SOUTH DAKOTA DEPARTMENT OF HEALTH

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2023 Blood Lead Annual Report

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EXECUTIVE SUMMARY

This report presents the South Dakota Department of Health's (SD-DOH) second annual childhood blood lead testing and surveillance, compiled by the South Dakota Childhood Lead Poisoning Prevention Program (SD CLPPP). It includes 2023 blood lead testing data for children and adults, with historical trends dating back to 2016 when blood lead became a reportable condition in South Dakota.

Lead poisoning is a preventable condition but represents a significant environmental hazard for children across the country. Young children up to age six are at the greatest risk of harm from lead exposure due to the rapid brain development that occurs during early childhood. Childhood exposure to lead, through inhalation or ingestion, can cause long-term neurological damage and decreased intelligence that may be associated with learning and behavioral problems (CDC, Health Effects of Lead Exposure, 2023).

While no safe blood lead level in children has been identified, the Centers for Disease Control and Prevention (CDC) uses a blood lead reference value (BLRV) to identify children with higher levels of lead in their blood compared to other children. From 2012-2021, the CDC BLRV was 5 micrograms per deciliter (µg/dL). In October 2021, the CDC lowered the BLRV to 3.5 µg/dL to reflect the decreasing presence of lead in the blood at the population level and further identify children still at risk for poor health outcomes at levels below the previous BLRV (CDC, Blood Lead Reference Value, 2021). This report uses a single capillary or venous blood lead test at or above the BLRV of 3.5 µg/dL to signify lead in the blood.

In 2023, SD-DOH received 4,923 blood lead test results for 4,694 unique South Dakota children under age six. Of these, 171 children (3.6%) had a blood lead level (BLL) at or above the BLRV of 3.5 µg/dL. Among them, 100 children met the national surveillance case definition for a confirmed case, and 71 were classified as suspect cases. Most children tested (77%) were between 0–24 months of age, reflecting Medicaid screening requirements at 12 and 24 months. Testing volume was highest in August (N = 508) and October (N = 421). By sex, 49% of children tested were female (N = 2,318), 51% were male (N = 2,373), and 3 were listed as unknown. Among females, 3.5% were confirmed or suspect cases (N = 81), while 3.8% of males were confirmed or suspect cases (N = 90). By race, White children made up the largest proportion of those tested (65.4%), followed by American Indian/Alaskan Native (14%), Black/African American (5.6%), and Asian (1.7%) children. Children identifying as American Indian/Alaskan Native (6.7%) and Asian (7.3%) had the highest elevated blood lead level (EBLL) prevalence by race. Ethnicity data was missing for 43.6% of tested children.

The majority of tests were capillary specimens 3,971 (81%), while 945 (19%) were venous, and 7 (0.1%) had unknown specimen type, which were classified as capillary per the 2023 national surveillance case definition. Of the 134 capillary tests that were ≥3.5 µg/dL, only 60 children (45%) received a recommended follow-up venous test while the remaining 74 (55%) did not receive venous testing within the 12-weeks window. This follow-up testing gap highlights an area for improvement in clinical response and case management.

To better understand the relationship between socioeconomic status and lead exposure, blood lead test results were matched with Medicaid enrollment and claims data. Of the 4,694 children tested, 2,547 (54%) were enrolled in Medicaid. However, only 1,416 of these children had claims indicating use of Medicaid-covered services. Among the 171 children with EBLLs, 136 (80%) were Medicaid recipients, further emphasizing the need for targeted prevention and follow-up in this vulnerable population.

By birth cohort, 3,269 of the 10,951 children born in 2020 (29.9%) received at least one blood lead test by age three, an increase from 27.2% among the 2019 birth cohort. Preliminary data also show that 31.4% of children born in 2021 and 26.8% of those born in 2022 have been tested by age three, though reporting for those cohorts may still be incomplete.

REPORTING OF TEST RESULTS

In 2023, the South Dakota clinical laboratories were required to report EBLL. Reports were received through electronic laboratory reporting, the disease rereport site, or by fax. It is common for different entities to report the same BLL test result. For example, the ordering provider and the lab performing the analysis may both report the same test. Maven, the CLPPP surveillance system, is designed to handle duplicate reports from different sources so the results are maintained under a single patient record. The total number of tests was defined as the total number of deduplicated blood lead tests obtained from children during 2023. All tests, including those collected for screening, confirmation, or follow-up purposes, were counted. Since many children had more than one test during the year, the total number of children tested is less than the total number of blood lead tests performed.

CASE DEFINITIONS

The national surveillance case definition, also known as the CDC case definition, was used in this report to identify children with confirmed and suspect lead in blood. A **confirmed case** was defined as either of the following: (1) a child with one venous blood test ≥ 3.5 µg/dL, or (2) two capillary blood tests ≥ 3.5 µg/dL drawn within 12 weeks of each other. A **suspect case** was defined as either of the following (1) a single capillary blood lead test ≥ 3.5 µg/dL, or (2) two capillary tests ≥ 3.5 µg/dL drawn more than 12 weeks apart (CDC, Lead in Blood, 2023 Case Definition)

To apply the case definition, several different data elements need to be evaluated. These data elements were handled as follows in our analyses.

- The maximum BLL was defined as the highest venous BLL obtained from a child in 2023 while they were in the specified age category. If a child had no venous BLL test performed during that time period, maximum BLL was defined as the highest BLL from a capillary. Venous results were ranked over capillary results because capillary test results may be skewed by the presence of lead dust on the skin.
- A child was considered to be a case if they met either the confirmed or suspect case definition above.

CASE MANAGEMENT

The SD CLPPP has dedicated investigators who monitor case management activities. They are responsible for reviewing surveillance data, identifying children with EBLL, and making appropriate referrals. They coordinate care with primary care physicians for children with EBLLs using case management standards that follow CDC guidelines. Case management of children with EBLLs is accomplished through a partnership with the University of South Dakota (USD) Community Action Response Epidemiology (CARE) team that provides support to SD CLPPP whenever a child with an EBLL is identified. The investigator follows up with the child's parents and/or guardians through phone calls, direct mailings of educational materials to the family, and linkage to resources. A confirmatory diagnostic test (e.g., venous specimen, or a second capillary specimen collected within 12 weeks) is

recommended once a child is detected as potentially having an EBLL from a capillary specimen. During telephone consultations with the parents/guardians, the investigators review with the family how to reduce lead hazards in the home. The investigator then mails appropriate materials such as additional educational materials and updates medical practices and families on case progress. The program does not offer environmental services due to funding limitations but can link families with community resources that can help with the testing of lead hazards in the home.

Appropriate steps are presented for both capillary and venous test results, as well as information on the case manager's role, sources of lead, referrals, and resources. The guidelines have an accompanying Childhood Blood Lead Case Management Guidelines for a quick verification of intervention recommendations for each blood lead level. Maven surveillance system enables investigators to frequently review child BLL to ensure that children with lead in the blood receive confirmatory testing, investigations, and necessary follow-up. A case will close once a test is below the CDC reference level of 3.5 μg/dL is received.

Data on blood lead testing has been collected by the South Dakota Department of Health (SD-DOH) since January 1, 2016. Data for the years 2016-2022 are shown for historical context. The number of children tested in South Dakota increased steadily from 2016 through 2019, decreased during 2020, and has been slowly increasing from 2021 through 2023. The COVID-19 pandemic which began in March 2020 had significantly impacted blood lead test reporting, likely indicating a similar decrease in testing on the part of medical providers. Since then, testing has gradually increased reaching 4,694 in 2023, surpassing pre-pandemic levels.

Blood lead testing for older children (6 through 17 years) and adults is much less common than for young children. Older children are not recommended to be routinely screened and tend only to receive blood lead tests if a medical provider knows the older child meets specific screening recommendations (e.g., post-arrival lead screening of all refugee children aged 0-16 years) or suspects the child may be exposed to lead. Of the 5,286 individuals tested in 2023, 4694 (88.8%) were children under six, 191(3.6%) were aged 6–17, and 401(7.6%) were adults.

Adults are tested for blood lead primarily if they are at risk for occupational lead exposure. Adult testing numbers have slightly increased, from 374 in 2022 to 401 in 2023.

Figure 1. Number of Persons Test for Blood Lead by Year and Age Group, South Dakota, 2016-2023

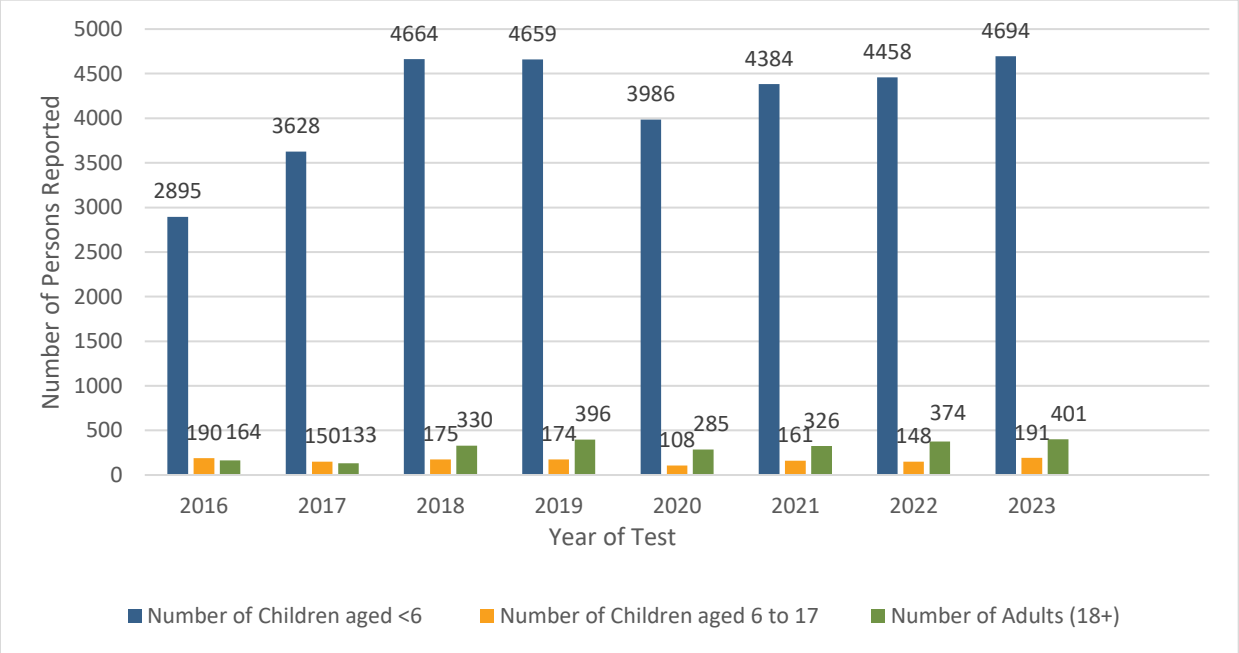
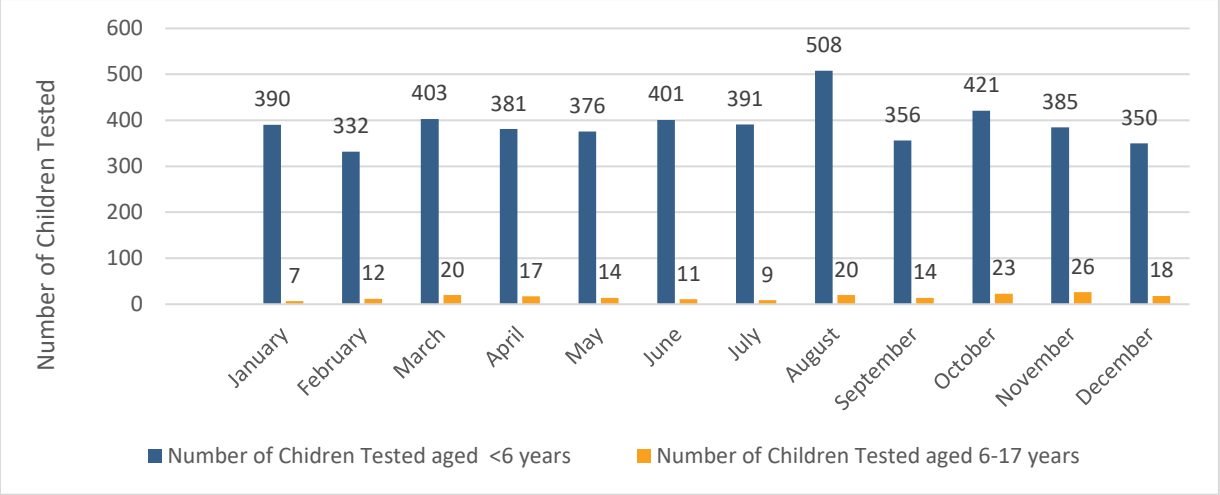


Figure 2 Illustrates the number of children tested by month during 2023. The highest volume of testing occurs for children aged less than 6 years old during the months of August and October with 508 (10.8%) and 421 (9%), respectively.

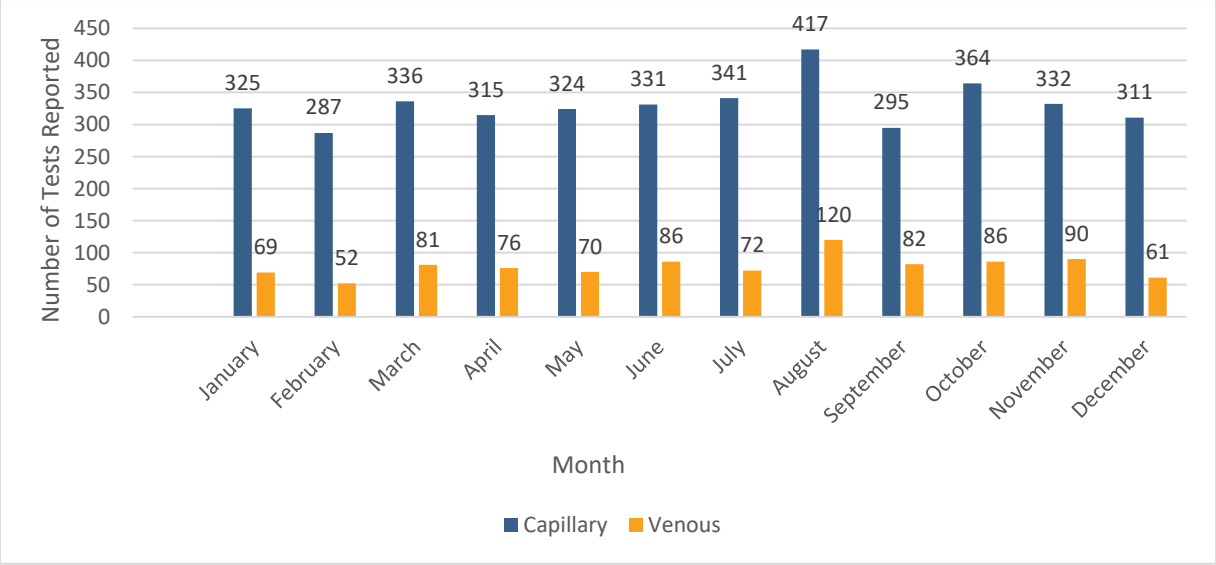
Figure 2. Number of Children Tested by Age Group and Month, 2023



**Number of children who had at least one blood lead test done with a specimen collection date in 2023.*
**This table was analyzed on a per child basis rather than per test*

Figure 3 shows the breakdown of capillaries and venous test results received by month for SD children aged <6 years during 2023. Of the 4,923 tests received, 3,978 (81%) were capillary specimens, 945 (19%) were venous specimens.

Figure 3. Capillary and Venous Testing Volume for Children Less Than 6 Years Old, 2023



**Per CDC 2023 case definition, unknown specimen types are classified as capillary if the individual is <16 years of age and venous if ≥16 years of age*
**Total number of deduplicated blood tests obtained on children under 6. A blood lead test may be collected for screening, confirmation, or follow-up. Many children had more than one test in any given year.*

Table 1 summarizes the number of children and blood lead testing results in total, distribution by age, and the number of children that tested at or above the BLRV of 3.5 µg/dL. Most testing occurred at ages 0-24 months (77%). This is likely a result of the regulatory requirement for testing at 12 months of age for children utilizing the Medicaid program. The second largest percentage occurred at the 25-48 months age range (14.8%).

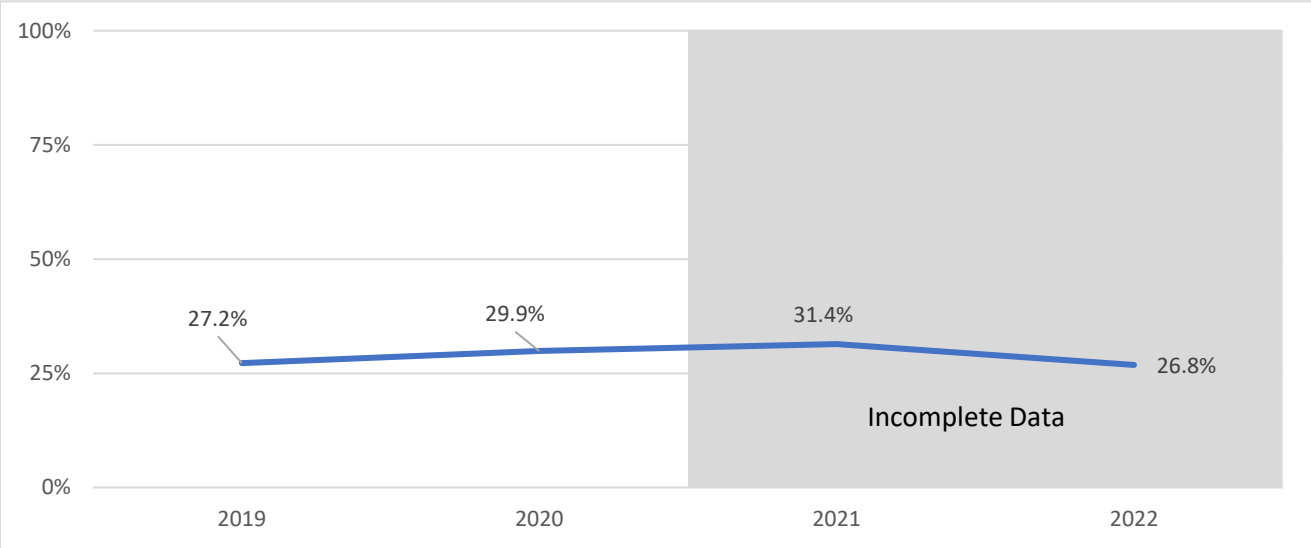
Table 1. Age Distribution of Children Receiving an Initial Blood Lead Test, 2023

Number of Children Tested	# Children	%	# Children with Lead Result ≥3.5 – <10 µg/dL	# Children with Lead Result ≥10 µg/dL
0-24 months	3613	77%	81	15
25-48 months	695	14.8%	49	10
49 -<72 months	386	8.2%	12	4
Total	**4694**	**100.00%**	**142**	**29**

**Age at time of specimen collection.*

Among the 10,951 SD children born in 2020, 3,269 (29.9%) were tested for blood lead at least once by age three as shown in figure 4. Preliminary data indicate that 31.4% of children born in 2021 and 26.8% of those born in 2022 have been tested by age three. Reporting for the 2021 and 2022 cohorts may still be incomplete.

Figure 4. Percent of Children Tested at Least Once by Age 3 Years, by Birth Cohort



In 2023, 171 South Dakota children were found to have a blood lead level ≥3.5µg/dL. Of these, 100 (59%) cases were confirmed. The breakdown of these confirmed cases includes:

- 6 (6%) children had an initial capillary test ≥3.5µg/dL followed by a secondary capillary test ≥3.5µg/dL within 12 weeks.
- 29 (29%) children had an initial capillary test ≥3.5µg/dL followed by a venous test ≥3.5µg/dL within 12 weeks.
- 65 (65%) children had an initial venous test ≥3.5µg/dL.

Of the South Dakota children, 71 (41%) were suspected, meaning no follow-up testing reported with 12-week timeframe after the initial capillary test ≥3.5µg/dL.

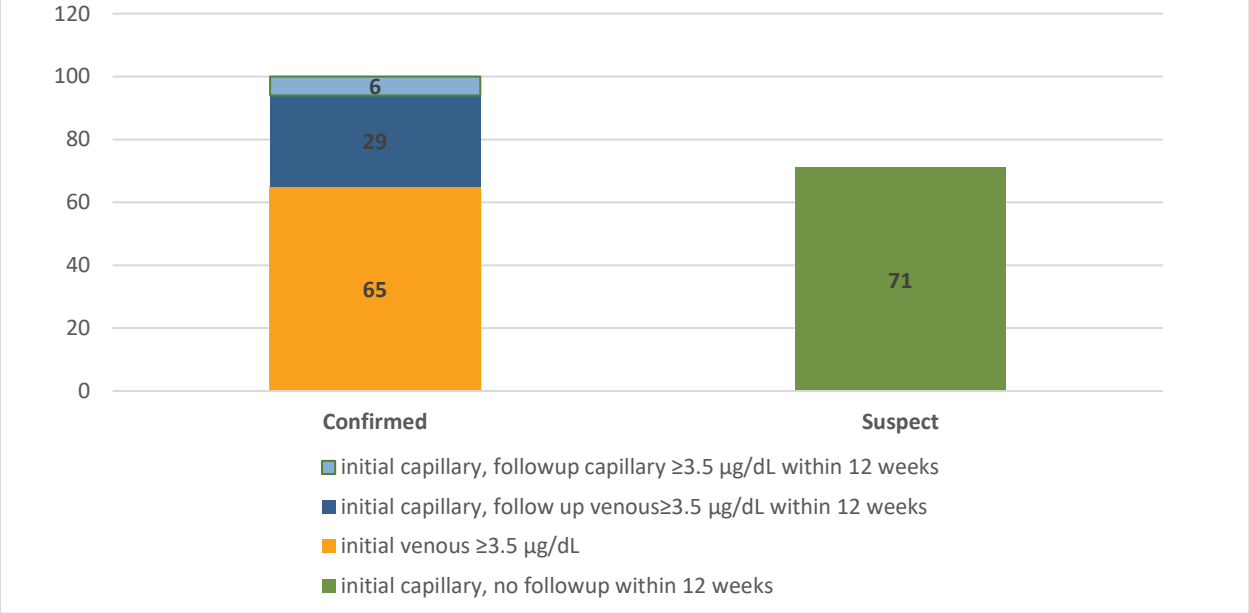
South Dakota blood lead testing guidelines recommend venous testing for children with an initial capillary test ≥3.5µg/dL. In 2023, a total of 34 children had an initial capillary test ≥3.5µg/dL that was retested and found to have a result less than 3.5µg/dL.

- 31 children received a follow-up venous test.
- 3 children underwent a follow-up capillary test.

Overall, only 43% of children with an initial elevated capillary test received a follow-up venous test within 12 weeks, while 57% did not receive the recommended venous testing.

Figure 5 shows the number of confirmed and suspect cases. The highest blood lead level among confirmed cases was 40.2 µg/dL.

Figure 5. Number of Children Less Than 6 Years Old with Confirmed and Suspect Blood Lead Levels ≥3.5µg/dL, 2023



**Capillary tests ≥ 3.5 µg/dL with a follow-up test within 12 weeks that was < 3.5 µg/dL were excluded*
**If a child has multiple venous test the highest venous was used in this report.*

Table 2 summarizes the demographic distribution and prevalence of lead in the blood by sex, race, and ethnicity. White children under 6 years of age made up the highest percentage tested at 65.4%, followed by American Indian/Alaskan Native (14%) and Black/African American (5.6%) children. Race was missing for 6.3% and ethnicity was missing for 43.6% of children tested. Among confirmed or suspect cases, male (3.8%), Asian (7.3%), and American Indian/Alaskan Native (6.7%) children surpassed the state percentage of 3.6%.

Table 2. Demographic Characteristics of Children Less Than 6 Years Old Tested, 2023

Sex	# Tested	% Tested	# Confirmed* And Suspect†	%
Female	2318	49%	81	3.5%
Male	2373	51%	90	3.8%
Unknown	3	0%	0	0.0%
American Indian/Alaskan Native	658	14%	44	6.7%
Asian	82	1.7%	6	7.3%
Black/African American	262	5.6%	9	3.4%
Other	321	6.8%	10	3.1%
Pacific Islander	5	0.1%	1	0.2%
Unknown	296	6.3%	13	4.4%
White	3070	65.4%	88	2.9%
Hispanic	342	7.3%	10	2.9%
Non-Hispanic	2305	49.1%	106	4.6%
Unknown	2047	43.6%	55	2.7%
TOTAL	4694	100%	171	3.6%

Figure 6 summarizes the Medicaid match among children tested for lead in 2023. Of the 4,694 South Dakota children under age six who received a blood lead test, 2,547 (54%) were enrolled in Medicaid and 2,147 (46%) were non-Medicaid. Among the 171 children identified with elevated blood lead levels ≥3.5 µg/dL, including both confirmed and suspected cases 136 (80%) were Medicaid recipients and 35 (20%) were non-Medicaid.

Figure 6. Percentage of Children Tested and with Elevated Blood Lead Levels among Medicaid Enrolled children, South Dakota, 2023

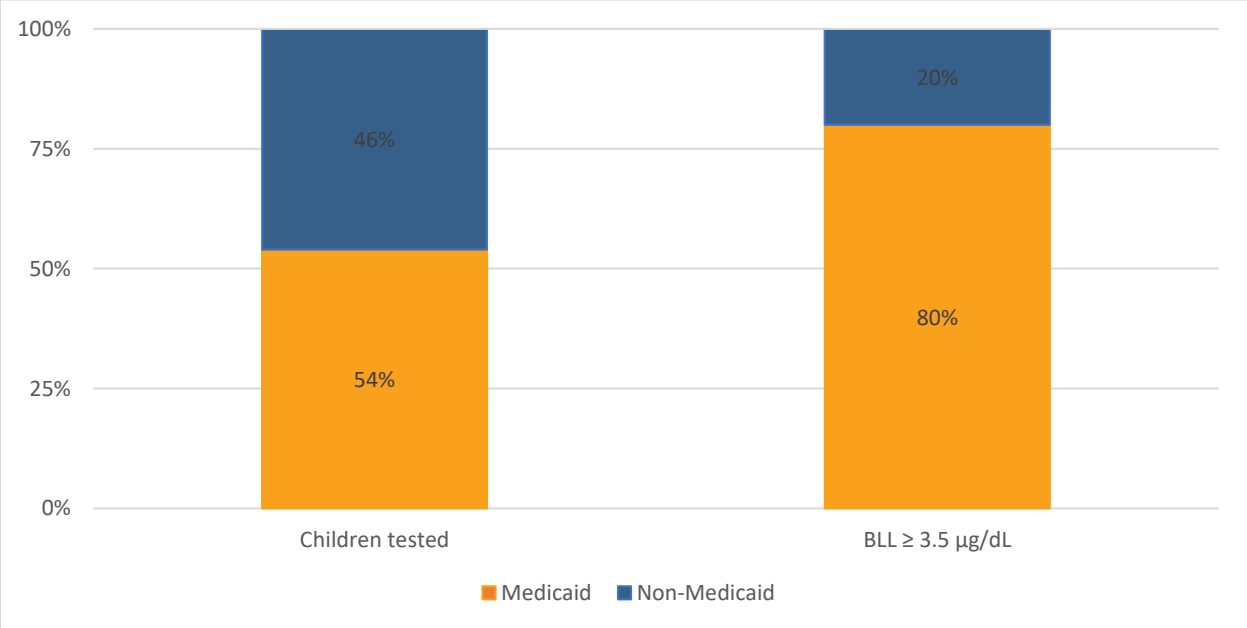


Table 3. Blood Lead Levels in South Dakota Children Less Than 6 Years Old by County, 2023

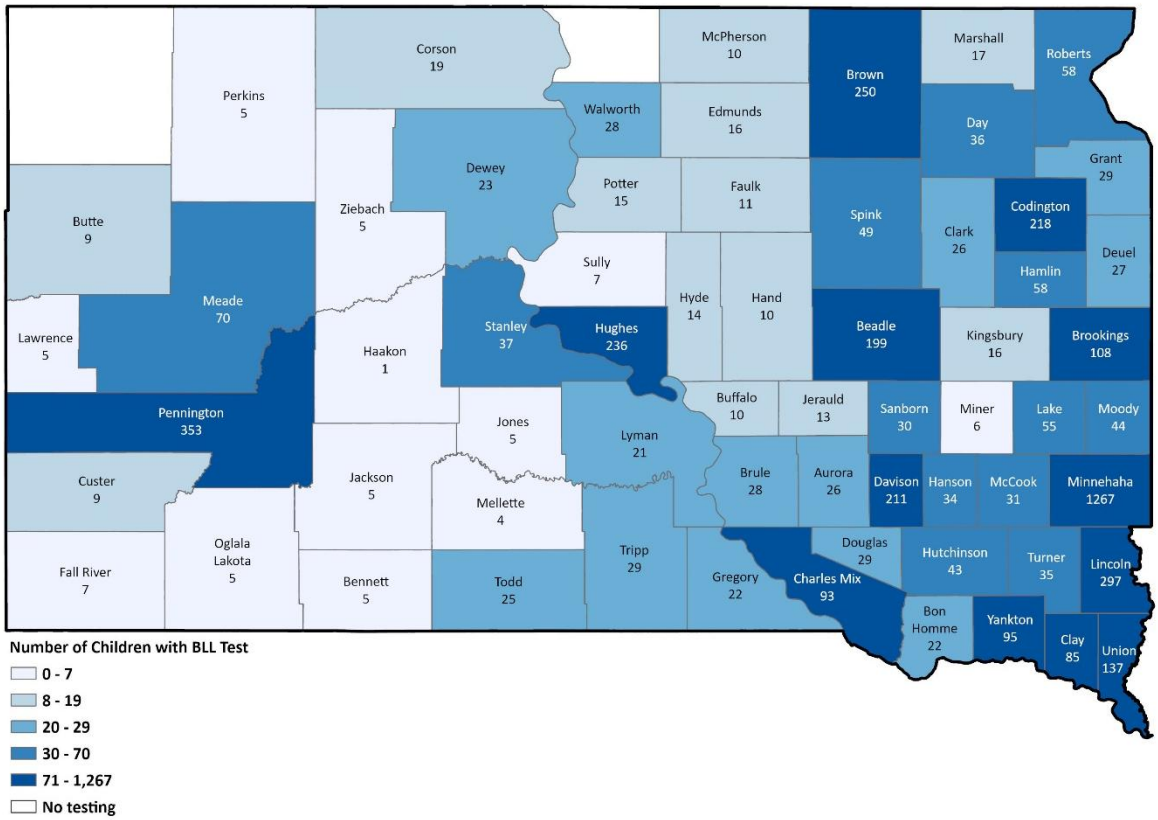
County	# Children Tested	% Tested	# Children with Confirmed And Suspect Blood Lead ≥3.5 µg/dL	Children with Confirmed And Suspect Blood Lead (%)
Aurora	26	0.55%	1	3.8%
Beadle	199	4.24%	11	5.5%
Bennett	5	0.11%	0	0.0%
Bon Homme	22	0.47%	3	13.6%
Brookings	108	2.3%	1	0.9%
Brown	250	5.33%	10	4.0%
Brule	28	0.60%	1	3.6%
Buffalo	10	0.21%	0	0.0%
Butte	9	0.19%	4	44.4%
Charles Mix	93	1.98%	7	7.5%
Clark	26	0.55%	1	3.9%
Clay	85	1.81%	6	7.0%
Codington	218	4.64%	4	1.8%
Corson	19	0.40%	1	5.3%
Custer	9	0.19%	0	0.0%
Davison	211	4.5%	5	2.4%
Day	36	0.77%	1	2.8%
Deuel	27	0.58%	1	3.7%
Dewey	23	0.49%	1	4.4%
Douglas	29	0.62%	1	3.5%
Edmunds	16	0.34%	0	0.0%
Fall River	7	0.15%	0	0.0%
Faulk	11	0.23%	0	0.0%
Grant	29	0.62%	5	17.2%
Gregory	22	0.47%	0	0.0%
Haakon	1	0.02%	0	0.0%
Hamlin	58	1.24%	4	6.9%
Hand	10	0.21%	0	0.0%
Hanson	34	0.72%	0	0.0%
Hughes	236	5.03%	3	1.3%
Hutchinson	43	0.92%	2	4.7%
Hyde	14	0.3%	1	7.1%
Jackson	5	0.11%	0	0.0%
Jerauld	13	0.28%	2	15.4%
Jones	5	0.11%	0	0.0%
Kingsbury	16	0.34%	2	12.5%

Lake	55	1.17%	2	3.6%
Lawrence	5	0.11%	2	40.0%
Lincoln	297	6.33%	0	0.0%
Lyman	21	0.45%	0	0.0%
Marshall	17	0.36%	0	0.0%
McCook	31	0.66%	1	3.2%
McPherson	10	0.21%	1	10.0%
Meade	70	1.49%	3	4.3%
Mellette	4	0.09%	0	0.0%
Miner	6	0.13%	0	0.0%
Minnehaha	1267	26.99%	36	2.84%
Moody	44	0.94%	4	9.1%
Oglala Lakota	5	0.11%	2	40.0%
Pennington	353	7.52%	20	5.7%
Perkins	5	0.11%	1	20.0%
Potter	15	0.32%	0	0.0%
Roberts	58	1.24%	1	1.7%
Sanborn	30	0.64%	1	3.3%
Spink	49	1.04%	1	2.0%
Stanley	37	0.79%	0	0.0%
Sully	7	0.15%	0	0.0%
Todd	25	0.53%	6	24.0%
Tripp	29	0.62%	0	0.0%
Turner	35	0.75%	2	5.7%
Union	137	2.92%	1	0.7%
Walworth	28	0.6%	1	3.6%
Yankton	95	2.02%	4	4.2%
Ziebach	5	0.11%	1	20.0%
Uknown	1	0.02%	3	
Grand Total	4694	100.00%	171	

***** *Children were assigned a county based on the address of residence at the time of the blood test as reported.*

**All counts were deduplicated.*

Figure 7. Number of South Dakota Children Less Than 6 Years Old Tested by County, 2023



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