers, a place to wash work clothes, showering facilities, or a lunch room. He wore a respirator approximately 6 hours of his 10 hour work day; however, he had never been fit tested or trained on how to use a respirator. He had facial hair. He reported never having had medical monitoring or being informed of the hazards of lead. He was a current smoker and was allowed to smoke in the work area and carried his cigarettes with him. He was not removed from the job; however, he did not return to work after chelation. He currently works digging trenches for another company. The company was referred for an enforcement inspection by MIOSHA; results are pending. There was an infant in the home that was tested for lead; those results were  $< 10 \mu\text{g}/\text{dL}$ .

### ***Primary Metals Industry (Foundry) (2)***

A male in his 40s requested a blood lead test from his physician. His result was 65  $\mu\text{g}/\text{dL}$ . He denied lead-related health symptoms. He denied any lead-related recreational activities. He worked at a small foundry pouring lead for the past eighteen years. He reported that the foundry did not have separate lockers to separate work clothes from street clothes, he did not wear a respirator and he had never had any medical monitoring. He did indicate that there were showering facilities at work, coveralls were provided, and a lunch room available. He was not removed from the job. He was a non-smoker. The foundry was referred for an enforcement inspection by MIOSHA. Final results are pending; however, initial 8-hour time-weighted average (TWA) results for lead indicate levels of 130, 200, 780, 500 and 380  $\text{mg}/\text{m}^3$  of air compared to the allowable limit of 50  $\text{mg}/\text{m}^3$ .

A male in his 20s had multiple blood lead tests during 2004 ranging from 28 to 52  $\mu\text{g}/\text{dL}$ . He works for an alloy foundry. To date, we have been unable to contact him.

### ***Automotive Repair Services (1)***

A male in his 50s had a blood lead result of 50  $\mu\text{g}/\text{dL}$ . For the past eight years he has had results ranging from 31 to 53  $\mu\text{g}/\text{dL}$ . He was the owner and operator of a radiator repair shop. He was experiencing depression, having nightmares, and difficulty concentrating. He denied any lead-related recreational activities. He reported, at that time, that he did not have a separate locker at work for work clothes and street clothes, washed his clothes at home, did not shower after work, did not have a lunch room, and did not wear a respirator. He did not remove himself from the job because of elevated lead. He was a non-smoker. A MIOSHA enforcement inspection was conducted at that time and citations for lead were issued. Citations for lead included: no hazard

communication program, no MSDSs for each hazardous chemical used, allowing an employee to be exposed to lead at a concentration greater than 50 mg/m<sup>3</sup> for lead averaged over an 8-hour period, not determining air levels prior to work, failing to implement engineering and work practice controls and utilize appropriate respiratory protection, failing to have a written compliance program, failing to provide protective work clothing and equipment, failing to maintain surfaces as free as practical from accumulations of lead, using compressed air for clean-up duties, failing to prohibit food and beverages in work areas, failing to institute a medical surveillance program, failing to provide biological monitoring, failing to inform employees of appendices A and B of the Lead Rules, failing to institute a training program, and failing to post a lead warning sign were the permissible exposure limit was exceeded.

### *Amusement and Recreation (1)*

A male in his 40s requested a blood lead test from his physician because a fellow co-worker had an elevated blood lead level. Multiple tests during 2004 showed results ranging from 42 to 59 µg/dL; tests in 2003 showed results of 53 and 82 µg/dL. He worked for a firearms sports shop for the past five years. A MIOSHA enforcement inspection was completed at the sports shop and citations for violations to the lead were issued. Citations included: not conducting biological monitoring of the employees, not providing follow-up blood sampling when indicated, and for not removing an employee from work when indicated.

# **Narratives of 146 Individuals with Blood Lead Levels Between $\geq 25$ and $< 50$ $\mu\text{g/dL}$ Grouped by Source of Exposure, 2004**

## **Non-Work, Environment (1)**

A Hispanic male in his late teens was referred for blood lead testing by the public school nurse. Multiple test results in 2004 ranged from 12 to 26  $\mu\text{g/dL}$ ; and in 2003 ranged from 23 to 42  $\mu\text{g/dL}$ . He reported weight loss, decreased appetite, exhaustion, and nervousness. It was noted that he was anemic and had low iron levels. He denied any lead-related hobbies or work. He was a non-smoker. A home inspection was conducted and the current residence was lead-free. It was concluded that the previous residence was the source of exposure as the teen was seen to be eating paint chips, soil, and dry cement that was laying around in old cement bags. He received chelation and his levels have been decreasing. One child, under the age of six, was found to have elevated lead levels and was treated.

## **Non-Work, Food (1)**

A Hispanic female in her 30's received a blood lead test as a prenatal screening. Multiple test results in 2004 ranged from 8 to 34  $\mu\text{g/dL}$ . She reported exhaustion, apnea, and irritability. She also indicated difficulty having children. She denied any lead-related hobbies or work; however, she did indicate use of imported or handmade ceramics for cooking or serving food or drink. She was a non-smoker. A home inspection revealed recent travel to Mexico, during which time she craved and ate soil and used ceramic bean pots. One child, under the age of six, was found to have elevated lead levels.

## **Non-Work, Hobby: Casting (1)**

A male in his 30's requested a blood lead test from his physician due to symptoms he was experiencing; his result was 25  $\mu\text{g/dL}$ . He reported frequent joint pain, dizziness, exhaustion, and irritability. He also indicated high blood pressure since the late 1980's. He denied lead-related work, but did indicate outdoor firearms practice for the past year and occasionally casting bullets for the past 15 years. He was a smoker. Children, under the age of six, were present in the home, however, it was unknown if they had any blood lead testing.

## **Non-Work, Hobby: Other (1)**

A male in his 50's requested a blood lead from his physician after his spouse was found to have seriously elevated levels (see page Appendix V, page 1). Multiple test results in 2004 ranged from 6 to 33  $\mu\text{g/dL}$ . He reported frequent pain in joints, depression, exhaustion, nervousness, and difficulty concentrating. He also indicated having high blood pressure since the mid-1990's. He

denied any lead-related recreational activities or work. He was a non-smoker. A home investigation revealed elevated levels of lead in the basement. Further questioning of the family revealed the most likely source of lead exposure to be from leather tooling work using a block of lead as the backstop for the leather punches. His levels have decreased to less than 10 µg/dL without chelation.

### **Non-Work, Hobby: Reloading (2)**

A male in his 60's requested a blood lead test from his physician; his level was 27 µg/dL. He reported abdominal colic after meals, frequent pain in joints, and nervousness. He denied any lead-related work; however, he indicated that he was a gun enthusiastic and reloaded his own ammunition for the past ten years. He was a smoker.

A male in his 40's received blood lead testing from his physician; he had two tests in 2004, 26 and 36 µg/dL. He reloads his own gun shells. He was chelated.

### **Non-Work, Hobby: Sinkers (2)**

A male in his 30's requested a blood lead test from his physician because of symptoms he was experiencing; he had two tests in 2004, 18 and 27 µg/dL. He reported frequent pain in joints, exhaustion, and irritability. He denied any lead-related work; however, he indicated outdoor firearms use for the past 20 years and making his own fish weights and sinkers for the past four years. He was a smoker.

A male in his 60's had a blood lead test from his physician; he had two tests in 2004, 28 and 36 µg/dL. He denied any lead-related health symptoms. He did report having high blood pressure since 2000 and hearing loss since the 1950's. He denied any lead-related work; however, he did indicate making his own fish sinkers. He was a smoker.

### **Non-Work, Unknown (1)**

A female in her 50's had a blood lead test from her physician; her result was 34 µg/dL. She was unemployed. Her source of lead exposure was unknown; however, it was not work-related.

### **Non-Work, Remodeling (6)**

A male in his 60's had a blood lead test from his physician; his result was 40 µg/dL. He reported having a loss of appetite, frequent pain in joints, and exhaustion. He denied any lead-related work; however, he did indicate shooting at indoor and outdoor ranges for the past 53 years, casting bullets for the past 10 years, and remodeling a 1930's home. He was a smoker.

A male in his 40's requested a blood lead test from his physician; he had two tests in 2004, 7 and 25 µg/dL. He reported having headaches. He was a non-smoker. He denied any lead-related work; however, he did indicate remodeling/renovating and painting on his early 1900's home for six

years. There were two children, under the age of six, in his home. One was tested and found to have elevated lead levels.

A male in his 60's requested a blood lead test from his physician; his result was 25 µg/dL. He reported a loss of appetite and nervousness. He also indicated that he had high blood pressure for the past year. He was a smoker. He denied any lead-related work; however, he had been remodeling/renovating his late 1800's home for the past five years. There was one child, under the age of six, in the home and no lead testing had been done.

A female in her 20's requested a blood lead test from her physician; she had two tests in 2004, 18 and 29 µg/dL. She denied any lead-related health symptoms. She denied any lead-related work; however, she did indicate remodeling/renovating on her early 1900's home for two years. She was a smoker. There was one child, under the age of six, who had elevated lead levels.

A female in her teen's had a blood lead test from her physician. Multiple test results in 2004 ranged from 15 to 25 µg/dL. She reported headaches and irritability. She was a non-smoker. She denied any lead-related work; however, she did indicate painting her 1950's home for a year.

A male in his 50's requested a blood lead test from his physician; he had two tests in 2004, 18 and 25 µg/dL. He complained of abdominal discomfort, fatigue, and bilateral ear pain. It was determined that his lead exposure was from removing lead-based paint in his home. He indicated that he was using a respirator and wore long-sleeved shirts.

## **Non-Work, Hobby: Firearms (18)**

Eighteen individuals had lead exposure from firearms use. Results ranged from 25 to 49 µg/dL. For twelve of the eighteen, questionnaire data was available. All twelve individuals received blood lead testing from their physician. Eleven (91.7%) were males. Symptoms were reported with the following frequency: loss of appetite (8.3%); abdominal colic (8.3%); pain in joints (41.7%); muscle weakness (25.0%); headaches (25.0%); dizziness (16.7%); depression (33.3%); exhaustion (66.7%); nervousness (16.7%); apnea (25.0%); nightmares (8.3%); irritability (25.0%); difficulty concentrating (16.7%); difficulty having a child (16.7%); anemia (8.3%); kidney disease (8.3%); high blood pressure (25.0%); and hearing loss (16.7%). Five (41.7%) reported indoor firearms range use, two (16.7%) reporting outdoor firearms range use, and five (41.7%) reported using both indoor and outdoor firearms ranges. The number of years engaging in firearms as a hobby varied greatly from 3 to 43 years. Most (66.7%) reported shooting on a weekly basis. One individual (8.3%) received chelation. Seven (58.3%) reported being a smoker. No one reported having children, under the age of six, in their home.

## **Work-Related (100)**

### ***Special Trade Construction (SIC 17)***

Thirty-nine individuals had elevated blood lead levels from construction work. This work generally involved removal of lead paint, often while doing abrasive blasting.

### *Painting and Paper Hanging (1721)*

Eight males worked for Company #1; their bls ranged from 25 to 35 µg/dL.  
Six males worked for Company #2; their bls ranged from 25 to 30 µg/dL.  
Six males worked for Company #3; their bls ranged from 26 to 43 µg/dL.  
Three males worked for Company #4; their bls ranged from 25 to 27 µg/dL.  
Two males worked for Company #5; their bls were 27 and 33 µg/dL.  
One male worked for Company #6; his highest bl was 26 µg/dL.  
One male worked for Company #7; his highest bl was 27 µg/dL.  
One male worked for Company #8; his highest bl was 31 µg/dL.  
One male worked for Company #9; his highest bl was 43 µg/dL.  
One male worked for Company #10; his highest bl was 28 µg/dL.  
One male worked for Company #11; his highest bl was 29 µg/dL.

### *Structural Steel Erection (1791)*

One male worked for Company #12; his highest bl was 28 µg/dL.

### *Glass and Glazing Work (1793)*

Two males worked for Company #13; their bls were 28 and 32 µg/dL.

### *Wrecking and Demolition (1795)*

One male worked for Company #14; his highest bl was 25 µg/dL.  
One male worked for Company #15; his highest bl was 27 µg/dL.  
One male worked for Company #16; his highest bl was 30 µg/dL.

### *Special Contractors (1799)*

One male worked for Company #17; his highest bl was 41 µg/dL.  
One male worked for Company #18; his highest bl was 28 µg/dL.

Symptoms were reported with the following frequency: weight loss (22.2%); loss of appetite (12.5%); abdominal colic (27.8%); pain in joints (35.3%); muscle weakness (23.5%); headaches (44.4%); dizziness (16.7%); depression (27.8%); exhaustion (38.9%); nervousness (27.8%); apnea (33.3%); irritability (27.8%); difficulty concentrating (27.8%); and anemia (13.3%). Ninety-four percent reported their blood lead testing was part of a company medical screening. The status of their working conditions was reported with the following frequency: having lockers to separate their work clothes from their street clothes (72.2%); clothes laundered at work (29.4%); showering facilities (66.7%); lunch room (47.1%); cleaning up before eating (100%); eating in lunchroom (30.0%); and respirator use (100%). Sixty-seven percent reported still being exposed to lead at work and 28% reported being removed from the job because of their lead level. Of those that ever smoked cigarettes (83.3%), 93% still smoked. Of those that still smoked, 57.1% did *not* smoke in their work area and 85.7% did *not* keep their cigarettes in their pockets. Thirty-nine percent reported having children, under the age of six, in their home; of those, 50% had had their children tested for lead.

## ***Stone, Clay, Glass and Concrete Products (SIC 32)***

### ***Flat Glass (3211)***

One male worked for Company #19; his highest bll was 44 µg/dL. He reported exhaustion, irritability, and high blood pressure. He reported his blood lead testing was part of a company medical screening. For work conditions he reported having lockers to separate his work clothes from his street clothes, clothes were laundered at work, showering facilities, lunch room, cleaning up before eating, eating in lunchroom, and respirator use. He was still being exposed to lead at work and was removed from the job because of his lead level. He was a non-smoker. A child, under the age of six, was present in the home, however the child was not tested for lead.

## ***Primary Metals Industry (SIC 33)***

Twenty-five workers had elevated blood lead levels from work in this type of industry.

### ***Steel Foundries (3325)***

Four males worked for Company #20; their blls ranged from 37 to 48 µg/dL.

### ***Rolling, Drawing and Extruding of Copper (3351)***

Fourteen males worked for Company #21; their blls ranged from 25 to 36 µg/dL.

One male worked for Company #22; his highest bll was 28 µg/dL.

### ***Copper Foundries (3366)***

Five males worked for Company #23; their blls ranged from 32 to 38 µg/dL.

One male worked for Company #24; his highest bll was 32 µg/dL.

Symptoms were reported with the following frequency: weight loss (13.3%); loss of appetite (6.7%); abdominal colic (6.7%); pain in joints (35.7%); muscle weakness (6.7%); headaches (20.0%); dizziness (6.7%); depression (6.7%); exhaustion (40.0%); apnea (20.0%); irritability (13.3%); difficulty concentrating (13.3%); and high blood pressure (20.0%). One (6.7%) individual was given chelation. All reported their blood lead testing was part of a company medical screening. The status of their work conditions was reported with the following frequency: having lockers to separate their work clothes from their street clothes (80.0%); clothes laundered at work (66.7%); showering facilities (86.7%); lunch room (93.3%); cleaning up before eating (100%); eating in lunchroom (86.7%); and respirator use (93.3%). All reported still being exposed to lead at work and one (6.7%) reported being removed from the job because of his lead level. Of those that ever smoked cigarettes (93.3%), 64% still smoked. Of those that still smoked, 70.0% did *not* smoke in their work area and 50.0% did *not* keep their cigarettes in their pockets. Sixty percent reported having children, under the age of six, in their home; however, no lead testing was done on the children.



### ***Fabricated Metal Products (SIC 34)***

Eleven workers had elevated blood lead levels from work in this type of industry.

#### ***Metal Stampings, NEC (3469)***

Four males worked for Company #25; their bls ranged from 25 to 30 µg/dL.

Seven males worked for Company #26; their bls ranged from 25 to 37 µg/dL.

Symptoms were reported with the following frequency: pain in joints (57.1%); headaches (28.6%); depression (28.6%); exhaustion (57.1%); apnea (14.3%); difficulty concentrating (28.6%); and high blood pressure (28.6%). All reported their blood lead testing was part of a company medical screening. The status of their work conditions was reported with the following frequency: having lockers to separate their work clothes from their street clothes (85.7%); clothes laundered at work (71.4%); showering facilities (85.7%); lunch room (85.7%); cleaning up before eating (100%); eating in lunchroom (66.7%); and respirator use (71.4%). All reported still being exposed to lead at work and 29% reported being removed from the job because of their lead level. Of those that ever smoked cigarettes (42.9%), 33% still smoked. Of those that still smoked, 100% did *not* smoke in their work. Twenty-nine percent reported having children, under the age of six, in their home.

### ***Industrial and Commercial Machinery (SIC 35)***

Five individuals had elevated blood lead levels from work in this type of industry.

#### ***Special Industry Machinery, NEC (3559)***

Three males worked for Company #27; their bls ranged from 27 to 38 µg/dL.

One male worked for Company #28; his highest bl was 36 µg/dL.

#### ***Ball and Roller Bearings (3562)***

One male worked for Company #29; his highest bl was 32 µg/dL.

Symptoms were reported with the following frequency: headaches (25.0%) and exhaustion (25.0%). All reported their blood lead testing was part of a company medical screening. The status of their work conditions was reported with the following frequency: having lockers to separate their work clothes from their street clothes (66.7%); clothes laundered at work (50.0%); showering facilities (75.0%); lunch room (100%); cleaning up before eating (100%); eating in lunchroom (50.0%); and respirator use (100%). Seventy-five percent reported still being exposed to lead at work. Of those that ever smoked cigarettes (50.0%), 67% still smoked. Of those that still smoked, 50.0% did *not* smoke in their work area and 50.0% did *not* carry their cigarettes in their pockets.

### ***Transportation Equipment (SIC 37)***

Three individuals had elevated blood lead levels from welding or repairing radiators.

### ***Motor Vehicle Parts and Accessories (3714)***

One male worked for Company #30; his highest bll was 36 µg/dL.

Two males worked for Company #31; their blls were 26 and 34 µg/dL.

Only one individual was interviewed, he reported pain in joints, headaches, exhaustion, nervousness, apnea, nightmares, irritability, and difficulty concentrating. He reported having lockers to separate his work clothes from his street clothes, clothes laundered at work, cleaning up before eating, and respirator use. He reported still being exposed to lead. He smoked cigarettes.

### ***Wholesale Trade-Durable Goods (SIC 50)***

### ***Scrap and Waste Materials (5093)***

One male worked for Company #33; his highest bll was 31 µg/dL. He received his blood lead testing as part of a company medical screening. He denied any lead-related health symptoms. He reported having lockers to separate his work clothes and his street clothes, work clothes were washed at home, no showering facilities were provided at work, a lunchroom was provided, however, he didn't eat there, he did cleanup before eating and he wore a respirator. He was no longer exposed to lead and had never been removed from the job because of lead levels. He was a smoker. No children were present in his home.

### ***Automotive Dealers and Gasoline Service Stations (SIC 55)***

Three individuals had elevated blood lead levels from work repairing radiators.

### ***Auto and Home Supply Stores (5531)***

Three males worked for Company #34; their blls ranged from 27 to 36 µg/dL.

Only one individual was interviewed, he reported having high blood pressure. He reported his blood lead testing was part of a company medical screening. He reported having lockers to separate his work clothes from his street clothes, clothes laundered at work, showering facilities, lunch room, cleaning up before eating, and respirator use. He reported still being exposed to lead at work. He smoked cigarettes, but did *not* smoke in his work area and did *not* keep his cigarettes in his pockets.

### ***Automotive Repair (SIC 75)***

Six individuals had elevated blood lead levels from work repairing radiators.

### ***Automotive Repair Shops, NEC (7539)***

One male worked for Company #35; his highest bll was 34 µg/dL.

One male worked for Company #36; his highest bll was 28 µg/dL.

One male worked for Company #37; his highest bll was 38 µg/dL.

One male worked for Company #38; his highest bll was 40 µg/dL.

One male worked for Company #39; his highest bll was 35 µg/dL.  
One male worked for Company #40; his highest bll was 27 µg/dL.

Symptoms were reported with the following frequency: weight loss (25.0%); loss of appetite (25.0%); abdominal colic (25.0%); pain in joints (25.0%); muscle weakness (25.0%); headaches (25.0%); dizziness (25.0%); exhaustion (50.0%); apnea (25.0%); nightmares (25.0%); irritability (66.7%); and difficulty concentrating (25.0%). Seventy-five percent reported their blood lead testing was part of a company medical screening. The status of their work conditions was reported with the following frequency: having lockers to separate their work clothes from their street clothes (75.0%); clothes laundered at work (25.0%); showering facilities (50.0%); lunch room (75.0%); cleaning up before eating (100%); and eating in lunchroom (50.0%). All reported still being exposed to lead at work. Of those that ever smoked cigarettes (75.0%), 67% still smoked. Of those that still smoked, 50% did *not* smoke in their work area and 50% did *not* keep their cigarettes in their pockets. Fifty percent reported having children, under the age of six, in their home; of those, 50% had testing.

### ***Amusement and Recreation Services (SIC 79)***

Five individuals had elevated blood lead levels from work on firing ranges.

#### ***Membership Sports and Recreation Clubs (7997)***

One male worked for Company #41; his highest bll was 27 µg/dL.

Two males worked for Company #42; their blls were 25 and 31 µg/dL.

One male worked for Company #43; his highest bll was 25 µg/dL.

#### ***Amusement and Recreation Services, NEC (7999)***

One male worked for Company #44; his highest bll was 33 µg/dL.

Symptoms were reported with the following frequency: exhaustion (50.0%). The status of their work conditions was reported with the following frequency: having lockers to separate their work clothes from their street clothes (100%); clothes laundered at work (100%); showering facilities (50.0%); lunch room (50.0%); cleaning up before eating (100%); and respirator use (100%). All were non-smokers. Fifty percent reported having children, under the age of six, in their home.

### ***Engineering, Accounting, Research and Related Services (SIC 87)***

#### ***Testing Laboratories, Environmental Services (8734)***

One male worked for Company #45; his highest bll was 30 µg/dL.

### **Source of Exposure: Pending (13)**

There are currently thirteen individuals with blood lead levels ranging from 25 to 48 µg/dL that are pending source of lead exposure.