

Missouri Adult Blood Lead Epidemiology & Surveillance

Annual Report for Calendar Year 2014

January 1, 2014 through December 31, 2014



Missouri Department of Health and Senior Services

<http://health.mo.gov/data/ables/index.php>

573-751-6102 or 866-628-9891

About Our Program

The Centers for Disease Control and Prevention (CDC), National Institute for Occupational Safety and Health ([NIOSH](#)) oversees the Adult Blood Lead Epidemiology and Surveillance ([ABLES](#)) program. ABLES is a state-based surveillance program of laboratory-reported adult blood lead levels (BLLs). The public health objective of the ABLES program is objective OSH-7 in *Healthy People 2020*, which is to reduce the rate of adults (age 16 and older) who have elevated blood lead concentrations from work exposures. The program objective is to build state capacity to initiate, expand, or improve adult blood lead surveillance programs which can accurately measure trends in adult BLLs and which can effectively intervene to prevent lead over-exposures. Nationwide data from the state ABLES programs are published in CDC's Morbidity and Mortality Weekly Report ([MMWR](#)). As of December 2015, 28 states collaborate with NIOSH to conduct surveillance of adult lead exposures.

In 2015, NIOSH designated a BLL of 5 µg/dL (micrograms per deciliter), in a venous blood sample, as the reference BLL for adults; this designation defined an elevated adult BLL the same as an elevated childhood lead level. This case definition is used by the ABLES program, the Council of State and Territorial Epidemiologists ([CSTE](#)), and CDC's National Notifiable Diseases Surveillance System ([NNDSS](#)). Previously (i.e. from 2009 until November 2015), the case definition for an elevated BLL was a BLL ≥10 µg/dL. The U.S. Department of Health and Human Services ([DHHS](#)) recommends that BLLs among all adults be reduced to <10 µg/dL. The U.S. Occupational Safety and Health Administration (OSHA) Lead Standards require workers to be removed from lead exposure when BLLs are greater than or equal to 50 µg/dL (construction industry) or 60 µg/dL (general industry) and allow workers to return to work when the BLL is below 40 µg/dL. Data from the National Health and Nutrition Examination Survey (NHANES) show that the average BLL (geometric mean) of all adults in the United States in 2009–2010 was 1.2 µg/dL. [Reference Blood Levels for Adults](#) illustrates these reference values. Elevated BLLs can damage the nervous, hematologic, reproductive, renal, cardiovascular, and gastrointestinal systems. Current research has found decreased renal function associated with BLLs at 5 µg/dL and lower ([National Toxicology Program, Health Effects of Low-level Lead Evaluation](#)). The majority of lead elevations in adults are due to workplace exposures.

The Missouri ABLES (MO ABLES) program has participated in the national program since 2001. All blood lead testing of Missouri residents is reportable to the Missouri Department of Health and Senior Services (DHSS) under the Missouri Code of State Regulations, [19 CSR 20.20-020](#) regardless of patient age or blood lead laboratory result. Non-identifying patient-level data are reported to NIOSH for surveillance purposes. Missouri companies with worker BLLs that warrant removal from lead exposure per OSHA Lead Standards are reported to OSHA via a memorandum of understanding established between the two agencies. DHSS' Bureau of Environmental Epidemiology (BEE) administers the MO ABLES program. This report summarizes blood lead testing and elevated lead levels in Missouri residents age 16 years and older for calendar year 2014.

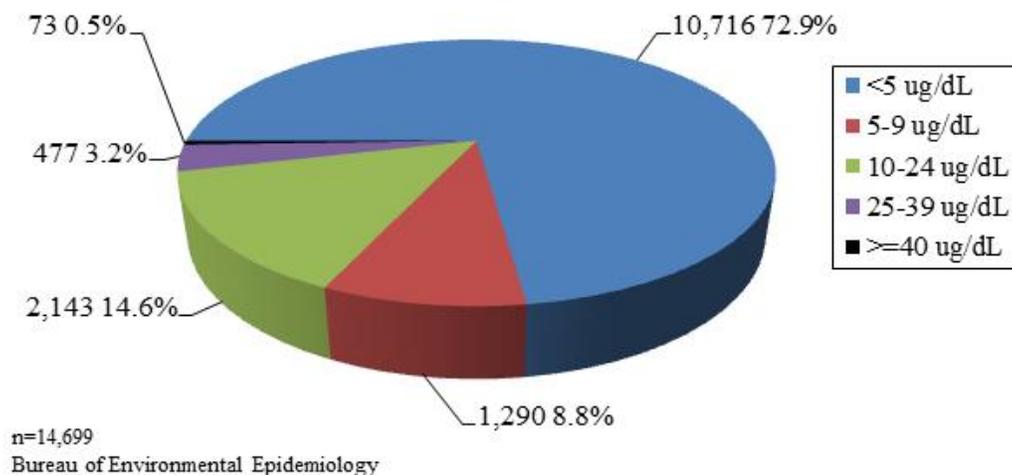
Testing and Prevalence

The MO ABLES program data are primarily collected through reporting by laboratories analyzing blood lead specimens. Information to be reported includes patient name, date of birth, home address, sex, race, date of blood lead test, laboratory results, and health care provider. However, laboratory data often do not include all information needed by the MO ABLES program to determine work-relatedness, occupation or industry. Missing information on individuals with BLLs >10 $\mu\text{g}/\text{dL}$ is sought by contacting medical providers and employers; therefore, data on elevated adults are more likely to be complete in the MO ABLES database.

There were 25,826 blood specimens drawn, analyzed, and reported to the MO ABLES program for Missouri residents' age 16 years and older for the period January 1 through December 31, 2014. Blood lead specimens drawn but not analyzed are excluded. The reported BLLs for 2014 ranged from zero (or non-detectable) to a high of 112 $\mu\text{g}/\text{dL}$.

Individuals considered at risk for lead poisoning or who are known to have exposure to lead may receive multiple blood lead tests within a year. For statistical purposes, BLL determination for individuals tested more than once during a given timeframe is based upon their highest reported BLL. Analysis of the MO ABLES 2014 data revealed a total of 14,699 unduplicated Missouri residents were tested in 2014. Of these, 10,716 (72.9%) had lead levels <5 $\mu\text{g}/\text{dL}$; 1,290 (8.8%) had lead levels between 5 and 9 $\mu\text{g}/\text{dL}$; 2,143 (14.6%) had lead levels between 10 and 24 $\mu\text{g}/\text{dL}$; 477 (3.2%) had lead levels between 25 and 39 $\mu\text{g}/\text{dL}$, and 73 (.5%) were reported with a blood lead result ≥ 40 $\mu\text{g}/\text{dL}$.

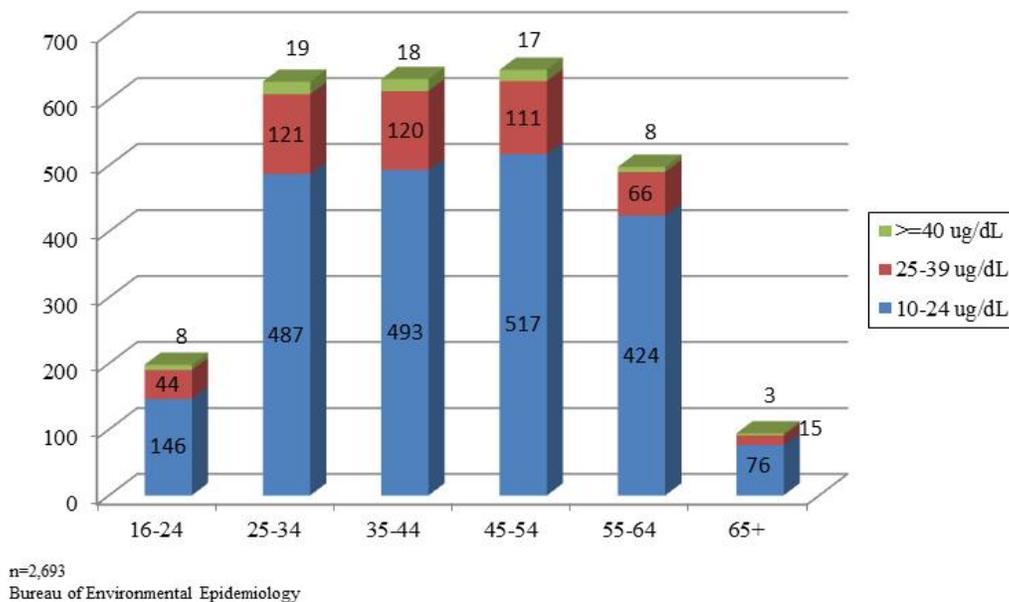
Adult Lead Testing by Blood Lead Level,
Missouri 2014



During the 2014 calendar year, 2,693 Missouri adults (18.3% of all individuals tested) had at least one blood lead test ≥ 10 $\mu\text{g}/\text{dL}$, the CDC lead level of concern for adults during that year. The highest acceptable level for workers by the U.S. Occupational Safety and Health Administration ([OSHA](#))

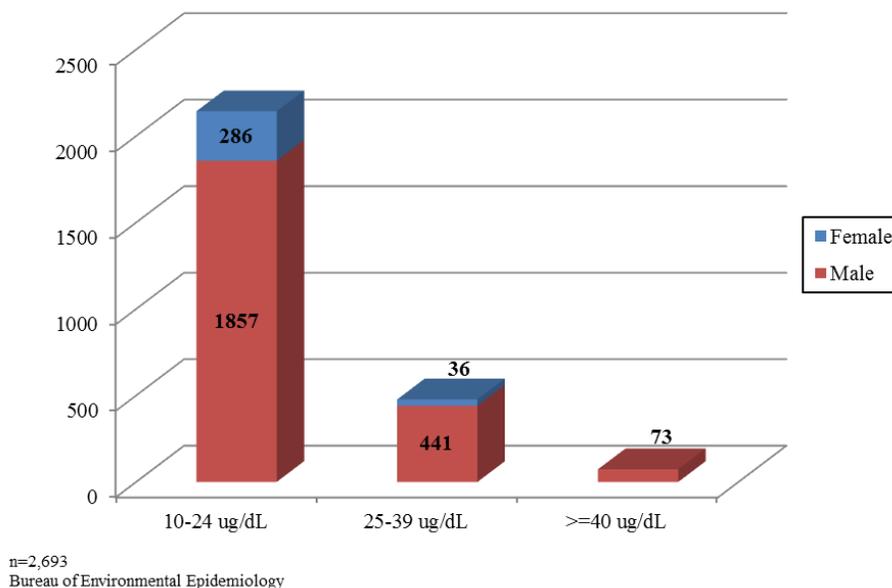
standards is 40 µg/dL. The following data analyses were performed on the data set consisting of only the 2,693 individuals with at least one blood lead laboratory result >10 µg/dL during calendar year 2014. Of the 2,693 elevated adults tested in 2014, the majority (2,401, 89.2%) were between 25 and 64 years of age at the time their blood specimen was drawn. There were 198 (7.4%) elevations in the 16- through 24-year-old age range and 94 (3.5%) elevations among those age 65 or older.

Adults with Elevated Lead Levels by Age, Missouri 2014



There were 322 (12.0%) adult women with elevated lead levels in 2014, and 2,371 (88.0%) men. All of the 73 adults with lead levels >40 µg/dL were male.

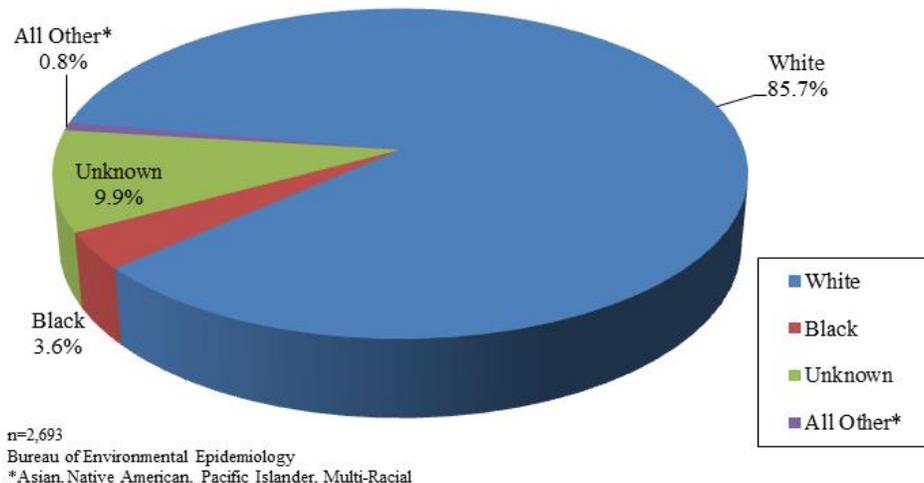
Adults with Elevated Blood Lead Levels by Sex, Missouri 2014



Although health care providers and laboratories are required to include the patient's race, this information is often missing when test results are reported. In 2014, there were 266 (9.9%) adults with

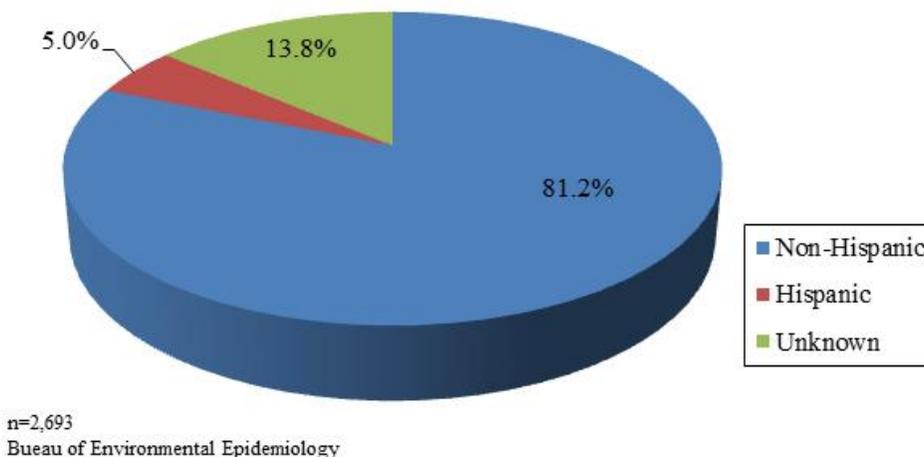
elevated lead levels whose race is unknown. People who were multi-racial comprised only .1% (2), Pacific Islander .1% (3), Native American .2% (5), Asian .4% (12) and blacks 3.6% (98). The majority of adults with elevated lead levels were white (2,307, 85.7%), which is to be expected since whites comprised 85.9% of those employed in Missouri in that year (source: U.S. Department of Labor).

Adults with Elevated Lead Levels by Race, Missouri 2014



Ethnicity for Missourians tested for elevated lead levels is also sought by the MO ABLES program. In 2014, 2,187 (81.2%) elevated adults were Non-Hispanic and 134 (5.0%) were Hispanic. However, ethnicity was unknown for 372 (13.8%) of adults with elevated lead levels.

Adults with Elevated Lead Levels by Ethnicity, Missouri 2014



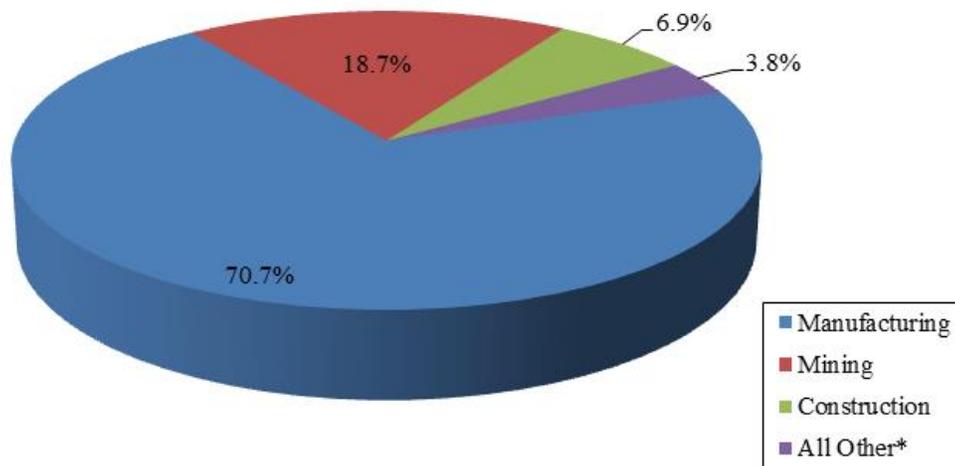
Lead battery manufacturing, mining, smelting, and other related industries are an important part of Missouri's economic base. Some of the world's largest known lead deposits are located in Missouri, and mining has been ongoing since the 1700s. While lead is a great economic resource, lead in the

human body is a health hazard. Missouri's largest lead industries provide community education and services, and test their employees according to OSHA requirements. These companies also cooperate in providing demographic information to aid the MO ABLES program in data collection.

Of the 2,693 individual records with BLLs >10 µg/dL drawn in 2014, 2,639 (98.0%) were known to be work related. All but one of these work-related records were assigned a 2002 North American Industry Classification System (NAICS) code based upon the type of employment of the worker. One individual's elevated BLL was believed to be work related, but information on the type of employment or industry was unknown. A worker's place of employment was assumed to be their source of exposure unless other source information, such as an exposure due to a hobby, was received.

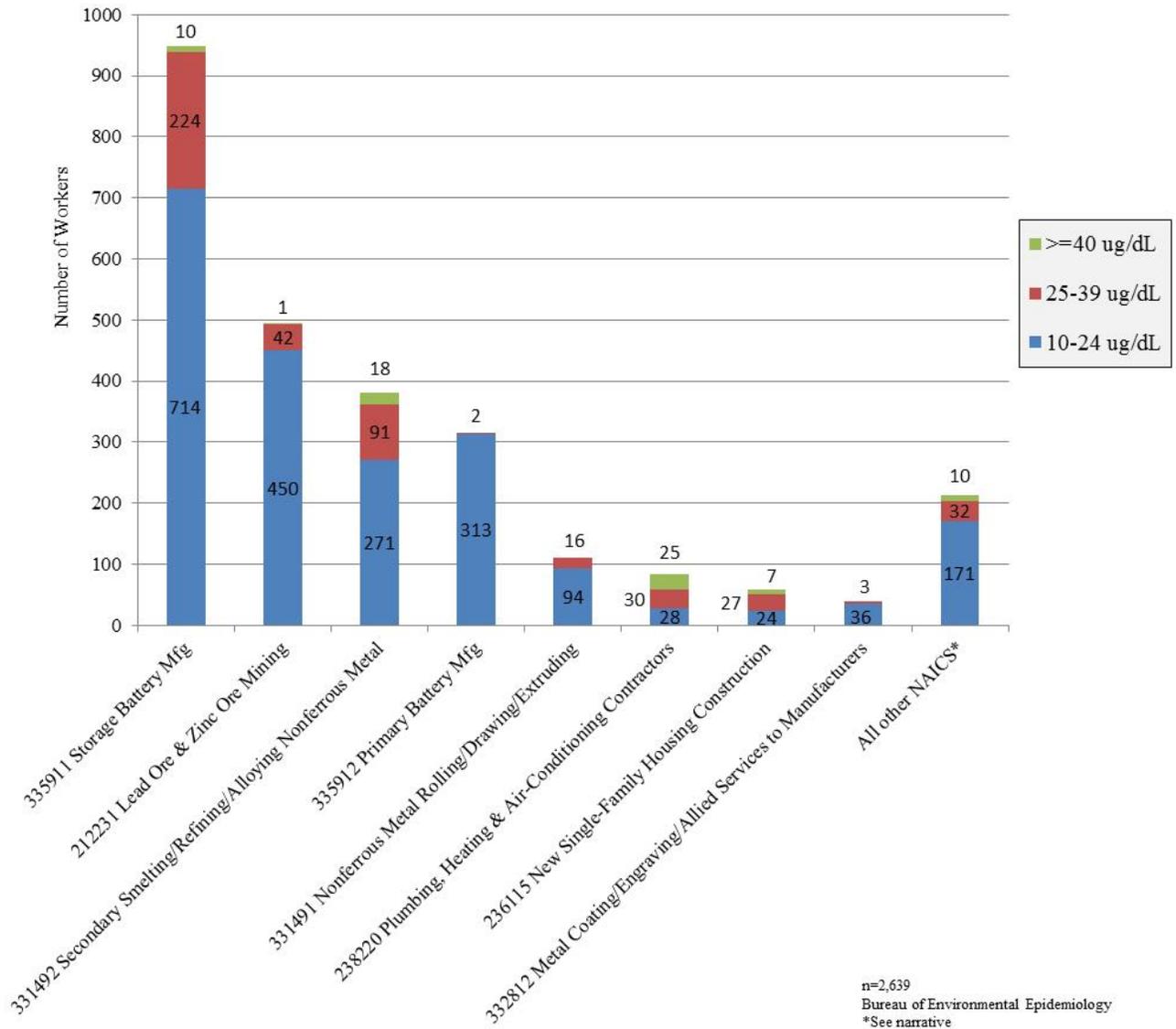
The majority of adults reported to MO ABLES in 2014 with elevated lead levels worked in manufacturing (1,866, 70.7%), including storage and primary battery manufacturing, secondary smelting, and nonferrous metal rolling, drawing and extruding. Workers were also employed in mining (493, 18.7%) and construction (181, 6.9%). Construction activities included plumbing, painting, highway/bridge construction, and housing construction. Other industry sectors reported with elevated workers included: Arts, Entertainment and Recreation (22, .8%); Automotive Repair & Maintenance (16, .6%); Administrative Support and Waste Management and Remediation Services (15, .6%); Health Care and Social Assistance (13, .5%); Wholesale Trade (12, .5%); and six others with fewer than eight elevated workers in each (21, .8%).

Workers with Elevated Lead Levels by Industry Sector, Missouri 2014



n=2,639
Bureau of Environmental Epidemiology
*See narrative

Workers with Elevated Lead Levels by NAICS, Missouri 2014

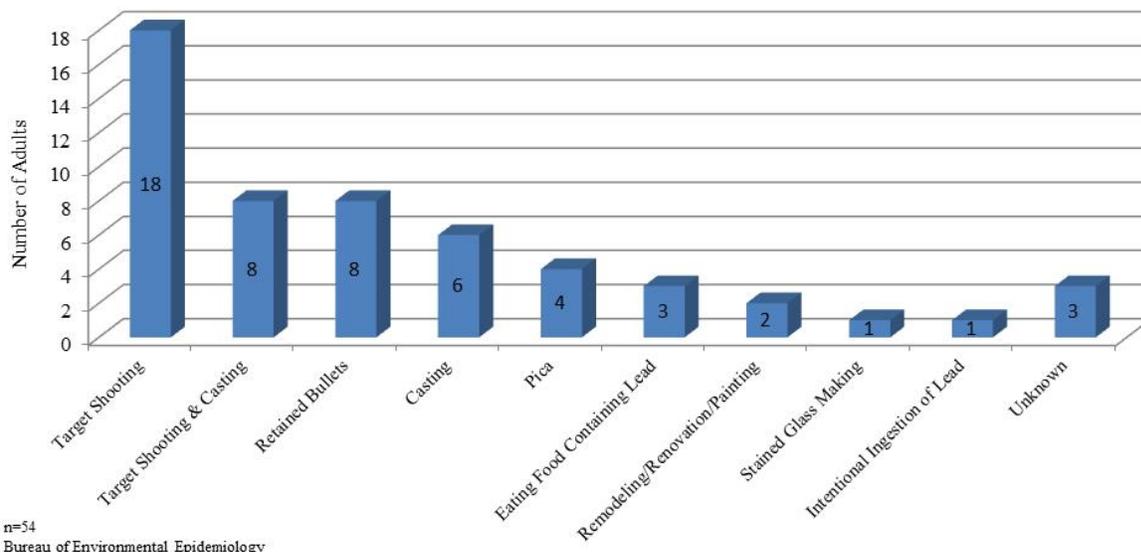


Workers with Elevated Blood Lead Levels by North American Industry Classification System (NAICS), Missouri 2014

Industry Sector	NAICS	NAICS Title	Number of Workers Elevated ≥ 10 $\mu\text{g/dL}$
Manufacturing	335911	Storage Battery Manufacturing	948
Mining	212231	Lead Ore and Zinc Ore Mining	493
Manufacturing	331492	Secondary Smelting, Refining, and Alloying of Nonferrous Metal (except Copper and Aluminum)	380
Manufacturing	335912	Primary Battery Manufacturing	315
Manufacturing	331491	Nonferrous Metal (except Copper and Aluminum) Rolling, Drawing and Extruding	110
Construction	238220	Plumbing, Heating, and Air-Conditioning Contractors	83
Construction	236115	New Single-Family Housing Construction (except Operative Builders)	58
Manufacturing	332812	Metal Coating, Engraving (except Jewelry and Silverware), and Allied Services to Manufacturers	39
Manufacturing	332992	Small Arms Ammunition Manufacturing	23
Arts, Entertainment & Recreation	713990	All Other Amusement and Recreation Industries	22
Manufacturing	331528	Other Nonferrous Foundries (except Die-Casting)	21
Construction	238320	Painting and Wall Covering Contractors	13
Wholesale Trade	423930	Recyclable Material Merchant Wholesalers	11
Manufacturing	336399	All Other Motor Vehicle Parts Manufacturing	10
	All other NAICS (<10 workers in each of 39 codes) and 1 with unknown NAICS		113
Total with NAICS			2,639

There were 54 records (2.0% of 2,693) for elevated adults who had only non-occupational sources of lead exposure. These included target shooting (18 or 33.3% of 54), both target shooting and casting of bullets or fishing weights (8, 14.8%), retained bullets/shrapnel lodged in body (8, 14.8%), only casting bullets or fishing weights (6, 11.1%), pica (4, 7.4%), eating foods containing lead (3, 5.6%), non-occupational remodeling, renovating or painting (2, 3.7%); making stained glass (1, 1.9%), and the intentional ingestion of lead (1, 1.9%). There were three (5.6%) non-occupational lead elevations for which exposure activity was unknown.

Adults with Elevated Lead Levels by Non-Occupational Source of Exposure, Missouri 2014



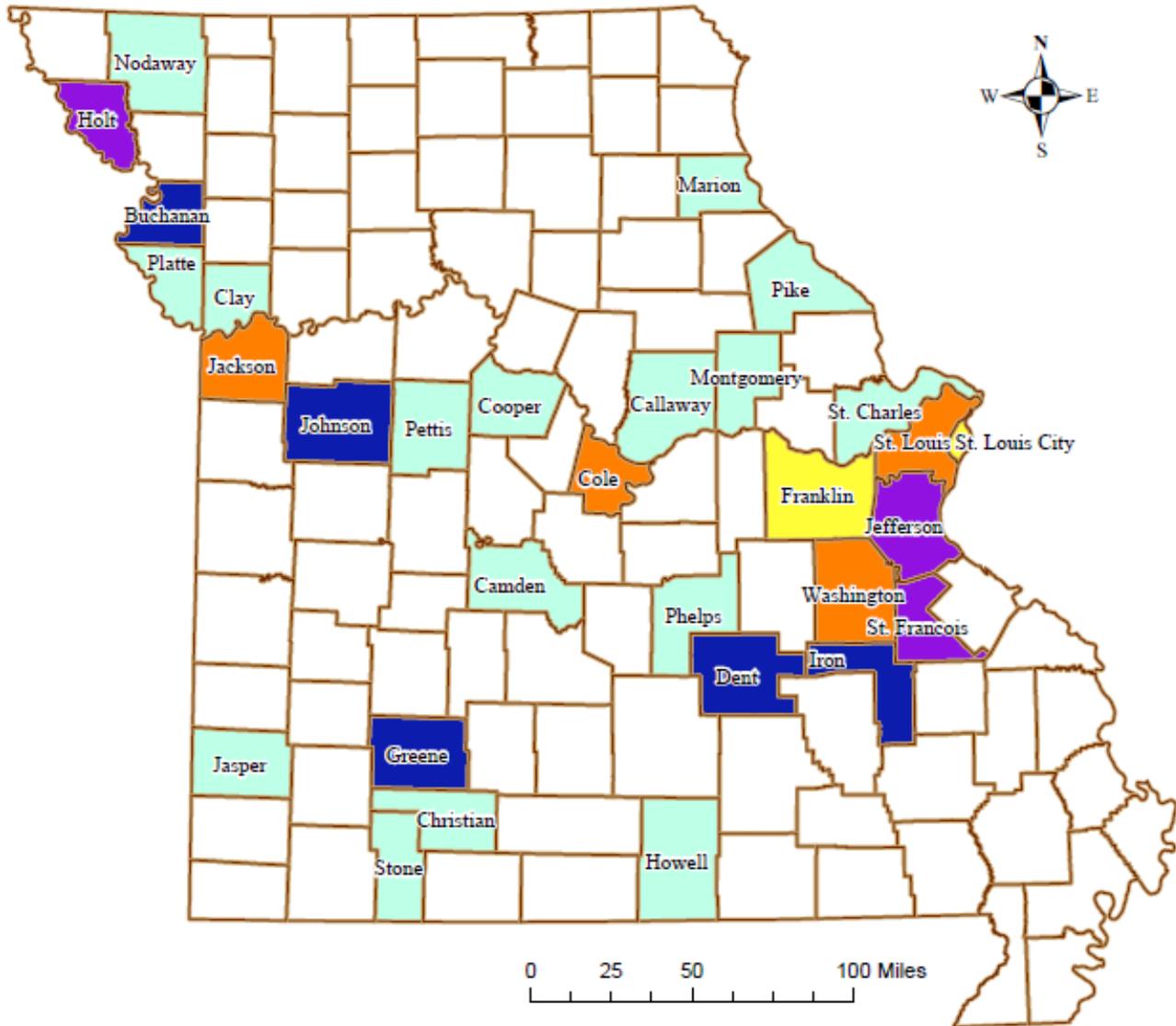
There were 13 individuals who had both work-related and non-work-related lead overexposures in 2014. Almost all of these (11, 84.6%) were people who had both employment and a hobby that involved firearms or ammunition.

Source of lead exposure information could not be obtained on four Missouri adults (<.1% of 2,693) with lead levels $\geq 10 \mu\text{g/dL}$. Three of these are known to be not occupational (but exposure activity was unknown) and one was thought to be occupational but type of employment was unknown. The range for these four tests was from 10 to 27 $\mu\text{g/dL}$.

The MO ABLES database includes BLL testing of all Missouri adults even if their place of employment is out of state. Of the 2,639 occupationally exposed adults in 2014, there were 206 elevated Missourians who were employed in another state. These were Kansas (148), Illinois (21), Iowa (17), Florida (5), Nebraska (4), Wisconsin (3), two each in Ohio and Texas, and one each in Alabama, Idaho, New Mexico, and Pennsylvania. There were 22 workers (<1% of 2,639) for whom industry is known, but the address of employment is unknown. There were 2,411 (91.4%) workers who were known to both live and work in Missouri, representing 82 Missouri companies.



Elevated Blood Lead Levels by County of Employment, Missouri 2014



Number of Workers with Elevated Blood Lead Levels



A total of 2,639 workers had elevated blood lead levels of 10 micrograms of lead per deciliter of blood ($\mu\text{g}/\text{dL}$) or greater. There were 206 workers employed outside of Missouri, including 148 in Kansas. A county of employment was not known for 22 workers.

Workers with Elevated Lead Levels by County of Employment, Missouri 2014

County of Employment	Number of Workers ≥10 µg/dL	Percent of Total
Johnson	414	15.7%
Iron	403	15.3%
Dent	393	14.9%
Greene	386	14.6%
Buchanan	319	12.1%
Jefferson	133	5.0%
Holt	101	3.8%
St. Francois	77	2.9%
Washington	46	1.7%
Jackson	44	1.7%
St. Louis County	31	1.2%
Cole	11	.4%
All other Missouri counties (<10 each)	53	2.0%
Non-Missouri counties	206	7.8%
Unknown	22	7.8%
Total	2,639	100.0%

There were 30 Missouri counties where at least one elevated Missourian worked in 2014. However, 2,149 (81.4%) occupationally elevated adults worked in only seven counties, reflecting the concentration of lead industries in these areas.

National ABLES reporting benchmarks in the past have included BLLs ≥ 25 µg/dL and ≥ 40 µg/dL. Overall, U.S. prevalence rates of lead levels ≥ 25 µg/dL declined from 14.0 per 100,000 employed adults in 1994 to 5.7 per 100,000 employed adults in 2012, the most recent year available for national data.

Prevalence rates for Missouri were calculated for 2014 for BLL concentrations of ≥ 10 µg/dL, ≥ 25 µg/dL, and ≥ 40 µg/dL. Rate numerators were all Missouri resident adults with elevated lead levels, whether occupational, non-occupational or from an unknown source. The denominator used was 2,871,221, the average employed Missouri population aged ≥ 16 years for 2014 from the U.S. Department of Labor, Bureau of Labor Statistics. Trends of annual prevalence rates of elevated BLLs for Missouri and the U.S. are available on the state Environmental Public Health Tracking ([EPHT](#)) Occupational Health Indicators website.

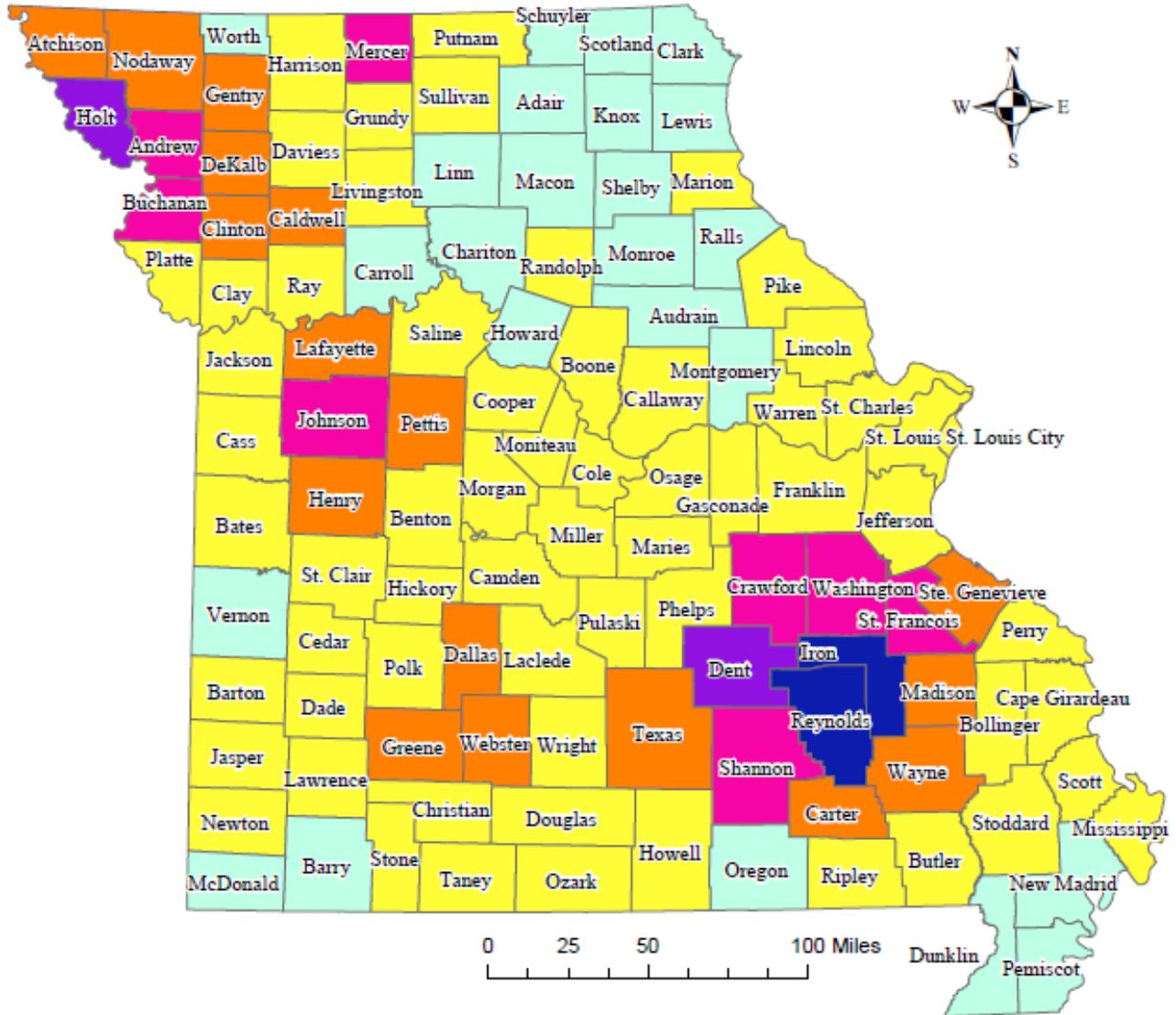
Prevalence Rates of Elevated Lead Levels, Missouri 2014

Blood Lead Levels ≥10 µg/dL		Blood Lead Levels ≥25 µg/dL		Blood Lead Levels ≥40 µg/dL	
Number Elevated	Rate per 100,000	Number Elevated	Rate per 100,000	Number Elevated	Rate per 100,000
2,693	93.8	550	19.2	73	2.5

Prevalence rates per 1,000 employed adults for all Missouri counties were also calculated for 2014. For these rates, an elevated BLL was defined as a concentration ≥ 10 µg/dL, the lead level of concern for adults at that time. Location used was county of residence. These rates ranged from zero in 24 counties that had no elevated adults to 65.3 per 1,000 adults in Reynolds County.



Statewide Prevalence Rates of Elevated Adult Blood Lead Levels by County of Residence, Missouri 2014



Prevalence Rate Per 1,000 Workers

0.0	5.1 - 15.0
0.1 - 1.0	15.1 - 35.0
1.1 - 5.0	35.1 - 70.0

A total of 2,693 adult Missouri residents had elevated blood lead levels of 10 micrograms of lead per deciliter of blood ($\mu\text{g}/\text{dL}$) or greater.

Last edited: 02/09/2016

Source: Missouri ABLES 2014

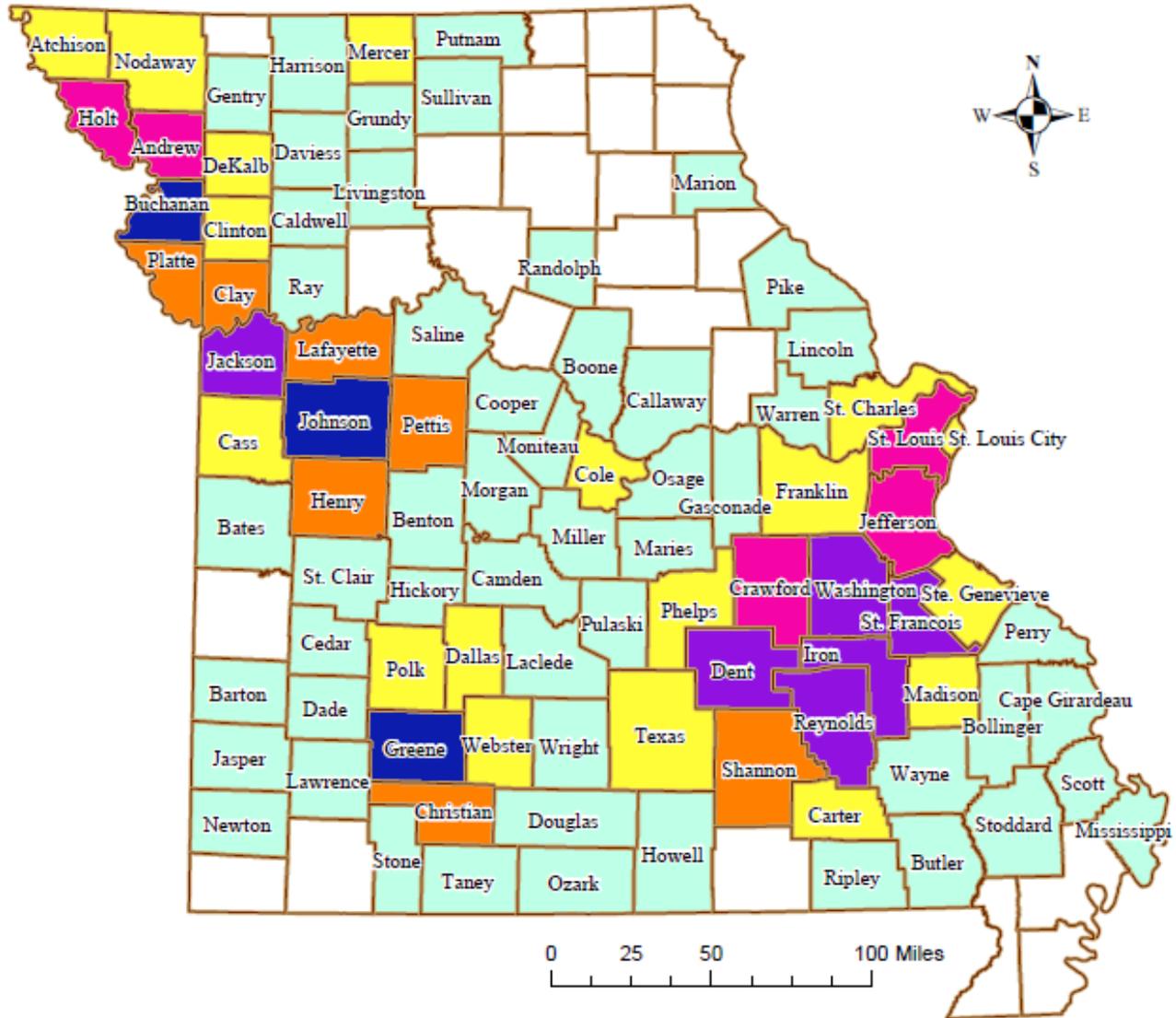
**Ten Counties with Highest Prevalence Rates
of Elevated Lead Levels,
Missouri 2014**

County of Residence	Average Employment	Number Adults ≥10 ug/dL	Rate per 1,000
Reynolds	3,481	162	65.3
Iron	3,555	130	36.6
Dent	5,901	192	32.5
Holt	2,600	54	20.8
Johnson	21,717	312	14.4
Washington	9,625	131	13.6
Shannon	3,114	26	8.3
Crawford	10,144	62	6.1
St. Francois	24,455	147	6.0
Buchanan	44,184	255	5.8

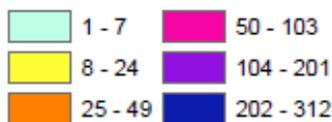
County of residence was known for all of the 2,693 workers with elevated BLLs in 2014. Of the 115 Missouri counties (including the City of St. Louis), there were adults with occupational lead elevations living in 91 counties, illustrating that many workers commute across county boundaries to work.



Elevated Adult Blood Lead Levels by County of Residence, Missouri 2014



Number of Residents with Elevated Blood Lead Levels



A total of 2,693 adult Missouri residents had elevated blood lead levels of 10 micrograms of lead per deciliter of blood ($\mu\text{g}/\text{dL}$) or greater. Prevalence rates were calculated using 2014 average employment data from the U.S. Department of Labor, Bureau of Labor Statistics.

Last edited: 02/09/2016

Source: Missouri ABLES 2014

Although some improvements in the rates of elevated adult lead levels have been seen nationwide and in Missouri, much work is still needed to protect workers from lead over-exposure. Because blood lead testing is often not available or provided to many lead-exposed workers (e.g. the workers may not be tested or their tests may not be reported to the public health department), ABLES data should be considered a low estimate of the true magnitude of elevated adult lead exposures in the United States and Missouri. [Data into Action: NIOSH Blood Lead Surveillance Program Contributes to a Decline in National Prevalence Rates](#)

For more information on the Missouri Adult Blood Lead Epidemiology and Surveillance Program, contact:

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