DEPARTMENT OF HEALTH

2024 Blood Lead Surveillance Report

LEAD AND HEALTHY HOMES PROGRAM

2024 Blood Lead Surveillance Report

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Upon request, this material will be made available in an alternative format such as large print, Braille or audio recording.

Contents

Acronyms and Abbreviations

ABLES	Adult Blood Lead Epidemiology and Surveillance Program
BLIS	Blood Lead Information System
BLL	Blood Lead Level (mcg/dL)
CDC	Centers for Disease Control and Prevention
DHS	Minnesota Department of Human Services
DLI	Minnesota Department of Labor and Industry
EBLL	Elevated Blood Lead Level
EPA	Environmental Protection Agency
EPSDT	Medicaid's Early and Periodic Screening, Diagnosis, and Treatment Program
ESNDC	East Side Neighborhood Development Company
FDA	U.S. Food and Drug Administration
IDEPC	Division of Infectious Disease Epidemiology, Prevention, and Control
IQ	Intelligence Quotient
HUD	U.S. Department of Housing and Urban Development
LHHP	MDH Lead and Healthy Homes Program
M-CLEAN	Minnesota Collaborative Lead Education and Assessment Network
MA	Minnesota Medical Assistance, Minnesota's Medicaid program
mcg/dL	Micrograms of lead per deciliter of whole blood
MDA	Minnesota Department of Agriculture
MDE	Minnesota Department of Education
MDH	Minnesota Department of Health
MEDSS	Minnesota Electronic Disease Surveillance System
MN	Minnesota
MNCare	MinnesotaCare, a public health care program for Minnesotans with low incomes
NIOSH	National Institute for Occupational Safety and Health
ppb	Parts per Billion
SPRCPH	St. Paul-Ramsey County Public Health
U.S.	United States

Executive Summary

This 2024 Blood Lead Surveillance Report describes the activities of the Minnesota Department of Health (MDH) Lead and Healthy Homes Program (LHHP) and the data analysis from the MDH blood lead database for the 2024 calendar year. The annual report contains a description of the trends in lead testing and elevated blood lead levels (EBLLs) in Minnesota. In 2023, the Minnesota Legislature updated the definition of an EBLL to be a blood lead level of at least 3.5 mcg/dL. During 2024, a multidisciplinary workgroup came together to modify MDH's guidelines for follow-up testing and treatment to reflect this change. For the time period of this report, follow-up testing was recommended at 5 mcg/dL and data measures use 5 mcg/dL as a benchmark.

In 2024, about 95,000 Minnesota children received at least one blood lead test. Of these, 736 (under 1%) were found to have an EBLL. This number has been decreasing over the past decades, however, some populations and areas in Minnesota have much higher proportions of EBLLs than others. Childhood blood lead screening in Minnesota has generally improved since 2000. Approximately 82% of children born in 2021 were tested at least once prior to their third birthday in 2024, compared to 42% of those born in 2000. The Childhood Blood Lead Screening Guidelines were updated in late 2022 to recommend universal blood lead testing for all children at ages one and two years. Thus, further improvements in screening rates are anticipated in coming years: just 37% of children born in 2021 received blood lead tests at both one and two years of age.

If a child is detected as potentially having an EBLL (5+ mcg/dL) through a screening test, a diagnostic follow-up test is recommended. In 2024, 74% of children with an elevated screening test received a follow-up test within the recommended time period. Local public health agencies provide case management services, ranging from educational mailings to home visits, to all children with EBLLs. If a child's blood lead level is confirmed to be elevated via a venous blood test, an environmental risk assessment of the child's residence by a licensed risk assessor is mandated. In 2024, there were 493 newly identified children with venous blood lead levels to trigger an environmental risk assessment. Risk assessments identified lead-based paint and lead contaminated dust hazards in the homes of most of these children.

In addition to childhood lead exposure, adults can also be exposed to lead. Most adult lead exposures are occupational. In 2024, 980 Minnesota adults were found to have EBLLs. Common industries where workers were exposed in 2024 included secondary smelting, battery manufacturing, and small arms ammunition manufacturing.

Lead exposure surveillance through the Minnesota Electronic Disease Surveillance System enables the identification and response to lead exposures as well as monitoring of trends and patterns in the population. MDH also contributes to regional and national efforts to formulate strategies for identifying and preventing exposure to lead. MDH currently receives funding from state and federal sources, including funds from the Centers for Disease Control and Prevention (CDC) to support these activities. Ongoing investment is necessary to maintain data collection, entry, analysis, and quality assurance.

Lead Exposure

Although the toxicity of lead has been known for thousands of years, lead remains one of the most common environmental hazards for children. There are many sources of lead exposure, such as soil contaminated from years of leaded gasoline use, lead dust accidentally brought home from parents' workplaces and hobby areas, lead in plumbing, and some imported products and traditional remedies. However, deteriorated lead paint in homes remains the main source of lead exposure for U.S. children today. As lead paint deteriorates, it creates fine dust that is identical in appearance to ordinary house dust. Although lead paint was banned for residential use in 1978, many older homes still contain lead paint. It is estimated that nearly one million homes throughout Minnesota still have lead paint.

Elevated levels of blood lead occurring during the first years of life may not produce symptoms until the children enter school and display learning difficulties, reduction in IQ, or behavior problems.

Children less than six years old are most vulnerable to lead's toxicity due to their growing bodies, nutritional needs, mouthing behavior, and time spent on the floor. Pregnant people and the developing fetus are also at increased risk because lead easily passes through the placenta to the fetus. The changing nutritional needs of the mother may also cause the release of lead stored in bone. Certain populations are also at increased risk of lead exposure. For example, children enrolled in medical assistance programs are more likely to live in old, poorly maintained housing, which is more likely to contain lead paint hazards (CDC, Recommendations for Blood Lead Screening of Medicaid-Eligible Children Aged 1-5 Years: and Updated Approach to Targeting a Group at High Risk, 2009). Refugees arriving in Minnesota have also been found to be at increased risk for EBLLs, potentially due to lead exposure prior to their arrival (Zabel, Smith, & O'Fallon, 2008). Lead exposure is an important environmental justice concern, as it has a disproportionate impact on certain populations.

Lead in Drinking Water

While lead-based paint remains the most common source of lead exposure for children in Minnesota with EBLLs, lead in drinking water is more likely to create a lower-level exposure for a larger population (Zartarian, Xue, Tornero-Velez, & Brown, 2017). Efforts toward reducing lead in drinking water are therefore a means of primary prevention of lead exposure.

Minnesota source waters, including both drinking water wells and surface waters, do not typically contain lead. Lead gets into water when water remains in contact with lead in plumbing materials. The longer water remains in contact with lead materials, the more likely lead will get into water. Plumbing containing lead materials may include lead solder, lead service lines, brass, or other lead pipes. Plumbing installed before 1986 is more likely to have lead components than newer plumbing. MDH provides best practices and guidance for Minnesotans to reduce exposure to lead in drinking water by taking simple actionable steps at Lead in Drinking Water - MN Dept. of Health (https://www.health.state.mn.us/communities/environment/water/contaminants/lead.html).

Public water systems must meet regulations that minimize exposure to lead in water. MDH helps public water systems to meet regulations with the following activities:

- Enforcing the Safe Drinking Water Act Lead and Copper Rule, the 2021 Lead and Copper Rule Revisions, and 2024 Lead and Copper Rule Improvements, found at https://www.epa.gov/ground-water-and-drinking-water/lead-and-copper-rule-improvements
- Maintaining a statewide public inventory of lead service line materials, the Minnesota Service Line Material Tool (https://maps.umn.edu/LSL/)
- Approving public water systems' corrosion control treatment plans to prevent lead from lead service lines and home plumbing components from getting into the water
- Testing public water supplies for lead: water systems must take action to reduce lead when testing shows the presence of lead above 15 parts per billion (ppb) trigger level in more than 10% of their compliance samples. The trigger level will drop to 10 ppb when the Lead and Copper Rule Revisions/Improvements take effect. Community water systems include their lead results in their annual Consumer Confidence Report (https:/mnccr.web.health.state.mn.us/index.faces).
- Providing grants and loans through state and federal funding to water systems to assist with lead service line inventory and replacement Lead Service Line Replacement Program Facts (https://www.health.state.mn.us/communities/environment/water/lslrprogram.html)

Minnesota public schools and childcare centers are also required to test for lead and take action to reduce lead when lead is found in drinking water at 5 ppb or higher. MDH provides education and outreach to these facilities by:

- Providing a Model Plan which tells facilities how to test, remediate, and communicate required actions,
- Offering a voluntary, free, lead in drinking water testing program for eligible schools and all licensed childcare providers, and
- Offering a grant to support remediation activities for schools and childcare centers when lead remediation is required.

Additional information can be found at Drinking Water in Schools, Child Care and Head Start Programs (https://www.health.state.mn.us/communities/environment/water/schools/index.html). An interactive map of lead results at schools and child care centers is available at Results and Metrics (https://www.health.state.mn.us/communities/environment/water/schools/results.html).

Elevated Blood Lead Levels

In May of 2021, the federal Lead Exposure and Prevention Advisory Committee voted in favor of lowering the reference level for an EBLL from 5 micrograms of lead per deciliter whole blood (mcg/dL) to 3.5 mcg/dL, and the updated value was adopted by the CDC. Effective as of July 1, 2023, Minnesota Statutes 144.9501, Subd. 9 was updated to reflect the same change in reference value, from 5 mcg/dL to 3.5 mcg/dL. Minnesota case management guidelines were updated in early 2025 to reflect the lowered reference value. For the 2024 calendar year, health care providers were encouraged to use their discretion to confirm capillary blood lead

levels (BLLs) between 3.5–5 mcg/dL with a venous test if they felt it to be beneficial to their patients. This report reflects the 5 mcg/dL reference level that was observed by most health care providers in 2024.

The reference value is based on the 97.5th percentile of the blood lead distribution among U.S. children ages 1–5 years. CDC acknowledges that the reference value "is a screening tool to identify children with higher levels of lead in their blood compared with most children. The reference value is not health-based and is not a regulatory standard (CDC, Blood Lead Reference Value, 2021)." CDC also recognizes that there is no safe level of exposure to lead, and the effects of lead exposure appear to be irreversible. Therefore, primary prevention, or preventing lead exposure before it can start, is crucial.

Minnesota Statutes 144.9504 mandates environmental interventions for venous blood lead levels of 5 mcg/dL or greater in children less than 18 years old and in pregnant people. For most children and adults exposed to lead, identification and elimination of the source of lead is the primary intervention.

State Blood Lead Guidelines

MDH maintains a set of four guidelines for blood lead:

- Childhood Blood Lead Case Management Guidelines for Minnesota,
- Childhood Blood Lead Screening Guidelines for Minnesota,
- Childhood Blood Lead Clinical Treatment Guidelines for Minnesota, and
- Blood Lead Screening Guidelines for Pregnant & Breastfeeding Women in Minnesota.

These guidelines and their longer accompanying reference manuals are found at MDH Blood Lead Level Guidelines (https://www.health.state.mn.us/communities/environment/lead/prof/guidelines.html). Each of these guidelines was developed based on research and feedback from a multi-disciplinary workgroup. These guidelines are intended to establish standardized practices for screening and testing for lead exposure, and for clinical treatment and public health case management for children and pregnant/breastfeeding people with elevated blood lead levels.

During 2024, MDH convened a workgroup of health care and public health professionals, professional healthcare associations, and other relevant partners to revise the both the case management and treatment guidelines. Revisions to these guidelines, as well as small updates the Childhood Blood Lead Screening Guidelines, were implemented in early 2025. Data presented in this report are based on previous versions of these guidelines that were still in effect in 2024. Some major guideline changes implemented in 2025 include:

- Lowering the reference value for an elevated blood lead level from 5.0 mcg/dL to 3.5 mcg/dL,
- Defining a child as anyone less than 18 years of age for eligibility for public health services,
- Requiring environmental risk assessments for children with blood lead levels of 5.0 mcg/dL or greater on a venous sample, and

- Improving clarity and providing health care providers and case managers with more specific resources to which they can refer families.

Data Collection

Lead Testing

As of December 2022, state guidelines recommend universal blood lead testing for all children in Minnesota at both 12 and 24 months of age. Prior to this, targeted blood lead testing based on established risk factors was the recommendation. Because lead testing was neither universal nor randomly sampled, the historic data in this report are not generalizable to the population of children living in Minnesota. However, a large proportion of Minnesota children have historically been tested at least once prior to their third birthday. Of children born in 2021, 82% were tested at least once by their third birthday in 2024.

The blood specimens used in blood lead testing are drawn from either capillaries or veins. Tests on capillary blood are considered "screening" tests. They are drawn from a finger stick or heel stick, allowing them to be performed in a wide range of settings. While low (non-elevated) tests on capillary blood are considered accurate, Minnesota lead testing data suggest that about 60% of elevated capillary screening tests may be false positives (Wang, Rezania, Haugen, Baertlein, & Yendell, 2019). Therefore, a follow-up diagnostic test is needed to confirm an elevated capillary test. Venous specimens are drawn from a vein and are considered "diagnostic" because they are less prone to false positives than capillary tests, however, they can be more difficult to obtain. Venous tests are required to initiate an environmental investigation of an elevated lead result.

The Minnesota Blood Lead Database

MDH maintains a blood lead database for tracking and monitoring trends in blood lead levels in adults and children in Minnesota. Laboratories submit results to the LHHP, as mandated by Minnesota Statutes 144.9502. These data are used to ensure that environmental and medical follow-up is provided to children with EBLLs and to identify groups with the highest risk of lead exposure. Data are also used to plan, develop, and implement primary prevention programs. Local public health agencies can also access blood lead test results for children in their jurisdictions and communicate with the LHHP about care coordination for children with EBLLs.

Statewide Surveillance Data

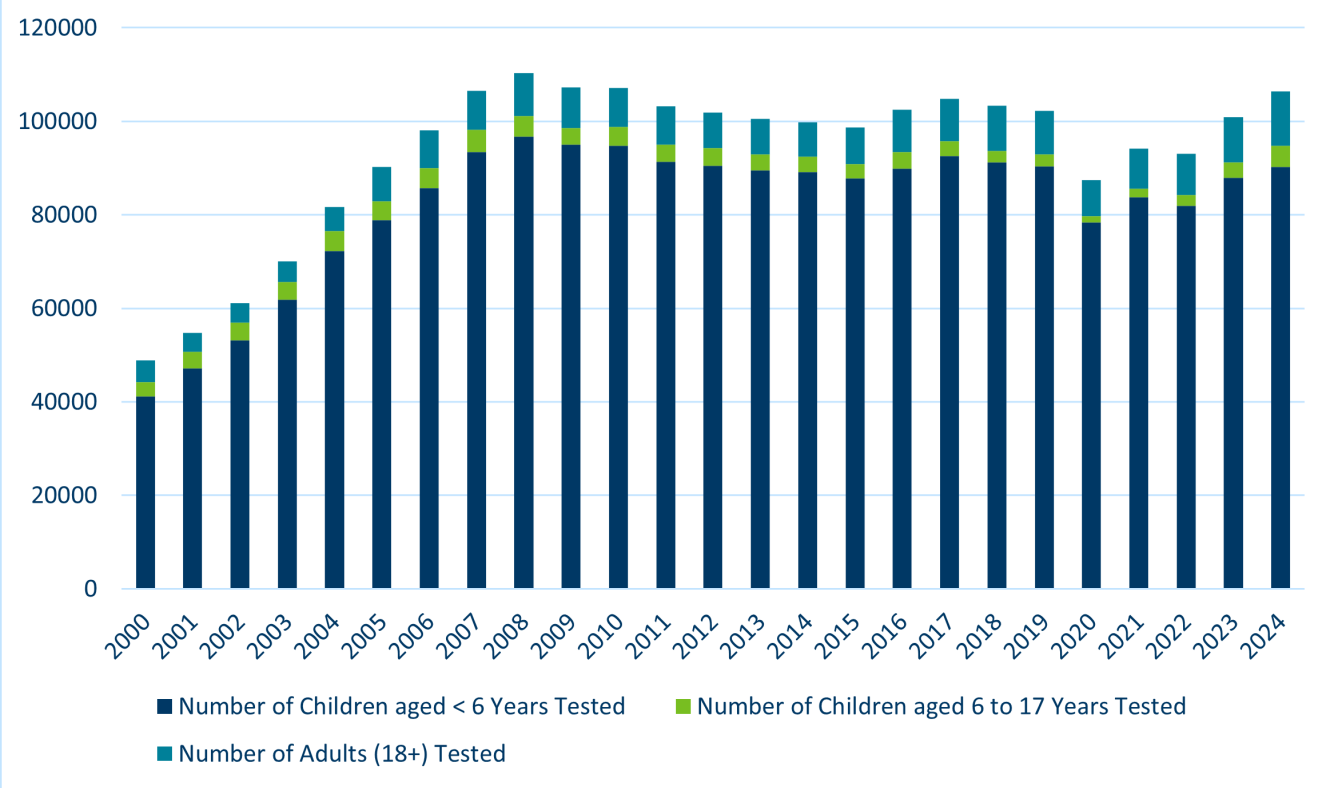
Statewide data are available starting from 1995. Data for years 2000–2023 are shown for historical context. The number of children tested for lead in Minnesota increased steadily from 2000 through 2008, decreased slightly over the next few years, and leveled off around 90,000 children tested annually. The COVID-19 pandemic had a significant impact on testing rates: from 2019 to 2020, there was a 16% drop in testing for children under 6 years. Testing rates recovered slowly, finally reaching pre-COVID rates in 2024. (**Figure 1**).

Blood lead screening for older children (aged 6 to 17 years) and adults is much less common than for young children. Routine screening is not recommended for older children, who tend to only receive blood lead testing if a provider suspects the child may be lead-exposed. Risk

factors for older children include recent immigration to the U.S. and lead-related hobbies. Individuals may also be tested if they appear to be symptomatic. In 2024, 4,564 children aged 6 to 17 years received a blood lead test.

Adults are tested for blood lead primarily if they are pregnant or at risk for occupational lead exposure. In many cases, this testing is part of routine medical monitoring programs implemented by their employers. In 2024, 11,622 adults (aged 18+) received a blood lead test.

Figure 1. Number of Persons Blood Lead Tested by Year and Age Group, Minnesota, 2000–2024



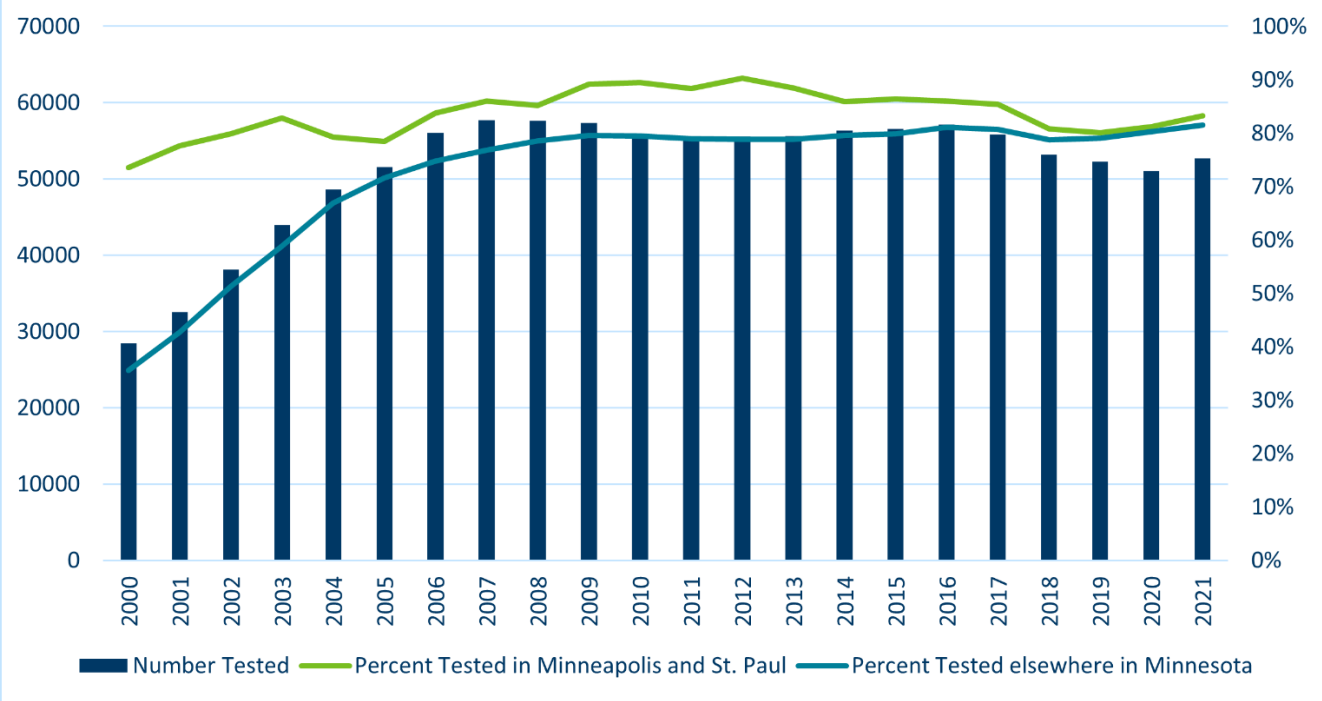
Childhood Blood Lead Screening

While Minnesota's blood lead screening guidelines prior to December 2022 recommended targeted rather than universal screening, the percentage of children tested has generally increased over time. To examine testing rates in children, a birth cohort approach can be useful. This approach looks at all children born in a given year and measures how many of these children receive blood lead screening at specific benchmarks. These benchmarks include the percent of children who receive at least one test by three years of age, the percent who receive a blood lead test around one year of age, the percent tested around two years of age, and the percent tested at both one year and two years of age.

The most recent birth cohort to have been observed for a full three years is children born in 2021. Among the 64,444 children born in 2021, 52,687 children (82%) statewide were tested at least once by age three years. Among children in Minneapolis and St. Paul, where universal

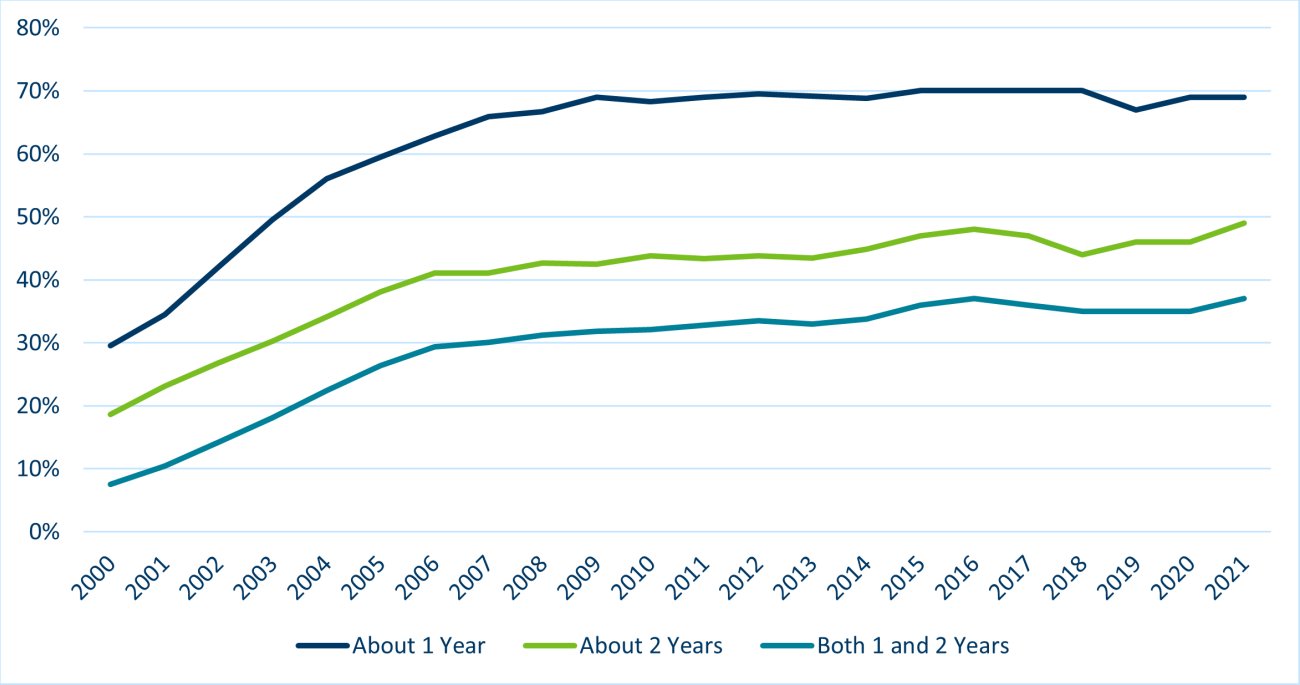
screening has historically been recommended, 83% were tested at least once. Elsewhere in the state, 81% were tested at least once. (**Figure 2**) These percentages have converged in recent years. After a slight decline in testing for children born in 2018 and 2019, likely related to the COVID-19 pandemic, testing increased for children born in 2020 and 2021. The number of births declined during 2016–2020 but increased slightly in 2021. Figure 2 shows that in recent years, the percentage of children tested has increased or remained steady, while the total number of children tested is more reflective of the number of births each year in Minnesota.

Figure 2. Number and Percent of Children Blood Lead Tested at Least Once by Age 3 Years, by Birth Cohort



Within the 2021 birth cohort, while 82% of children were tested at least once by age three, 69% were tested around one year of age (9 to 18 months), 49% were tested around two years of age (18 to 36 months), and only 37% were tested at both one and two years of age (**Figure 3**).

Figure 3. Children Tested at 1 Year and 2 Years of Age, by Birth Year



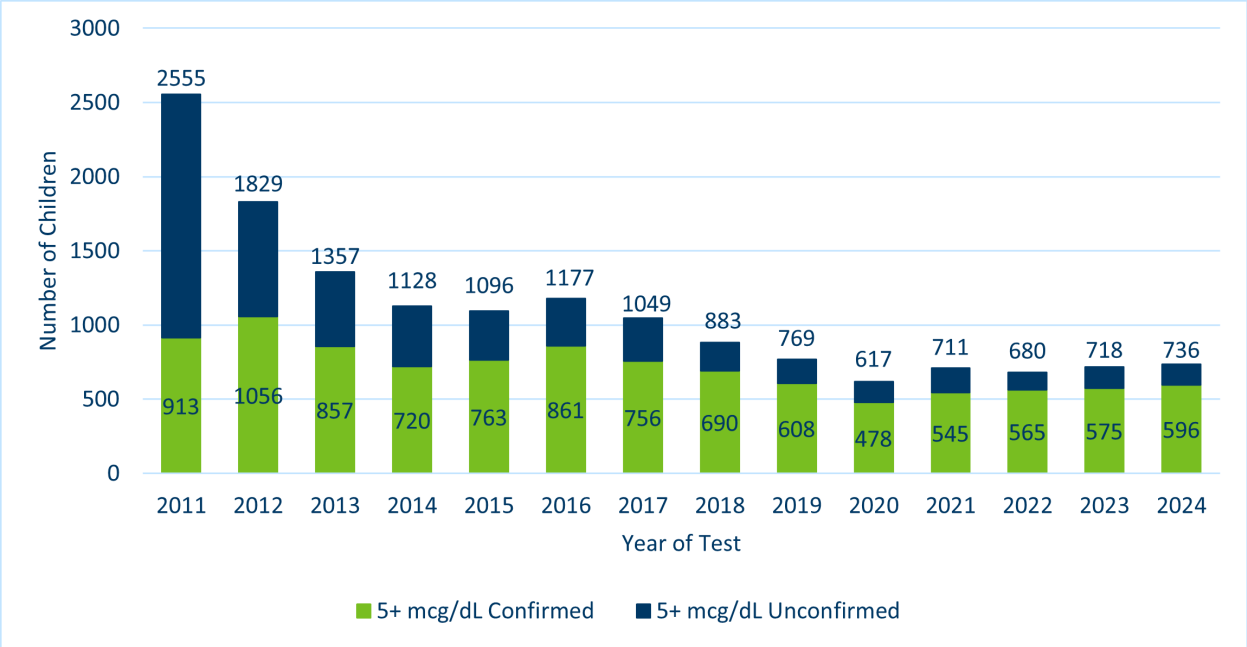
Two-year-old children are more mobile and interact with their environments differently than one-year-old children. This can change the risk for lead exposure between these ages, even if the child's house or other risk factors do not change. This is supported by MDH surveillance data: of children with an EBLL at age two years, 40% were tested and had a non-elevated test at one year of age. Therefore, the practice of not testing children at two years of age may lead to lead-exposed children going undetected.

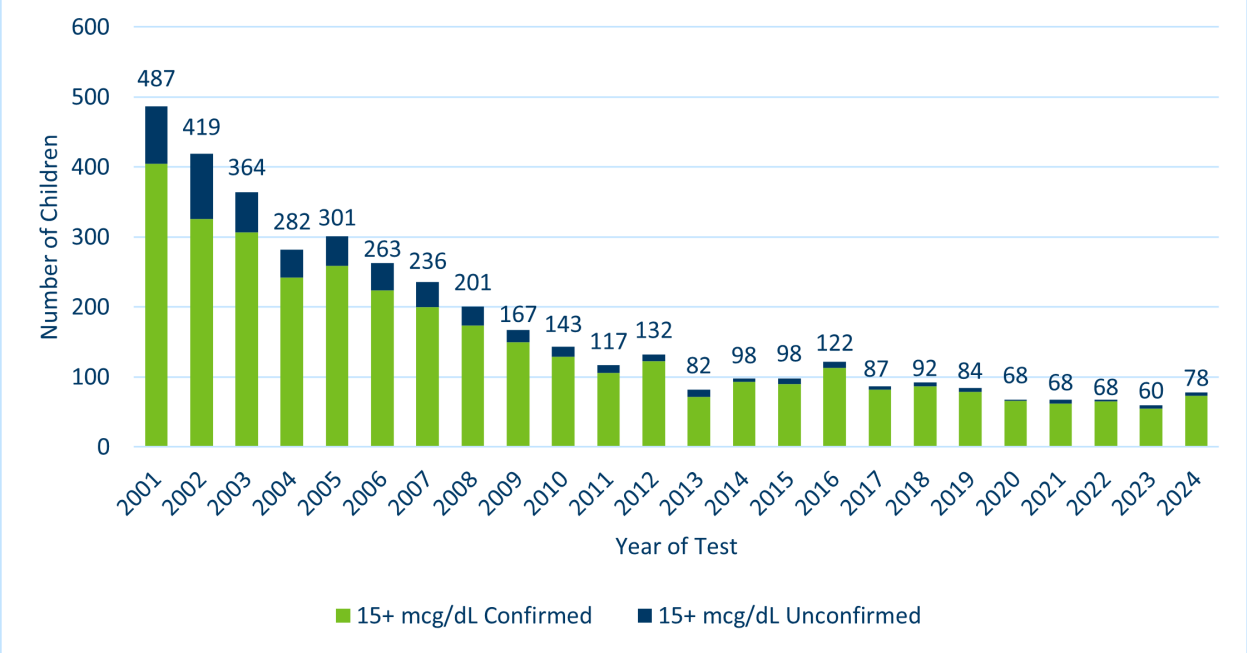
Blood lead screening statistics are available by county at the MDH Data Access Portal's Childhood Lead Exposure (https://data.web.health.state.mn.us/web/mndata/lead) page.

Elevated Blood Lead Levels in Children

Trends in the prevalence of lead exposure in Minnesota children can be understood by examining trends in the number of children with detected EBLLs per year (**Figure 4**). The number of EBLL cases has continued to decrease in recent years. However, in 2024, there were still 596 Minnesota children who had confirmed blood lead levels of at least 5 mcg/dL, 73 of whom had confirmed blood lead levels of at least 15 mcg/dL. The highest confirmed blood lead level identified in a child from Minnesota in 2024 was 65 mcg/dL.

Figure 4. Number of Children with Confirmed and Unconfirmed Elevated Blood Lead Levels (5+ mcg/dL and 15+ mcg/dL) by Year of Test, 2001–2024

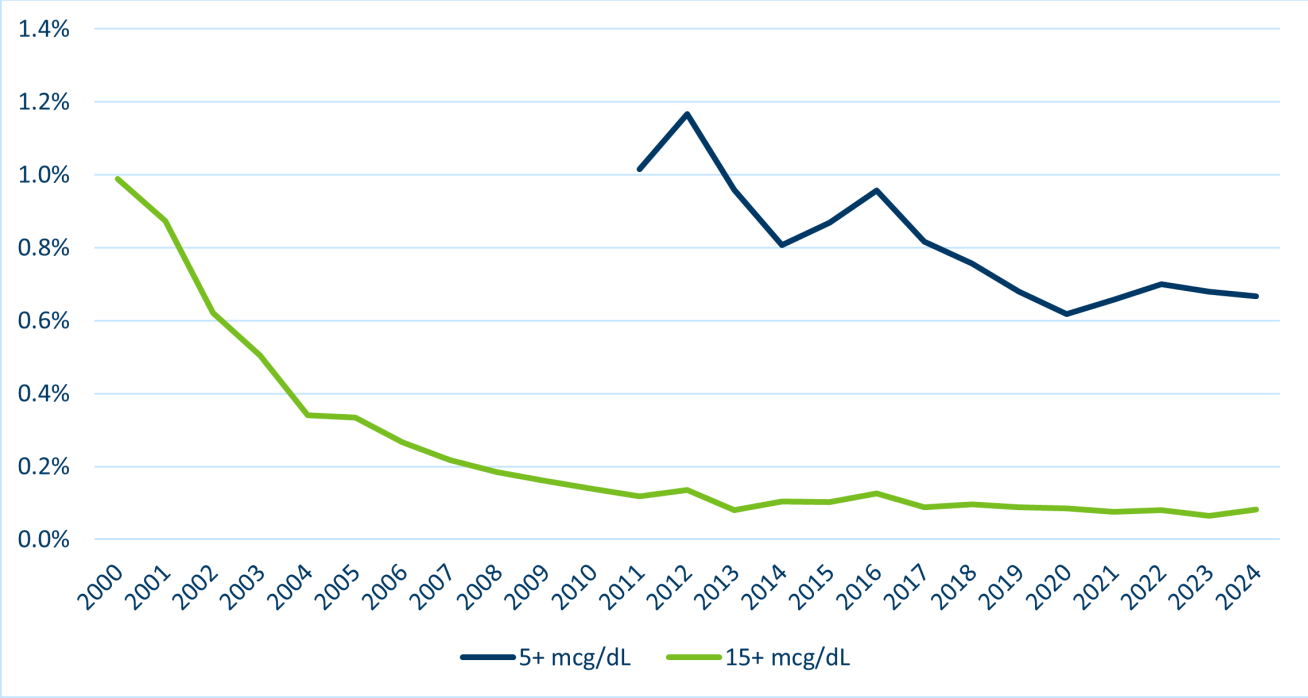




The surveillance definition of a confirmed EBLL is any elevated venous blood lead test result or any elevated capillary blood lead test result followed by a second elevated capillary test within 12 weeks (CDC, Standard Surveillance Definitions and Classifications, 2021). An unconfirmed EBLL is an elevated capillary blood lead test without a follow-up test. Elevated capillary tests that receive a non-elevated venous follow-up test within 12 weeks are excluded since these are likely to be false positive tests. The true number of children with EBLLs is likely somewhere between the total (confirmed and unconfirmed) count and the confirmed count. In 2024, for

levels 5 mcg/dL or greater, this would be somewhere between 596 and 736. In 2024, 89,477 children were blood lead tested and 596 (0.7%) had a confirmed EBLL of 5 mcg/dL or greater while 73 (0.1%) had a confirmed EBLL of 15 mcg/dL or greater (**Figure 5**).

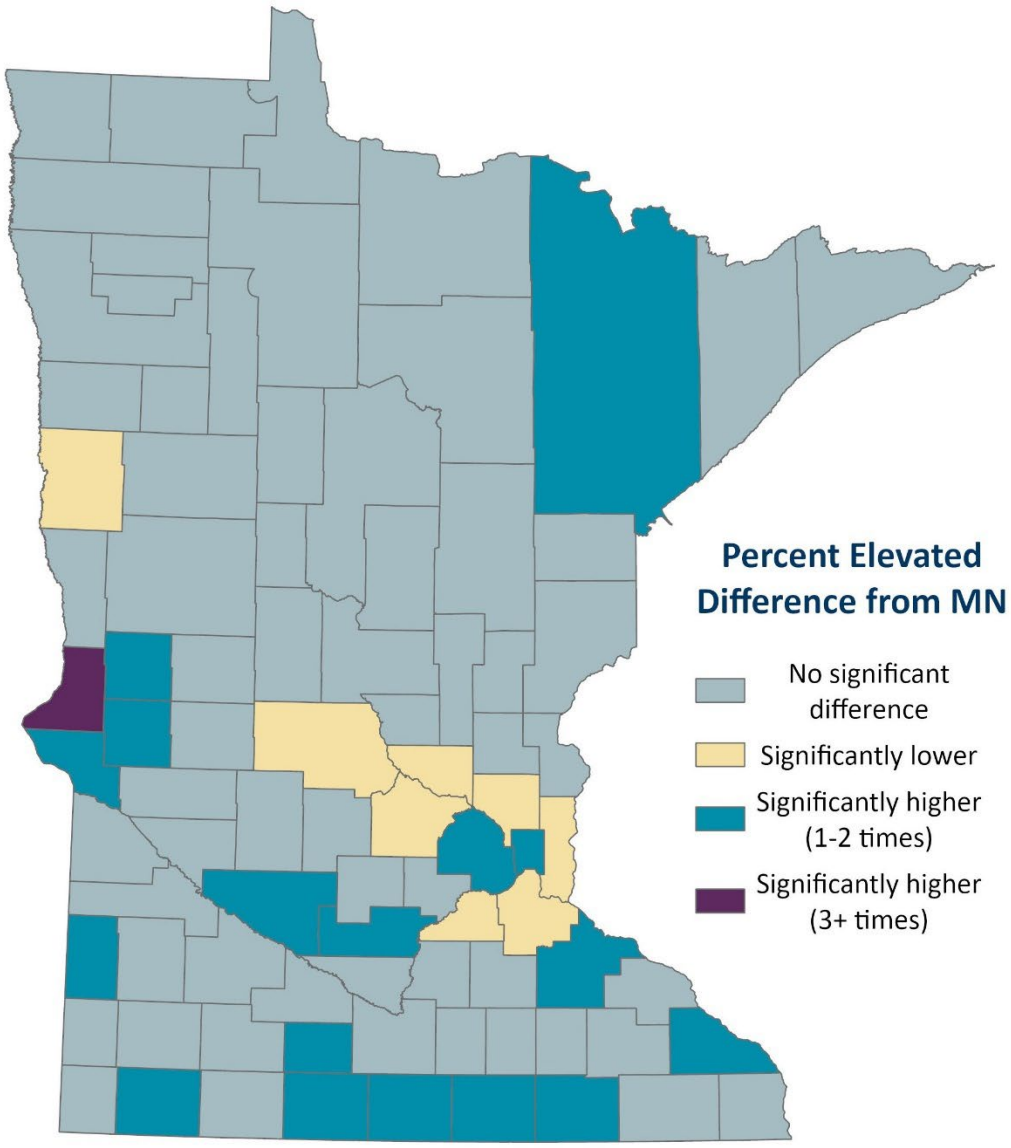
Figure 5. Percent of Children with Confirmed Elevated Blood Lead Levels by Year, Among Tested Children, 2000–2024



Geographic Variability in Elevated Blood Lead Levels

While the percent of children with EBLLs among tested children has declined statewide, there remain geographic areas where higher percentages of children are found to have EBLLs. To estimate the percent EBLL at county and sub-county geographic scales, blood lead testing data for three birth cohort years (2019–2021) were compiled to increase estimate precision. Statewide, the percentage of children tested with a confirmed EBLL was 0.7%. At the county level, the percentage of children tested with confirmed EBLLs ranged from 0% to 6.6%. Counties with EBLL rates that were statistically significantly higher than the statewide percent EBLL were mostly found in the southern half of the state and included Ramsey and Hennepin Counties. Counties surrounding Ramsey and Hennepin Counties tended to have EBLL rates that were statistically lower than the statewide percent EBLL. (**Figure 6)**

Figure 6. Elevated Blood Lead Levels (5+ mcg/dL) by County, Among Children Born 2019–2021



The majority of high percent-EBLL census tracts are found in the cities of Minneapolis and St. Paul, but can also be found in rural areas of the state. Tracts with a higher percentage of EBLLs tend to have more houses built prior to 1950, a larger proportion of the population living in poverty, and a larger proportion of the population being persons of color than tracts with a lower percentage of EBLLs.

Additional county-level and tract-level data regarding blood lead testing and the distribution of EBLLs among Minnesota children are available on the MDH Data Access Portal's Childhood Lead Exposure (https://data.web.health.state.mn.us/web/mndata/lead) page.

Demographics

The demographic indicators sex, race and ethnicity are collected by MDH with blood lead test results. While the reporting of sex and race with the results of a blood lead test is required under Minnesota Statutes 144.9502, MDH accepts records where these are reported as "Unknown." Data on sex tend to be mostly complete; race and ethnicity are often reported as "Unknown." This limits assessment of racial disparities in lead testing and lead exposure.

In 2024, blood lead test results for children aged less than six years were reported for 46,033 males, 43,421 females, and 23 persons for whom sex was not reported. The percentage of confirmed EBLLs was not significantly different between males and females **(Table 1)**.

Table 1. Summary of the Reported Demographic Characteristics of Children Aged < 6 Years Blood Lead Tested in 2024 and EBLL Cases (Confirmed ≥ 5 mcg/dL)

Demographic: Sex	Tested, n (%)	EBLL Cases, n	Percent EBLL
Female	43,421 (49%)	264	0.6%
Male	46,033 (51%)	332	0.7%
Unknown	23 (0%)	0	0%

Racial and ethnic disparities in the prevalence of lead poisoning have been shown in national data. A summary of 1999–2016 data from the National Health and Nutrition Examination Survey for U.S. children aged 1–5 years compared geometric mean BLLs among non-Hispanic Black children and non-Hispanic White children. While lead levels have been declining for all racial/ethnic groups over time, non-Hispanic Black children continue to show higher BLLs than non-Hispanic White children (Teye, et al., 2021). The gap has been declining over time, but continues to be statistically significant.

Individual race and ethnicity data reported with blood lead tests is too incomplete to provide reliable estimates of racial and ethnic disparities in Minnesota, but the LHHP is working to improve data completeness (see *Evaluation of data and LHHP* section of this report).

Special Populations: Medicaid Enrolled Children

Nationally, children enrolled in Medicaid are more than twice as likely to have EBLLs as non-enrolled children (CDC, Blood Lead Levels in Children Aged 1-5 Years - United States, 1999-2010, 2013). However, this disparity may vary by state and the CDC has recommended that states develop screening plans consistent with their local risk patterns. A study of Minnesota blood lead surveillance data indicates that the disparity in EBLL prevalence between children enrolled in Minnesota's Medicaid programs – Medical Assistance (MA) and MinnesotaCare (MNCare) – and those not enrolled parallels the national disparity: of Minnesota children tested in 2022, 1.4% of children who had been enrolled in Medicaid had an EBLL, compared to 0.6% of non-enrolled children**.**

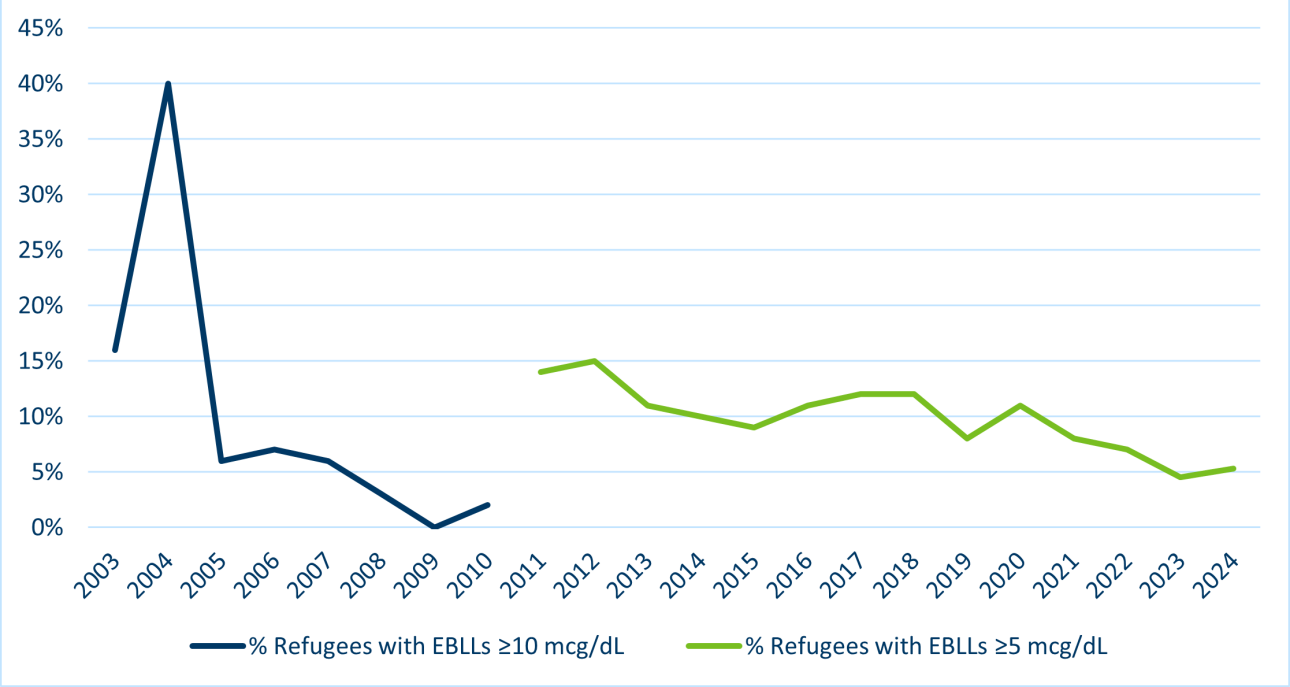
MA and MNCare's Early and Periodic Screening, Diagnosis, and Treatment (EPSDT) program requires that well-child visits include blood lead testing at both 12 and 24 months, however, compliance rates are unclear. The MDH LHHP and the Minnesota Department of Human

Services (DHS) have established a data sharing agreement to improve surveillance of blood lead screening and blood lead levels in the Medicaid-enrolled child population. The LHHP matches claims for blood lead tests completed for Medicaid-enrolled children to tests in the blood lead database biannually. For claims that cannot be matched to blood lead tests in the database, LHHP staff contact health care facilities to recover unreported results or determine other reasons why a billed test was not reported. The LHHP has also begun to identify missed opportunities for blood lead testing in Medicaid-enrolled children – instances in which enrolled children visited a primary care provider around ages 12 or 24 months but did not receive a blood lead test. These data, along with other blood lead testing and outcome metrics, are shared with providers and clinics in efforts to improve testing and follow-up rates.

Special Populations: Refugee Children

Refugees are persons who are forced to leave their home country because of disasters, war, or persecution. Refugees come to Minnesota with a special immigration status and may be at high risk for lead exposure in their country of origin as well as further exposure once they arrive in the United States. The percentage of EBLLs for refugees who receive a blood lead test is seven times higher than the percentage of EBLLs among Minnesota children in general (**Figure 7**). The Division of Infectious Disease Epidemiology, Prevention, and Control (IDEPC) at MDH collects demographic data on refugee children aged under 17 years entering the state who receive an initial health screening. The LHHP and IDEPC work together to match blood lead tests to refugee information and provide resources and prompt follow-up for refugees with elevated results.

Figure 7. Elevated Blood Lead Levels (EBLLs) among Refugee Children who Received a Blood Lead Test



Case Management

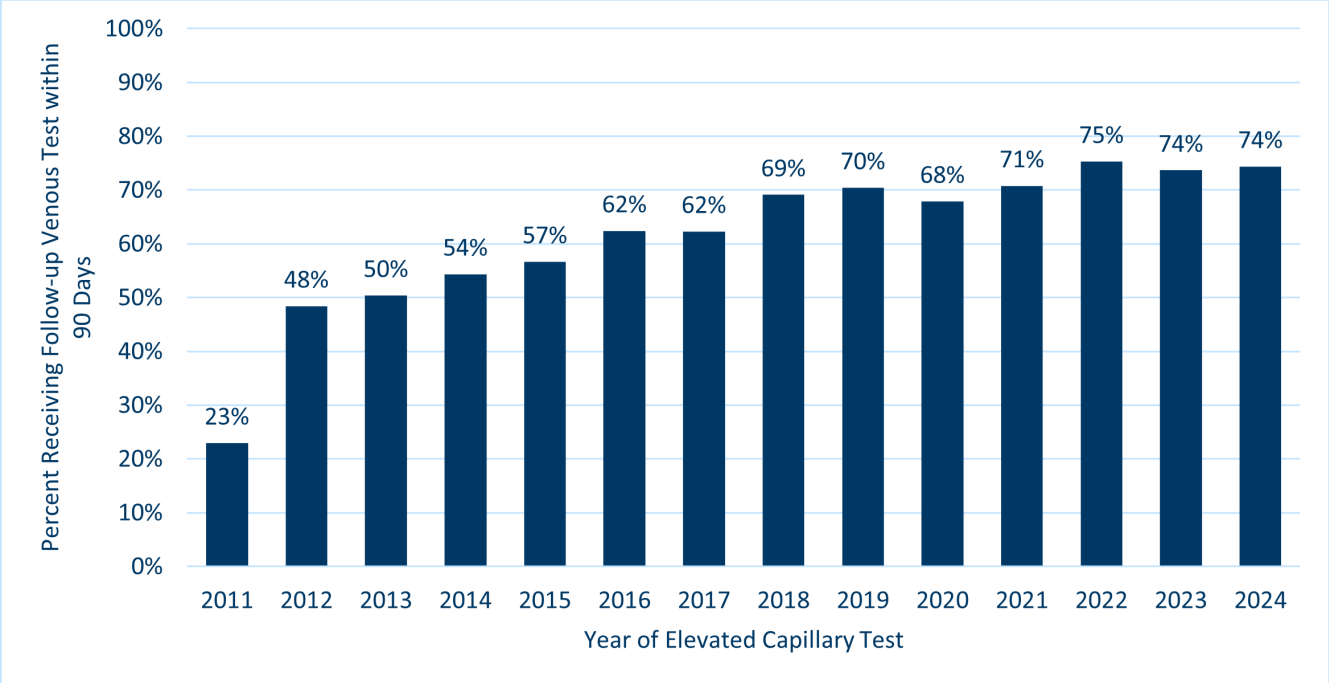
The LHHP provides technical assistance and coordinates with local public health agencies in the state of Minnesota to ensure case management services are available for children with blood lead levels greater than or equal to 5 mcg/dL. These activities include:

- Assuring case management activities and follow-up testing for children and pregnant people are performed in accordance with MDH guidelines,
- Providing educational materials in appropriate languages, to assist in communicating actions to prevent lead exposure,
- Coordinating communication and case management activities between health care providers and local lead case managers,
- Regular communication with lead risk assessors to assess progress on open lead cases and serving as a liaison between the lead risk assessors and local lead case managers.

Follow-up Testing

MDH recommends follow-up tests for children with elevated blood lead screening tests. The period of time recommended for re-testing varies according to the initial blood level and the test type. Diagnostic venous testing is recommended for all capillary results of 5 mcg/dL or greater. Of the 749 Minnesota children whose first EBLL was a capillary test in 2024, 557 (74%) received a follow-up venous test within 90 days (**Figure 8**). This is a significant improvement over 2011, the first year in which follow-up venous testing for capillary results in the 5–9.9 mcg/dL range was recommended, when just 23% received follow-up tests within 90 days.

Figure 8. Percent of Children with Initial Capillary Tests ≥ 5 mcg/dL Receiving a Follow-up Venous Test within 90 Days



Timely follow-up testing is important both for identifying cases so that public health responses can be initiated as well as detecting false-positive screening tests. Capillary tests, typically used for blood lead screening, are prone to false positive results. This can be due to contamination on a child's finger or other contamination during the testing and analysis process. A false positive test is defined as an elevated capillary test with a follow-up venous test result below 5 mcg/dL within 90 days. In 2024, 348 (59%) of the 587 initial elevated capillary tests that received a venous follow-up test within 90 days were false positives. This proportion is dependent on the prevalence of EBLLs in the population and is expected to increase as the prevalence decreases.

Healthcare providers can help prevent false positive capillary tests by thoroughly cleaning a child's finger prior to conducting a capillary test to remove any surface lead contamination. This should include thoroughly washing the child's hand with soap and water before drawing blood, wearing gloves, and blotting/discarding the initial drop of blood (CDC, Steps for Collecting Fingerstick Blood Samples in Micro-Vials for Lead Testing, 2021).

Environmental Risk Assessments

For children found to have an EBLL, identifying and removing the source of lead exposure is a priority. Not only does this prevent further exposure to the child who has already been exposed, it also prevents other children from being exposed to that lead hazard. Until July 2021, Minnesota Statutes 144.9504 required assessing agencies to ensure that children with venous blood lead levels 15 mcg/dL or greater were provided risk assessment services to limit exposure to lead hazards. Risk assessments are performed by licensed lead risk assessors using documented methodologies.

As of July 1, 2021, changes and language were added to trigger in-home assessments for children up to age 18 with venous BLLs of 5 mcg/dL or greater. The changes additionally broadened the type of properties where lead risk assessments can be conducted and expanded the assessing agency's authority to order the responsible party to perform lead hazard reductions. Agencies currently performing assessments in Minnesota are MDH, the City of Minneapolis Health Department and St. Paul-Ramsey County Public Health. MDH conducts risk assessments for other assessing agencies outside of Minneapolis and Ramsey County through contractual agreements.

In 2024, there were 493 newly identified children with venous confirmed EBLLs ≥ 5 mcg/dL. Of these children, 101 lived in Minneapolis, 121 lived in Ramsey County, and 271 lived elsewhere in Minnesota. For the combined assessing agencies in 2024, 30 residences included multiple children with newly identified venous EBLLs. In total there were 445 families contacted for 493 qualifying children. In some cases in which the child split time among residences, risk assessments were completed at multiple properties. For clarity, the following summary is presented in terms of children rather than residences.

Of the 493 qualifying children, 170 (34%) children received a lead risk assessment within 10 working days of the blood lead test being reported to MDH and 361 (73%) received an assessment within 60 working days. The median number of working days between the EBLL being reported to MDH and the risk assessment was 13 days. Twenty-five of the outstanding 132 children received environmental risks assessments after 60 working days; risk assessments

were not completed for 3 children whose siblings had received assessments at the current address in the previous year. For the remaining 104 children, contact could not be established or families declined to have a risk assessment performed.

Lead hazards were identified through environmental testing for 281 of the 386 (73%) children who received risk assessments, and many assessments identified multiple hazards. Lead-based paint and/or lead-contaminated indoor dust was identified as a possible source of lead exposure for 258 children. Indoor dust is commonly contaminated by deteriorating lead-based paint in the house, and is the main source of lead exposure for children in Minnesota. Laboratory analysis of soil samples identified lead soil hazards for 135 children; all but five also had paint/dust hazards identified during their assessments. Other sources of lead were identified in 24 assessments, including spices, parents' work clothes, pottery/cookware, and sidewalk chalk. Take-home lead was confirmed as the source of exposure for 8 children and suspected for 4 additional children. Take-home lead occurs when lead dust is tracked home from the workplace or hobby of a household member.

Not all types of potential hazards are tested during every risk assessment. For example, soil was not tested if there was no bare soil the child could have been exposed to or if snow coverage did not allow for soil sampling. The figures presented in **Table 2**, interpreted as 'ballpark' estimates, show that lead based paint and/or dust hazards are tested for most children (100% in this sample), and these hazards have traditionally been present for most children who receive an environmental risk assessment (259 of 386, 67%). Soil hazards are tested less frequently, with results reported for 254 of 386 (66%) children, but are often identified when soil is tested (identified for 135 children among 254 assessed, 53%). Other hazards are tested less regularly, but have been increasingly tested in recent years. In 2023, other sources of lead were tested for 86 (22%) of children who received a risk assessment.

Table 2. Lead Hazards Assessed and Identified during Lead Risk Assessments for Children, 2024 (n=386)

Lead Hazard Type	Tested	Hazard Identified, n (%)
Lead-based paint and/or lead-contaminated indoor dust	386	259 (67%)
Outdoor contaminated soil	254	135 (53%)
Contaminated drinking water	259	1 (0%)*
Other lead source	86	24 (28%)
Any hazard type	386	281 (73%)
Multiple hazard types†	355	141 (40%)

*Hazards in drinking water are shown in the table according to the EPA action level of 15 ppb. A detectable level of lead was found for 63 children, however, the concentration of lead exceeded 15 ppb for only one of these children.
†Includes paint/indoor dust (as a single type), soil, water, and other.

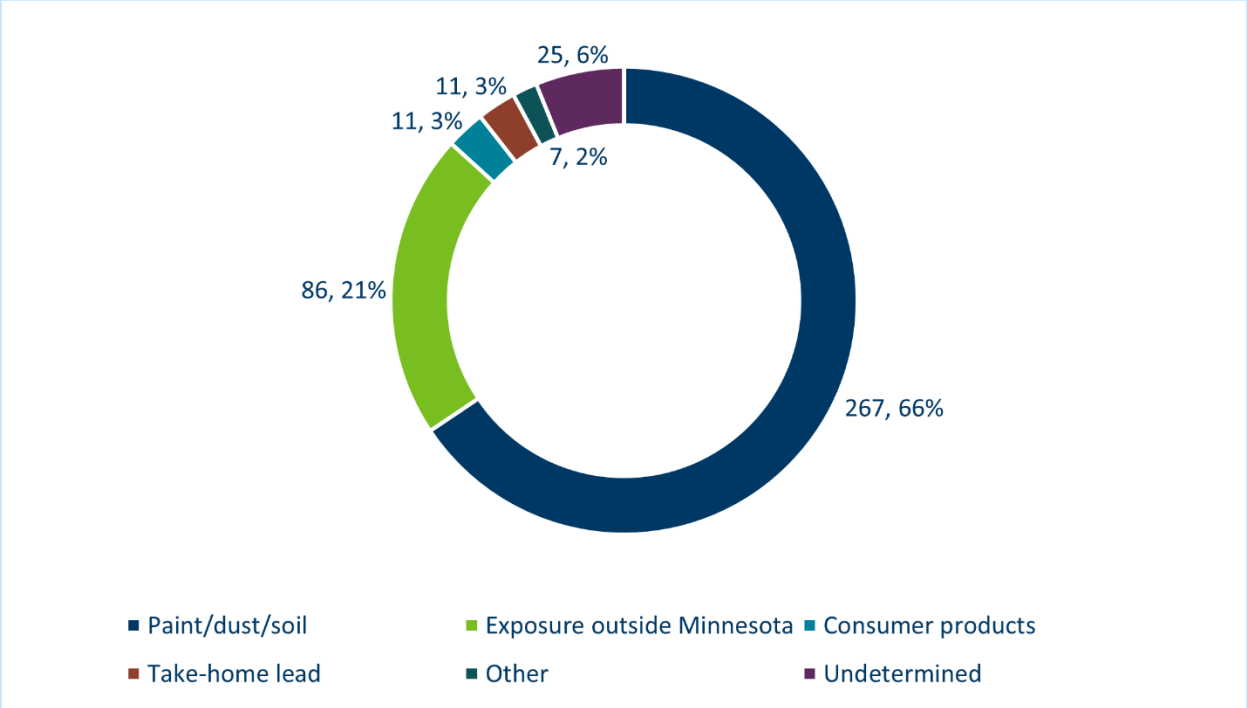
Drinking water was tested during risk assessments for 259 children; only one sample was found to be above the Environmental Protection Agency (EPA) action level of 15 ppb for public water systems. The sampling methods for drinking water samples taken during risk assessments may

not match the sampling methods required by the EPA for regulatory samples of public water systems; regulatory samples require families to not run water for 6 hours prior to the sample. This is not always possible. MDH refers any results over the action level to the public water system for further investigation and follow-up. For more information on lead in drinking water, see pages 3–4 of this report.

Multiple types of lead hazards were often identified for children. Multiple hazard types (paint/dust, soil, water and/or other) were tested for 355 children, and more than one hazard type was identified in 141 cases (40%). This suggests that it may be common for children with EBLLs to be exposed to multiple sources of lead contamination. Testing all possible sources as part of a comprehensive risk assessment, even after one hazard or type of hazard is identified, helps create a lead-safe environment for the lead-exposed child and other children in that environment.

For 105 children (27%), no current lead sources were identified through environmental testing. International exposure was suspected for 54 (51%) of these children. Exposure to paint/dust from a previous residence was suspected for 11 children. In two cases, lead was known to be absorbed through ingestion or retained bullet fragments. The 38 remaining children may have been exposed to lead prior to arriving in Minnesota or may have had transient lead exposure to an unidentified source. **Figure 9** illustrates the likely primary source of lead exposure for children who qualified for a risk assessment in 2024. In several cases an environmental risk assessment was not completed, but the likely lead source was determined through interviews. “Consumer products” includes spices, cultural products, ceramics, and sidewalk chalk.

Figure 9. Sources of Lead Exposure for Children under 18 years, 2024 (n=407)



Adults

In adults, lead exposure can lead to increased risk for chronic diseases such as hypertension and kidney disease. The Adult Blood Lead Epidemiology and Surveillance (ABLES) program is an active surveillance program within the LHHP that follows up on EBLLs among adults in Minnesota and ascertains the source of lead exposure. This includes calling healthcare providers to determine the source of an adult's lead exposure, their employer information, job title, known non-occupational lead exposures, and pregnancy status. The National Institute for Occupational Safety and Health (NIOSH), CDC, and the State of Minnesota use a reference value of 5 mcg/dL in adults. MDH reports work-related blood lead levels of 25 mcg/dL or greater to the Department of Labor and Industry (DLI) so DLI can investigate the conditions that led to the EBLL. Adult lead testing is most common among people working in high-risk industries and pregnant people with either occupational or non-occupational risk factors for lead exposure.

The total number of BLL tests reported for adults in 2024 in Minnesota is presented in **Table 3**. There were 14,452 BLL tests performed in 2024 on 12,107 adults (aged ≥ 16 years). Of those 12,107 adults, 5,044 (42%) were men and 7,028 (58%) were women; 35 adults (less than 1%) were of unknown gender. Of adults tested, 8% had an EBLL of 5 mcg/dL or greater, and of those people, 95% were under 25 mcg/dL.

Although more women than men were tested during 2024, 89% of adults with an EBLL of at least 5 mcg/dL were men. This was likely due to more men than women working in industries and occupations with high risk for lead exposure. Of the 980 adults with BLLs 5 mcg/dL or greater, 717 (73%) were fully or partially due to occupational exposures, 43 (4%) were due to non-occupational exposures, and 220 (22%) were due to unknown exposures.

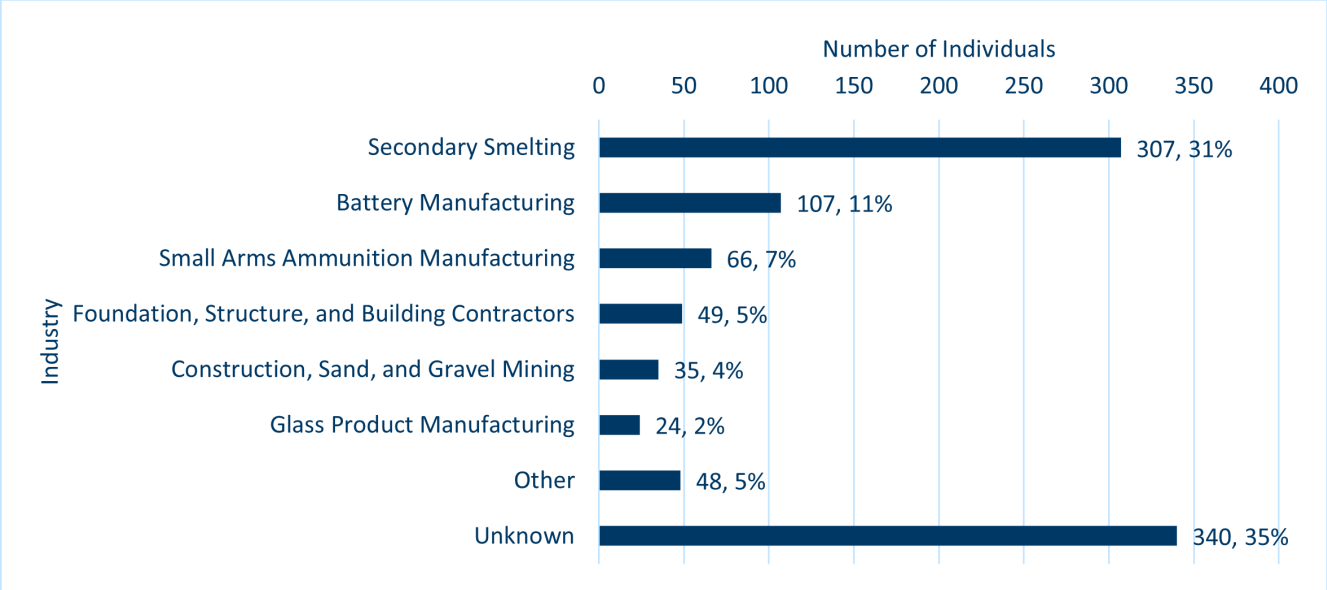
Table 3. Blood Lead Levels among Tested Adult (Aged 16+) Minnesota Residents

2024 Adult Blood Lead Data	BLL < 5 mcg/dL	BLL 5–9 mcg/dL	BLL 10–24 mcg/dL	BLL ≥ 25 mcg/dL	Total
Number of blood lead tests	11,864	970	1,538	80	14,452
Number of individuals tested	11,127	466	469	45	12,107
Occupational Exposure	35	291	387	39	752
Number of men tested	31	246	373	38	688
Number of women tested	3	43	14	0	60
Non-occupational exposure	0	12	27	4	43
Number of men tested	0	7	25	3	35
Number of women tested	0	5	2	1	8
Unknown exposure source	11,092	163	55	2	11,312
Number of men tested	4,145	126	48	2	4,321
Number of women tested	6,917	36	7	0	6,960

EBLLs caused by occupational exposures were analyzed and are reported in **Figure 10**. Together, the secondary smelting, battery manufacturing, and small arms ammunition

manufacturing industries accounted for half of known occupational exposures. Foundation/structure and building contractors, construction and sand/gravel mining, and glass product manufacturing together comprised another 11% of occupational exposures. Other occupational exposures included nonferrous metal foundries, window restoration, various types of contracting work, and amusement and recreation industries. Among people with EBLLs from non-occupational sources, shooting firearms as a hobby was the most common source, with retained bullets as the second most common source.

Figure 10. Work Related EBLLs (≥ 5 mcg/dL) by Industry, 2024



Evaluation of Data and LHHP

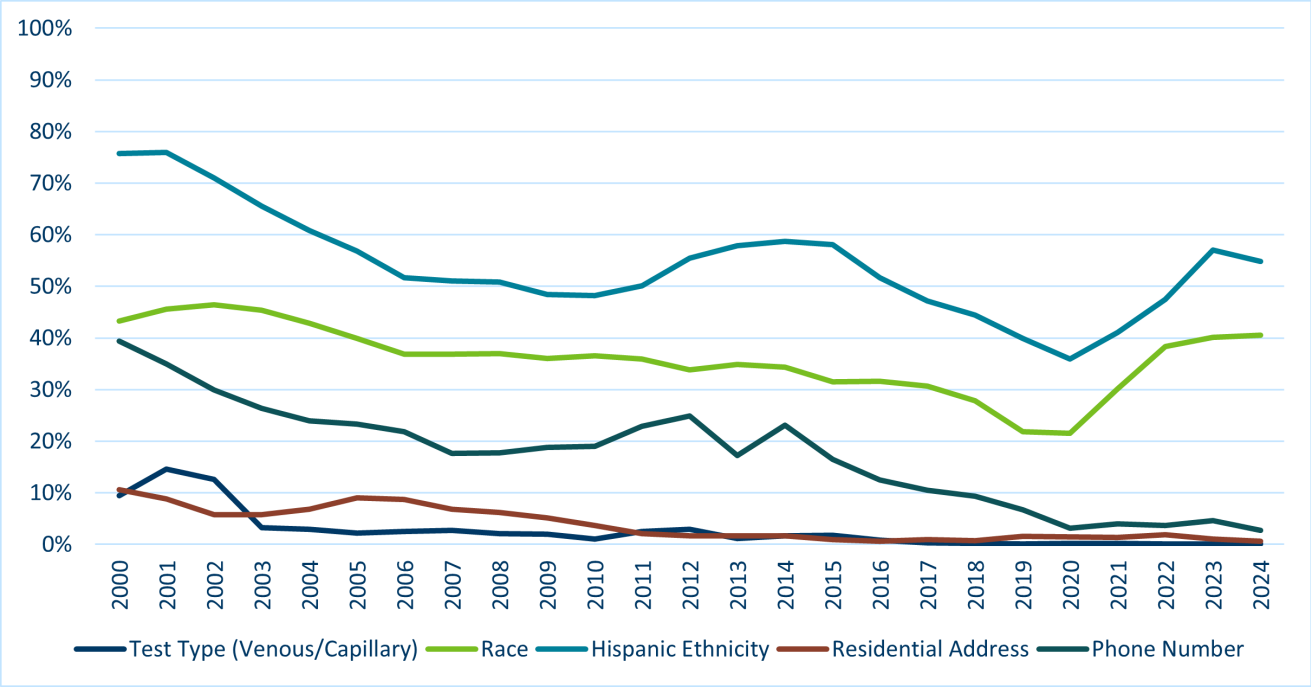
MDH has been consistently improving the blood lead database through recent years. Improvements have been made in the completeness and timing of the data in the system. In addition, reevaluation of processes within the LHHP is ongoing to assess the use of resources and their value to stakeholders.

Completeness of Data

Extensive efforts are made by MDH staff to ensure the completeness of data in MEDSS. This often involves contacting clinics and laboratories to obtain additional information when incomplete records are submitted to MDH, as well as monitoring submissions from laboratories to detect and remediate any missed submissions. These efforts have resulted in an improvement in the completeness of several variables that are necessary for both surveillance and case response functions of MEDSS. The test type (venous or capillary) has improved from being undocumented on nearly 10% of records in 2000 to 0.1% in 2024. Test type is used for case confirmation and initiation of environmental risk assessment services. The completeness of address and phone number fields have also improved substantially. These variables help local public health agencies contact families of lead-exposed children to provide public health services. Race and ethnicity data would be useful for assessing disparities and identifying high-risk populations, but the completeness of these data components needs improvement. In

recent years, the increased use of reference laboratories has unfortunately led to an uptick of missing information (**Figure 11**).

Figure 11. Missing Data Elements in Blood Lead Records Sent to MDH by Year

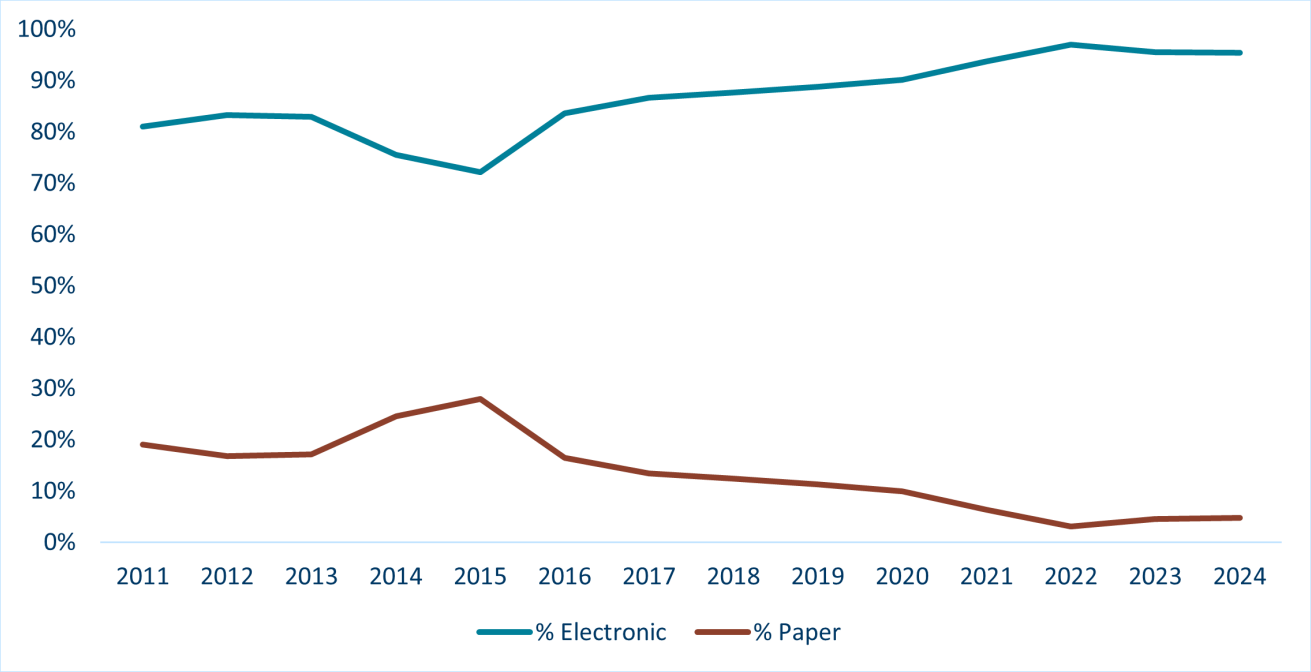


Timing of Data

The timing of the data entered into the blood lead database is measured by the time between a blood lead test, its submission to MDH, and its entry into MEDSS. The use of electronic reporting formats allows for greater efficiency in handling large numbers of records.

In 2024, there were 113,416 total blood lead tests reported to the LHHP, 95% of which were received electronically via secure data connection, encrypted email, or secure web downloads. Although the majority of test results were received electronically, there were still 5,305 results received by paper reporting through mail or fax. Electronic reporting significantly improves timeliness and requires less staff time for entry of records into MEDSS compared to paper reporting. The LHHP continues to work with laboratories to increase their capacity to submit results electronically. From 2015–2022 the percentage of results received electronically by the LHHP increased steadily. From 2022 to 2023, however, there was a slight increase in paper reporting due to increased testing by clinics with point-of-care devices, and this remained steady in 2024. (**Figure 12**).

Figure 12. Percentage of Electronic and Paper Blood Lead Test Results by Year



Other Resources Available from LHHP

The Lead Program maintains a Lead (www.health.state.mn.us/lead) webpage through the MDH website that provides lead education materials for providers, regulated parties, and the general public. This site contains numerous fact sheets in 15 languages, a list of "frequently asked questions," all publications and reports (including guidelines for screening children and pregnant women, case management, and clinical treatment in children), and links to many external lead resources.

M-CLEAN

The Minnesota Collaborative Lead Education and Assessment Network (M-CLEAN) is a workgroup that meets twice a year to discuss various sources of lead exposure, prevention initiatives, and legislative developments. Membership is open to all interested stakeholders. Organizations that typically participate in M-CLEAN include MDH, local public health agencies, other governmental agencies, community action agencies, nonprofit organizations, and industry groups. More information on M-CLEAN meetings can be found at Lead Poisoning Prevention: M-CLEAN (Minnesota Collaborative Lead Education and Assessment Network) (https://www.health.state.mn.us/communities/environment/lead/prof/mclean.html). The M-CLEAN webpage also contains a link to subscribe to the Lead Hot Topics newsletter.

Lead Hazard Reduction Grant

MDH has been awarded a $3.6 million grant from the U.S. Department of Housing and Urban Development (HUD) to fund work protecting families from lead and other household hazards in southeastern Minnesota. MDH delivers these services in Dodge, Fillmore, Freeborn, Goodhue,

Houston, Mower, Olmsted, Rice, Steele, Wabasha and Winona counties. The grant period runs until November 2027.

According to MDH data, southeastern Minnesota has higher rates of EBLLs in children compared with the state average. Factors contributing to these higher rates include the region's high percentage of older homes painted with lead-based paint, its relatively high proportion of low-income families, and the region's shortage of newer housing for its growing population. Many families living in older homes are unable to afford to maintain or rehabilitate them, exposing children to lead dust and other hazards.

The grant prioritizes connecting families whose children already have EBLLs to lead hazard reduction resources, but also provides primary prevention to families whose children have not yet had EBLLs. This work aligns with MDH's goal and its ongoing CDC-supported initiatives to advance health equity by eliminating exposure to lead hazards in the homes of low-income Minnesota families.

Swab Team Services Grants

MDH has collaborated with community partners through Swab Team Services Grants since 2006. The grants are authorized under Minnesota Statutes 144.9512.

MDH's Swab Team Services Grant provides nonprofit organizations with funding to:

- Increase the screening of children under six years and pregnant people to identify EBLLs in populations at high risk for lead exposure
- Plan, implement, and execute successful lead screening events in communities with high lead exposure
- Provide education and outreach services when an EBLL is identified
- Provide swab team services to protect populations from identified lead hazards in their residences

Organizations funded by the Swab Team Services Grants during 2023 were Sustainable Resources Center in Minneapolis, East Side Neighborhood Development Company (ESNDC) in St. Paul, and Community Action Duluth.

Healthy Homes Information

In addition to lead exposure prevention responsibilities, the LHHP at MDH administers the Healthy Homes Program. This program distributes $240,000 per year in grants to local agencies and organizations as authorized by Minnesota Statutes 144.9513, which defined healthy housing and established healthy housing grants. These grants address lead, asthma, radon, injuries, smoking, excessive moisture/mold, pests, carbon monoxide, fire hazards, and other home-related health hazards. Additional information on the Healthy Homes Program and grants can be found at Healthy Homes Minnesota (https://www.health.state.mn.us/communities/environment/healthyhomes/hhgrant.html).

Further Lead Information

More information about lead exposure prevention in Minnesota is available at the MDH Lead (https://www.health.state.mn.us/lead) program website or by calling 651-201-4620.

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