

SOUTH DAKOTA DEPARTMENT OF HEALTH

2022 Blood Lead Annual Report

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Executive Summary

This is the South Dakota Department of Health (SD-DOH)'s first annual report on childhood blood lead surveillance produced by the SD Childhood Lead Poisoning Prevention Program (CLPPP). The report presents data for children and adults in South Dakota who were tested and reported to SD-DOH during 2022. Trend data for 2016-2021, which coincides with blood lead being reportable to SD-DOH but prior to the CLPPP, was also included.

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, 2022).

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 ($\mu\text{g}/\text{dL}$). In October 2021, the CDC lowered the BLRV to 3.5 $\mu\text{g}/\text{dL}$ 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 $\mu\text{g}/\text{dL}$ to signify lead in the blood.

In 2022, SD-DOH received 4,662 blood lead test results for children less than 6 years old. These results represented 4,458 unique children. Among these children, 3,333 (75%) were between the ages of zero to 24 months and 1,125 (25%) were between 25 to 72 months at the time of testing. Out of the 4,458 children tested, 132 (3%) (76 confirmed and 56 unconfirmed) were found to have a blood lead level of $\geq 3.5 \mu\text{g}/\text{dL}$. August and September had the highest number of reported children tested, with 514 (12%) and 425 (10%), respectively. By race, White children made up the highest proportion of those tested at 65%, followed by American Indian/Alaskan at 16%, Black, at 6% and Other at 6%. By sex, 49% were female (2,185) and 51% were male (2,262). Among the female group, 2.2% had confirmed blood lead levels (48 cases), while in the male group, 3.7% had EBL (84 cases).

Of the 4,662 tests that were reported to SD-DOH for children under the age of 6 years, a total of 3,840 (82%) were capillary tests, while 822 (18%) were venous tests. South Dakota guidelines recommend follow-up venous test for any capillary result of 3.5 $\mu\text{g}/\text{dL}$ or greater. Among the 3,840 capillary tests, 116 (3%) resulted as 3.5 $\mu\text{g}/\text{dL}$ or greater. However, only 46 (40%) had follow-up venous results reported while the remaining 70 (60%) did not receive any testing within the 12 weeks follow-up testing period.

Among the 11,448 SD children born in 2019, 3,119 (27.2%) children were tested at least once by three years of age. Further efforts are needed to improve blood lead testing and test reporting. If such efforts are successful, the testing data will reflect increases in testing rate, reporting, and completeness of information.

Reporting of Test Results

In South Dakota, in 2022, clinical laboratories were required to report elevated blood lead levels (BLL). Reports were received through electronic laboratory reporting, the disease reporting website, 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 2022. 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

In May 2021, the CDC's Federal Advisory Committee, called the Lead Exposure and Prevention Advisory Committee, voted unanimously in favor of updating the reference value to 3.5 µg/dL, based on data from the 2015–2018 NHANES cycles. CDC updated the BLRV from 5.0 µg/dL to 3.5 µg/dL. BLRV is intended to identify children with higher levels of lead in their blood compared with levels in most children. This level is based on the 97.5th percentile of the blood lead values among U.S. children ages 1-5 years from 2015-2016 and 2017-2018 National Health and Nutrition Examination Survey (NHANES) cycles BLRV (CDC, Blood Lead Reference Value, 2021). The national surveillance case definition for blood lead was used in this report to identify children with confirmed and unconfirmed lead in blood. A **confirmed BLL** 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. An **unconfirmed BLL** 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, Standard Surveillance Definitions and Classifications, 2021).

To apply the CDC 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 2022 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 have an EBLL if they met either the confirmed or unconfirmed BLL 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 EBL 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 EBL 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 family 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. The surveillance system enables investigators to frequently review child blood lead levels 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.

Childhood Blood Lead Screening and Follow up Guidelines.

The Childhood Blood Lead Screening Guidelines represent a set of best practices and recommendations for health care providers, local public health, and other individuals or organizations in identifying which children should receive a blood lead test.

<https://doh.sd.gov/media/xm3nc5jn/high-risk-area-lead-poisoning.png>

<https://doh.sd.gov/media/xffgfpgm/screeningguidelinesandfollowup.pdf>

Definitions

Blood lead level (BLL): The numeric result of a blood lead test, expressed in micrograms per deciliter ($\mu\text{g}/\text{dL}$)

Capillary: A blood lead test with blood drawn by a finger stick

CARE: Community Action Response Epidemiology

CDC: Centers for Disease Control and Prevention

Confirmed BLL $\geq 3.5 \mu\text{g}/\text{dL}$: One venous blood lead test $\geq 3.5 \mu\text{g}/\text{dL}$ or two capillary blood lead tests $\geq 3.5 \mu\text{g}/\text{dL}$ drawn within 12 weeks of each other.

Electronic lab reporting (ELR): The system by which blood lead reports are submitted electronically from a laboratory to SD-DOH

Micrograms per deciliter ($\mu\text{g}/\text{dL}$): The amount of lead in the blood, measured by micrograms of lead per deciliter of blood

SD CLPPP: South Dakota Childhood Lead Poisoning Prevention Program

Unconfirmed BLL $\geq 3.5 \mu\text{g}/\text{dL}$: One capillary blood test $\geq 3.5 \mu\text{g}/\text{dL}$ with no follow up test.

USD: University of South Dakota

Venous: A blood lead test with blood drawn from a vein in the arm

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, prior to the SD CLPPP. The number of children tested in South Dakota had increased steadily from 2016 through 2019, decreased during 2020, and has been slowly increasing from 2021 through 2022. 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. The number increased in 2021 and 2022 but remained lower than before the pandemic.

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. In 2022, a total of 4,980 persons received a blood lead test which was reported to SD CLPPP. Of those, 4,458 (89.5%) children were under the age of six years and 148 (3%) children aged 6 through 17 years received a blood lead test.

Adults are tested for blood lead primarily if they are at risk for occupational lead exposure. In 2022, 374 adults aged 18 years and older received a blood lead test. **(Figure 1)**

Figure 1. Number of Persons Test for Blood Lead by Year and Age Group, South Dakota, 2016-2022

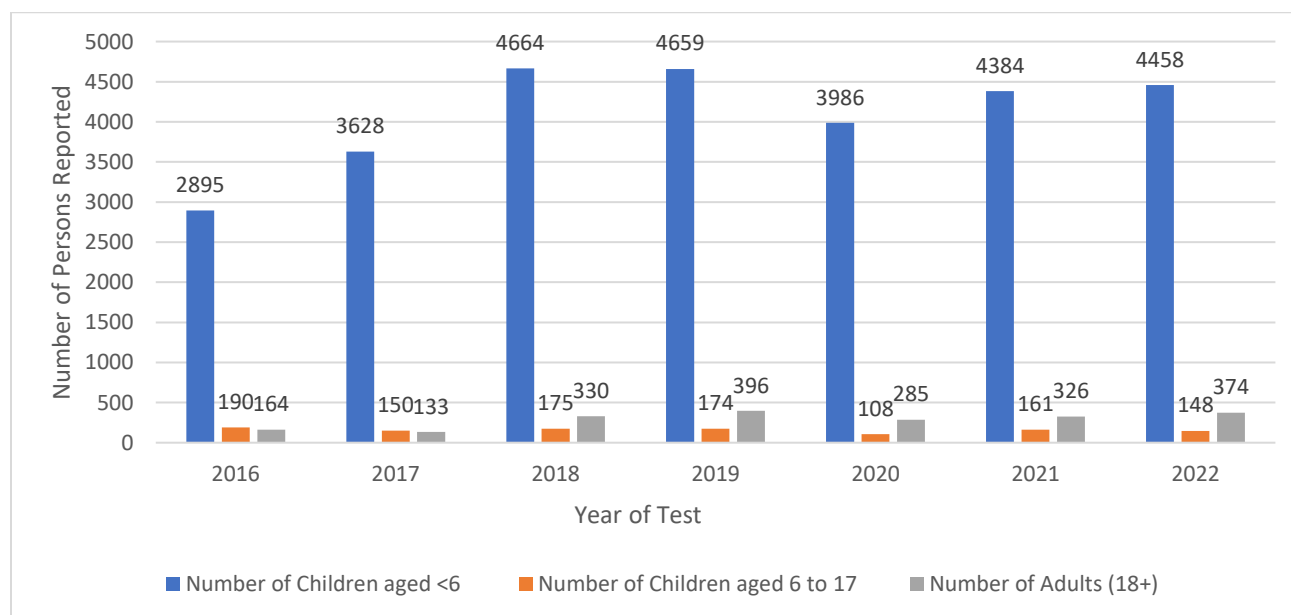
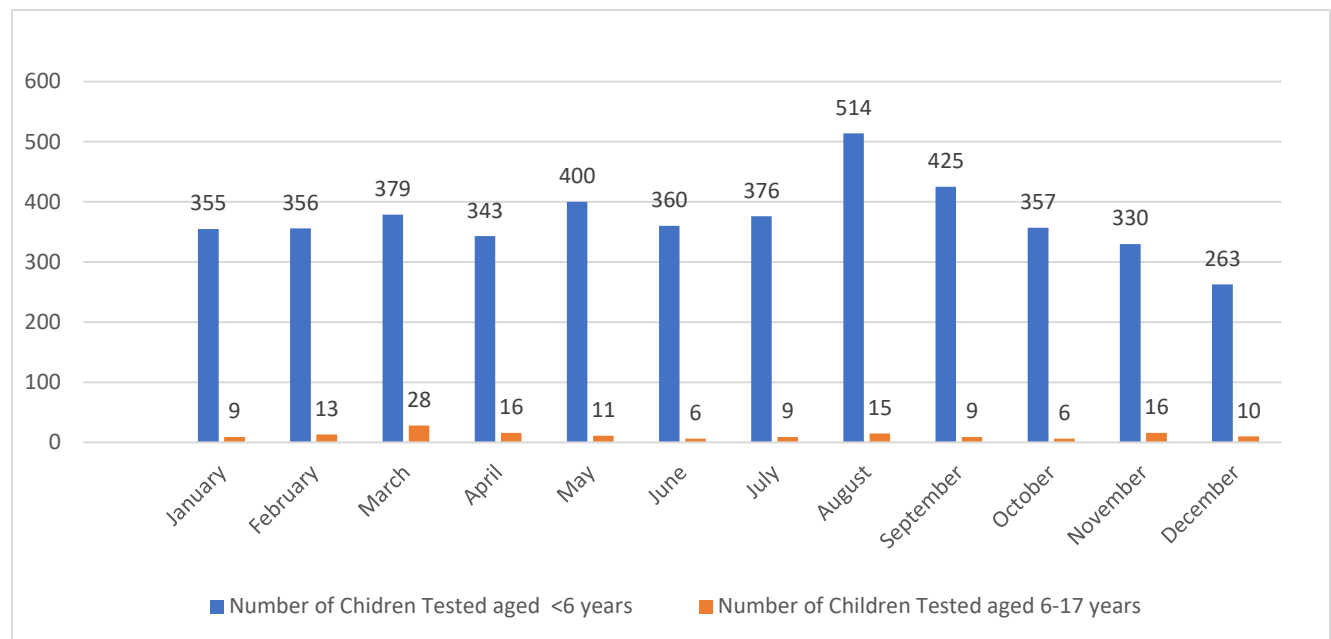


Figure 2 illustrates the number of children tested by month during 2022. The highest volume of testing occurs for children aged less than 6 years old during the months of August and September had the highest with 514 (12%) and 425 (10%), respectively.

Figure 2. Number of Children Tested by Age Group and Month, 2022

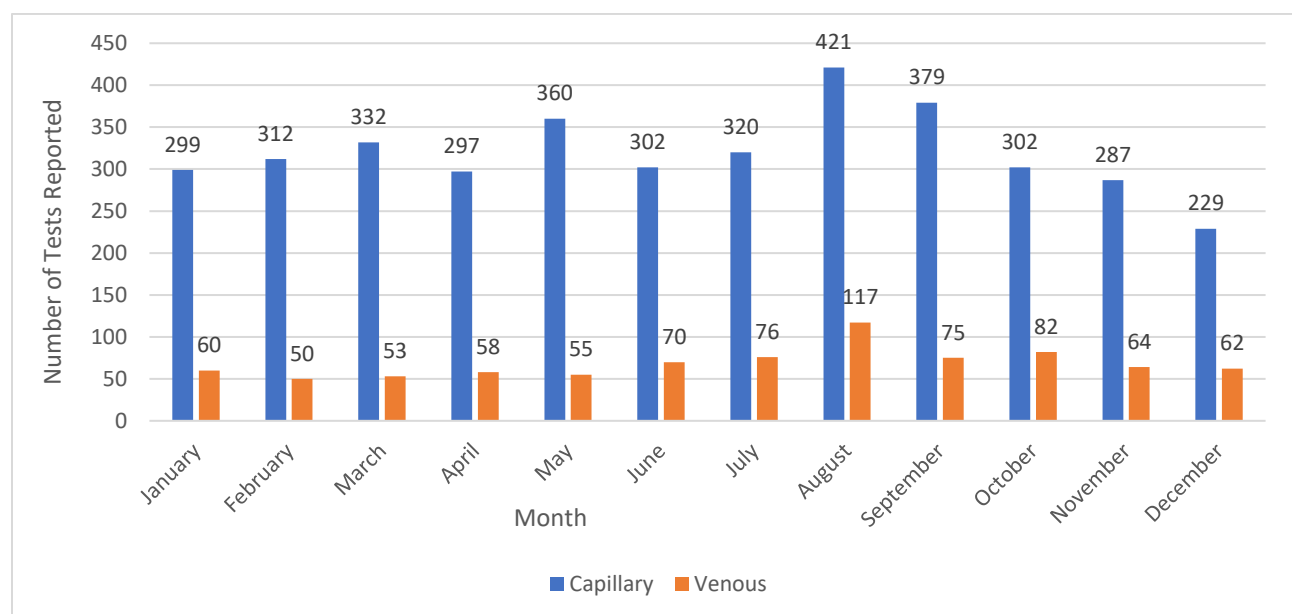


**Number of children who had at least one blood lead test done with a specimen collection date in 2022.*

**This table was analyzed on a per child basis rather than per test*

Figure 3 shows the breakdown of capillary and venous test results received by month for SD children aged <6 years during 2022. Of the 4,662 tests received, 3,840 (82.4%) were capillary specimens, 822 (17.6%) were venous specimens, and 0 (0%) were an unknown specimen type.

Figure 3. Capillary and Venous Testing Volume for Children Less Than 6 Years Old, 2022



**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 (75%). 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 (16%).

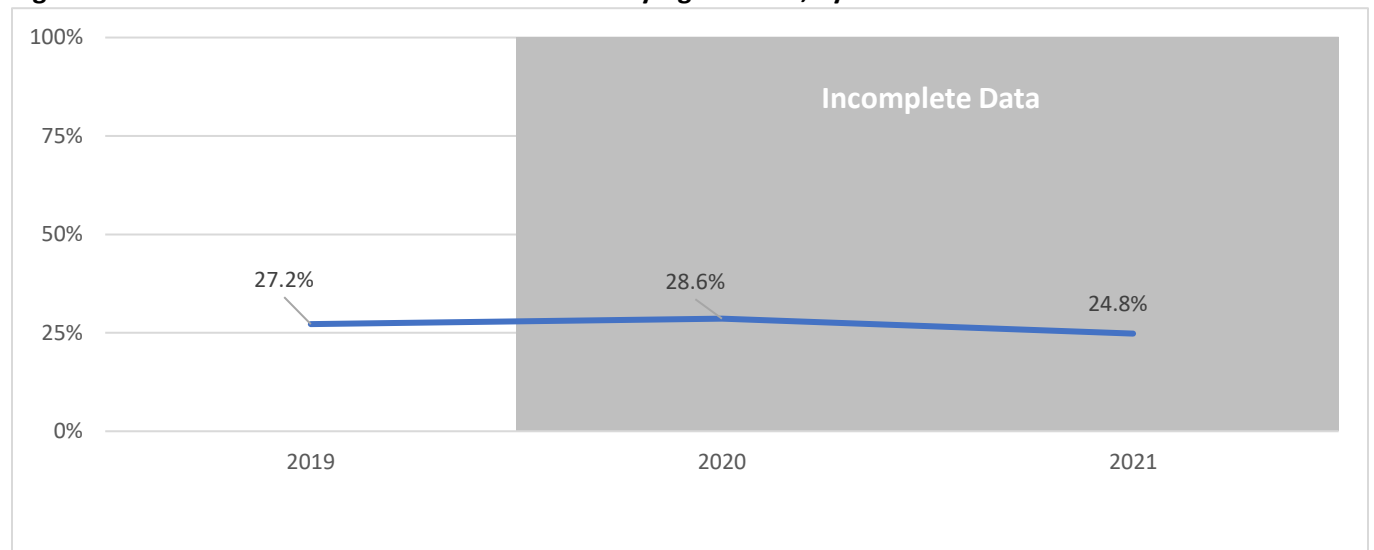
Table 1. Age Distribution of Children Receiving an Initial Blood Lead Test, 2022

Number of Children Tested	# Children	%	# Children with Lead Result $\geq 3.5 - <10$ µg/dL	# Children with Lead Result ≥ 10 µg/dL
0-24 months	3333	75%	67	5
25-48 months	707	16%	37	8
49 -<72 months	418	9%	12	3
Total	4458	100%	116	16

**Age at time of specimen collection.*

Among the 11,448 SD children born in 2019, 3,119 (27.2%) were tested at least once by age three years as shown in Figure 4. Incomplete reporting for the 2020 and 2021 birth cohorts shows 28.6% and 24.8% have been tested so far.

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



In 2022, 132 South Dakota children were found to have a blood lead level ≥ 3.5 µg/dL. Of these, 76 (58%) cases were confirmed. The breakdown of these confirmed cases includes:

- 9 (12%) children had an initial capillary test ≥ 3.5 µg/dL followed by a secondary capillary test ≥ 3.5 µg/dL within 12 weeks.
- 27 (36%) children had an initial capillary test ≥ 3.5 µg/dL followed by a venous test ≥ 3.5 µg/dL within 12 weeks.

- 40 (53%) children had an initial venous test $\geq 3.5\mu\text{g/dL}$.

Of the 132 South Dakota children, 56 (42%) were unconfirmed meaning no follow-up testing reported with 12-week timeframe after the initial capillary test $\geq 3.5\mu\text{g/dL}$.

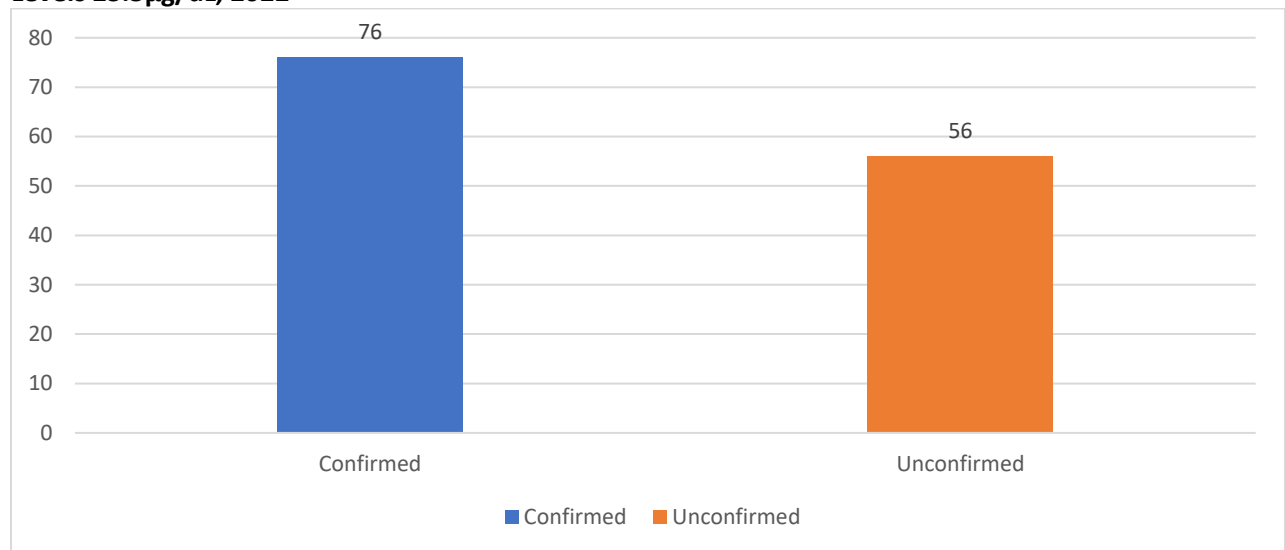
South Dakota blood lead testing guidelines recommend venous testing for children with an initial capillary test $\geq 3.5\mu\text{g/dL}$. In 2022, a total of 60 children had an initial capillary test $\geq 3.5\mu\text{g/dL}$ that was retested and found to have a result less than $3.5\mu\text{g/dL}$.

- 46 children received a follow-up venous test.
- 14 children underwent a follow-up capillary test.

Overall, only 40% of children with an initial elevated capillary test received a follow-up venous test within 12 weeks, while 60% did not receive the recommended venous testing.

Figure 5 shows the number with confirmed and unconfirmed results. The highest confirmed blood lead level identified in a SD child during 2022 was $67.3\mu\text{g/dL}$.

Figure 5. Number of Children Less Than 6 Years Old with Confirmed and Unconfirmed Blood Lead Levels $\geq 3.5\mu\text{g/dL}$, 2022



* Unconfirmed was defined as a single capillary blood lead test $\geq 3.5\mu\text{g/dL}$ without follow-up testing.

*Confirmed was defined as a single venous blood lead test $\geq 3.5\mu\text{g/dL}$ or two capillary blood lead tests $\geq 3.5\mu\text{g/dL}$ drawn within 12 weeks of each other

*Capillary tests $\geq 3.5\mu\text{g/dL}$ with a follow-up test within 12 weeks that was $< 3.5\mu\text{g/dL}$ 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%, followed by American Indian/Alaskan Native (16%) and Black/African American (6%) children. Race was missing for 5% and ethnicity was missing for 28% of children tested. Among those with a confirmed or unconfirmed blood lead level (BLL), male (3.7%), Asian (6.0%), and American Indian/Alaskan Native (4.1%) children surpassed the state percentage of 3.0%.

Table 2. Demographic Characteristics of Children Less Than 6 Years Old Tested, 2022

Sex	# Tested	% Tested	# Confirmed* And Unconfirmed†	%
Female	2185	49%	48	2.2%
Male	2262	51%	84	3.7%
Unknown	11	0%	0	0.0%
White	2884	65%	79	2.7%
American Indian/Alaskan Native	726	16.3%	30	4.1%
Black/African American	282	6.3%	8	2.8%
Asian	83	2%	5	6%
Other	251	6%	6	2.4%
Unknown	232	5.6%	4	1.7%
Hispanic	409	9.2%	10	2.4%
Non-Hispanic	2815	63.1%	92	3.3%
Unknown	1234	28%	30	2.4%
TOTAL	4458	100%	132	3.0%

*Confirmed was defined as a single venous blood lead test ≥ 3.5 $\mu\text{g}/\text{dL}$ or two capillary blood lead tests ≥ 3.5 $\mu\text{g}/\text{dL}$ drawn within 12 weeks of each other

† Unconfirmed was defined a single capillary blood lead test ≥ 3.5 $\mu\text{g}/\text{dL}$ without follow-up testing.

Table 3. Blood Lead Levels in South Dakota Children Less Than 6 Years Old by County, 2022

County	# Children Tested	% Tested	# Children with Confirmed And unconfirmed Blood Lead ≥ 3.5 $\mu\text{g}/\text{dL}$	Children with Confirmed And Unconfirmed Blood Lead (%)
Aurora	31	0.70%	1	3.2%
Beadle	169	3.79%	7	4.1%
Bennett	3	0.07%	0	0.0%
Bon Homme	30	0.67%	1	3.3%
Brookings	118	2.65%	1	0.8%
Brown	215	4.82%	3	1.4%
Brule	36	0.81%	1	2.8%
Buffalo	8	0.18%	4	50.0%
Butte	3	0.07%	2	66.7%
Charles Mix	89	2.00%	4	4.5%
Clark	22	0.49%	0	0.0%
Clay	65	1.46%	3	4.6%
Codington	189	4.24%	5	2.6%

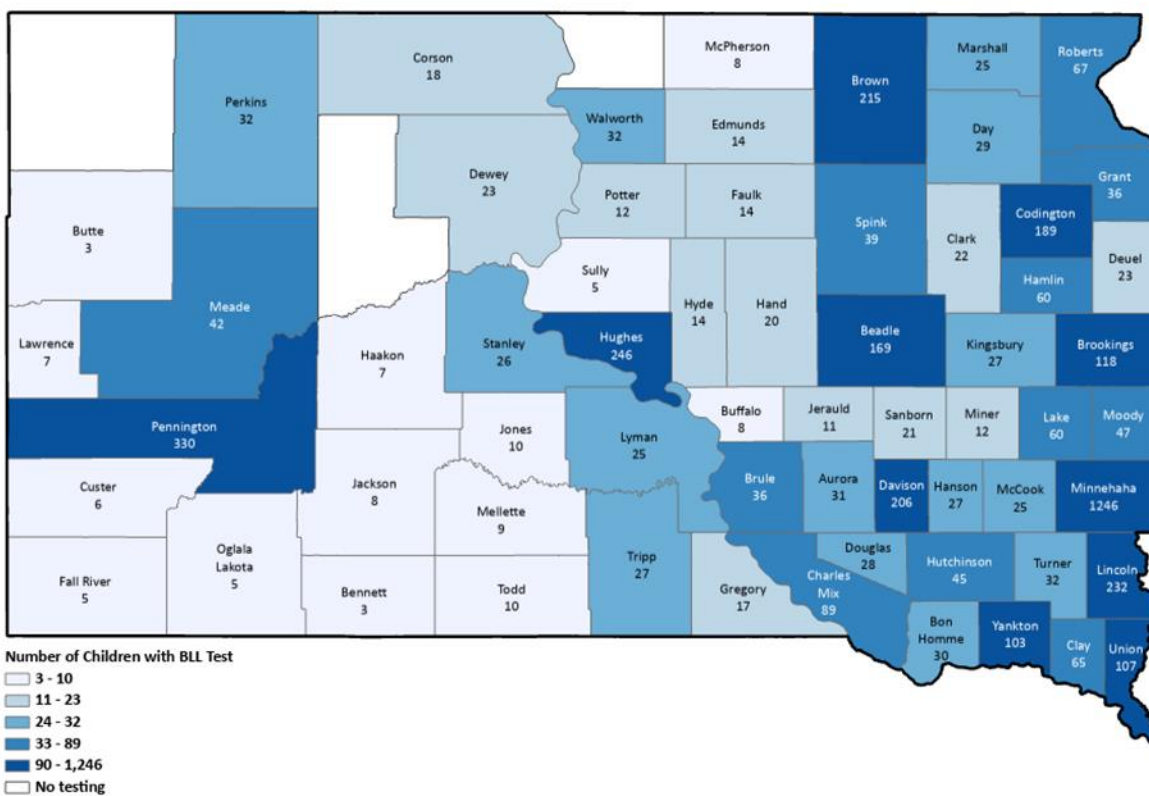
Corson	18	0.40%	1	5.6%
Custer	6	0.13%	0	0.0%
Davison	206	4.62%	7	3.4%
Day	29	0.65%	3	10.3%
Deuel	23	0.52%	1	4.3%
Dewey	23	0.52%	0	0.0%
Douglas	28	0.63%	1	3.6%
Edmunds	14	0.31%	0	0.0%
Fall River	5	0.11%	0	0.0%
Faulk	14	0.31%	0	0.0%
Grant	36	0.81%	3	8.3%
Gregory	17	0.38%	0	0.0%
Haakon	7	0.16%	0	0.0%
Hamlin	60	1.35%	3	5.0%
Hand	20	0.45%	0	0.0%
Hanson	27	0.61%	4	14.8%
Hughes	246	5.52%	1	0.4%
Hutchinson	45	1.01%	1	2.2%
Hyde	14	0.31%	1	7.1%
Jackson	8	0.18%	4	50.0%
Jerauld	11	0.25%	0	0.0%
Jones	10	0.22%	0	0.0%
Kingsbury	27	0.61%	2	7.4%
Lake	60	1.35%	4	6.7%
Lawrence	7	0.16%	5	71.4%
Lincoln	232	5.20%	3	1.3%
Lyman	25	0.56%	1	4%
Marshall	25	0.56%	0	0.0%
McCook	25	0.56%	2	8.0%
McPherson	8	0.18%	2	25.0%
Meade	42	0.94%	0	0.0%
Mellette	9	0.20%	0	0.0%
Miner	12	0.27%	0	0.0%
Minnehaha	1246	27.95%	21	1.7%
Moody	47	1.05%	2	4.3%
Oglala Lakota	5	0.11%	2	40.0%
Pennington	330	7.40%	10	3.0%
Perkins	32	0.72%	2	6.3%
Potter	12	0.27%	0	0.0%
Roberts	67	1.50%	0	0.0%
Sanborn	21	0.47%	2	9.5%
Spink	39	0.87%	1	2.6%
Stanley	26	0.58%	1	3.8%
Sully	5	0.11%	0	0.0%

Todd	10	0.22%	2	20.0%
Tripp	27	0.61%	0	0.0%
Turner	32	0.72%	1	3.1%
Union	107	2.40%	2	1.9%
Walworth	32	0.72%	3	9.4%
Yankton	103	2.31%	2	1.9%
Grand Total	4458	100.00%	132	

* 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 6. Number of South Dakota Children Less Than 6 Years Old Tested by County, 2022



References

CDC. (2021, October 27). Blood Lead Reference Value. Retrieved from Childhood Lead Poisoning Prevention: <https://www.cdc.gov/nceh/lead/data/blood-lead-reference-value.htm>

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