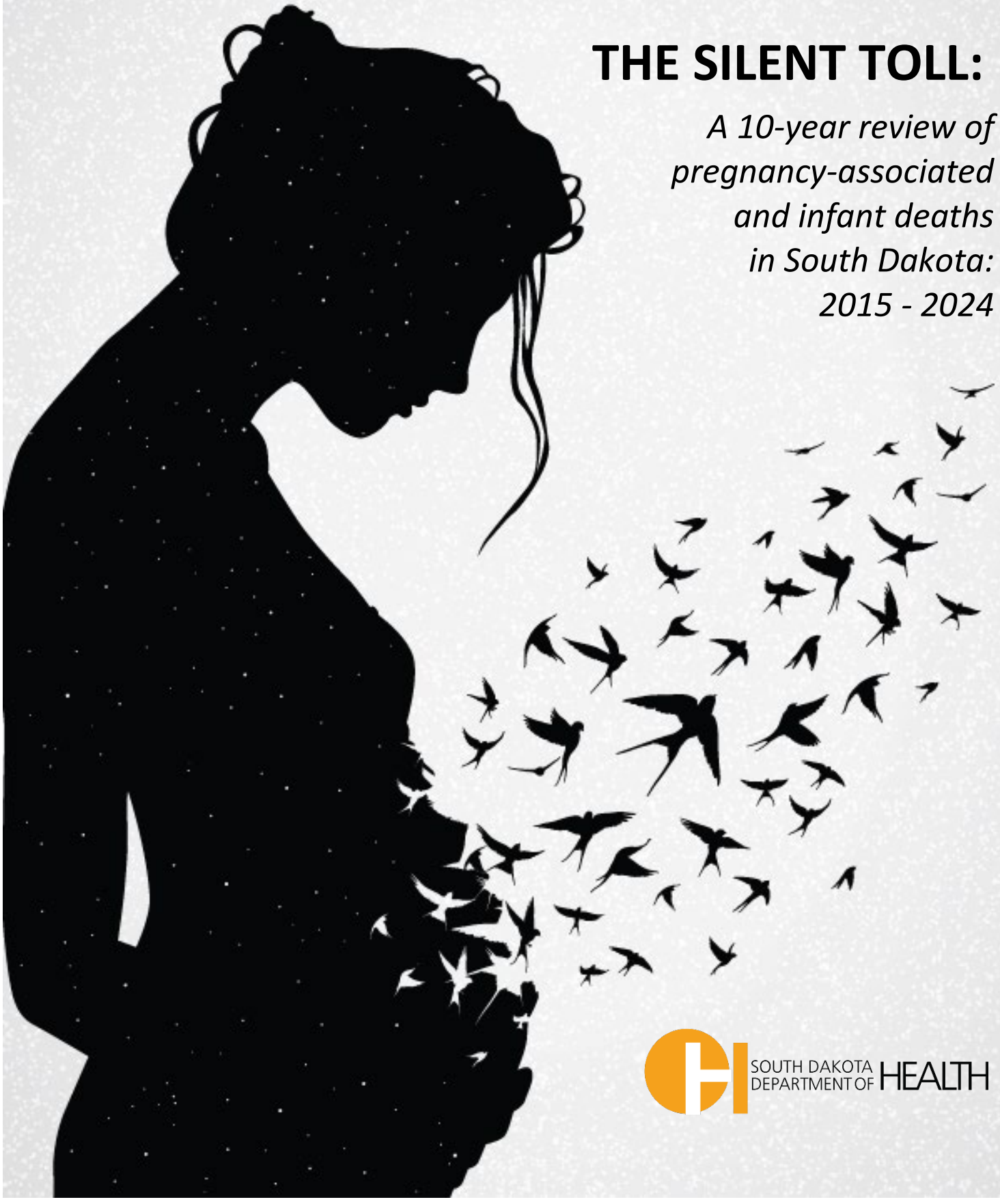
THE SILENT TOLL:

A 10-year review of pregnancy-associated and infant deaths in South Dakota: 2015 - 2024



SOUTH DAKOTA DEPARTMENT OF HEALTH

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Purpose

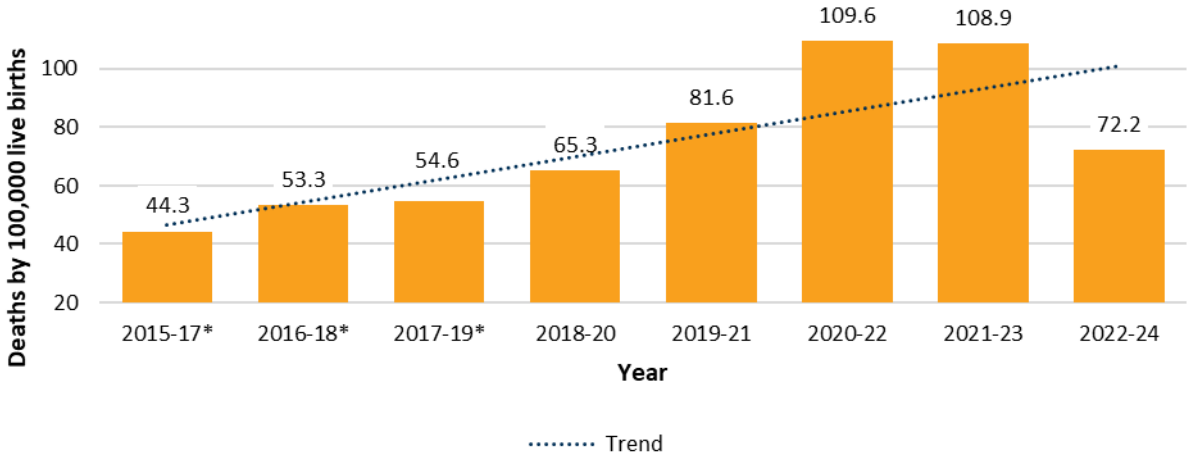
The following report describes the characteristics of mothers who died during pregnancy or within one year of the end of pregnancy, as well as infants who died before their first birthday, in South Dakota from 2015–2024. Throughout this report, we refer to these losses as pregnancy-associated deaths and infant deaths.

During this ten-year period, there were 787 infant deaths and 75 pregnancy-associated deaths. These deaths are more than statistics; they reflect the overall health and well-being of pregnancies across the state. The healthier a woman is during the pregnancy, the less likely an infant or a mother is to die[1, 2].

To understand the magnitude of those deaths, we need to compare them to the number of live births in the same period. From 2015 to 2024, there were 116,110 live births in South Dakota. During this time, **6.8** infants died for every 1,000 live births, and **65.7** mothers died for every 100,000 live births.

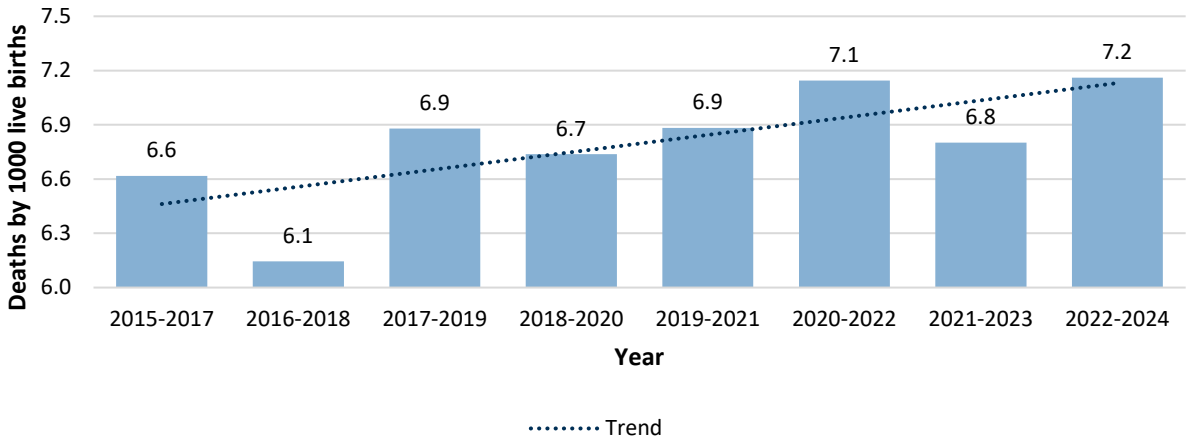
Rates and Trends of Deaths

Pregnancy-associated death rates recently declined but remain elevated within a 10-year upward trend. South Dakota, 2015-2024.



Source: Birth and Death records. Office of Health Statistics, Department of Health.
*Rates are unreliable due to small numbers of cases and should be considered with caution.

Infant death rates varied in the last 10 years but continue to increase. South Dakota, 2015-2024.

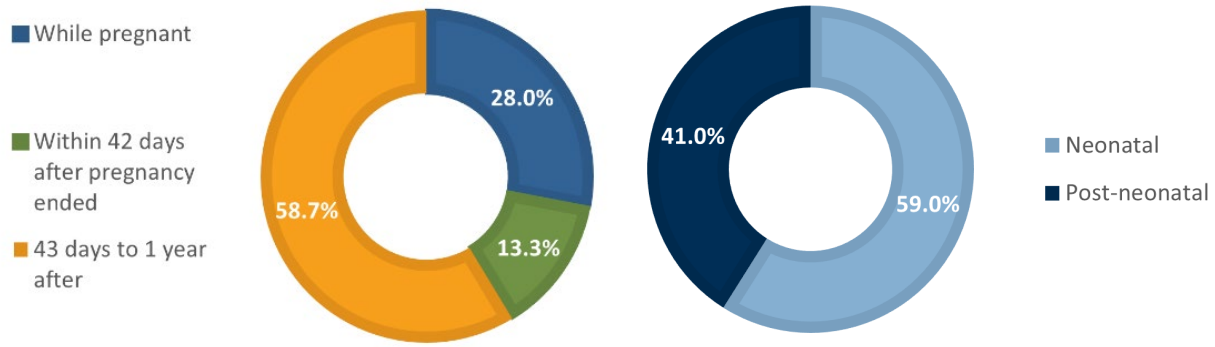


Source: Birth and Death records. Office of Health Statistics, Department of Health.

Time of Death

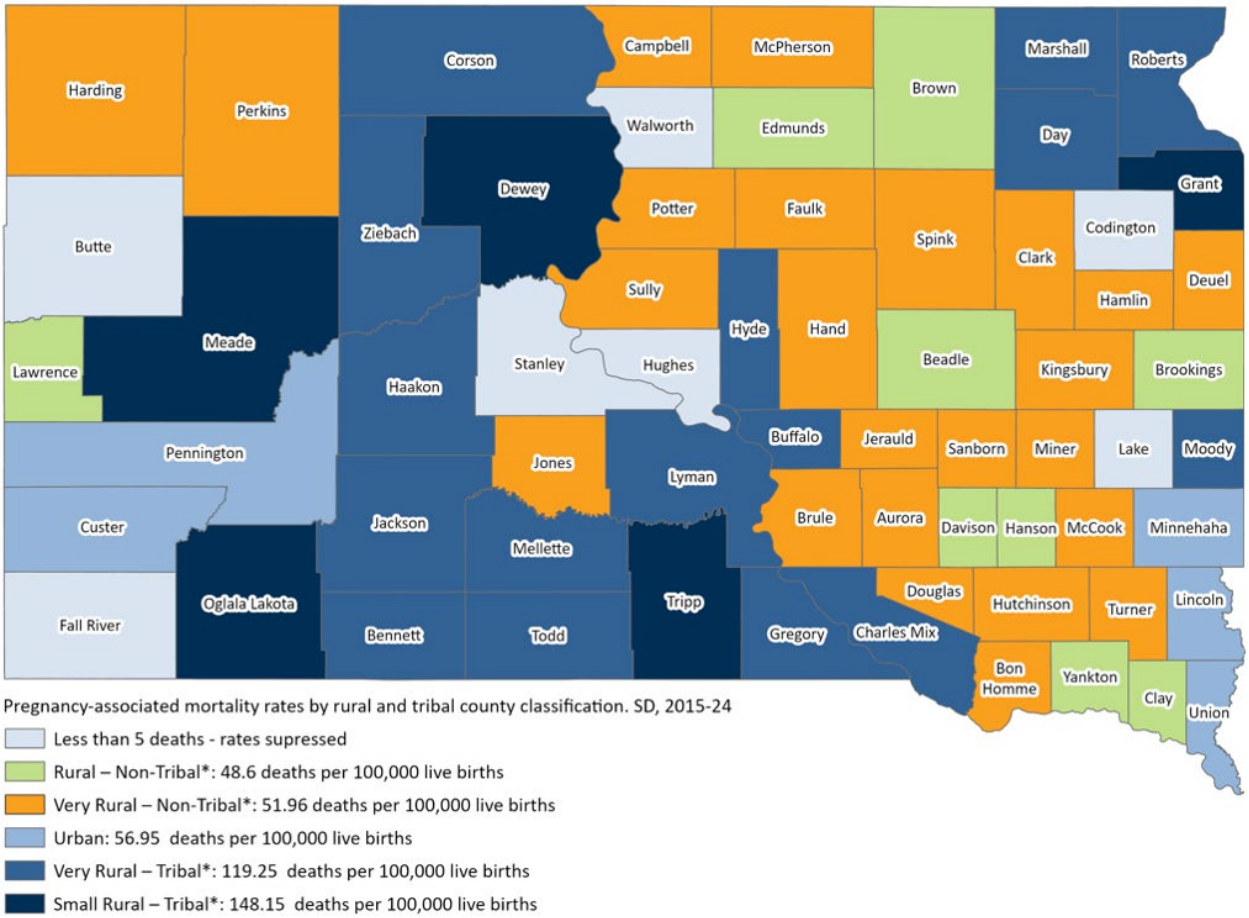
More than half of the infant deaths take place within the first 4 weeks after birth. In contrast, most pregnancy-associated deaths occur six weeks to one year after pregnancy ends - often after the routine postpartum follow-up visit has taken place.

Timing of pregnancy-associated deaths and infant deaths. South Dakota, 2015-2024.



Where are those deaths taking place?

Pregnancy-associated deaths by race and tribal county classification. South Dakota, 2015-2024.



Pregnancy-associated mortality rates by rural and tribal county classification. SD, 2015-24

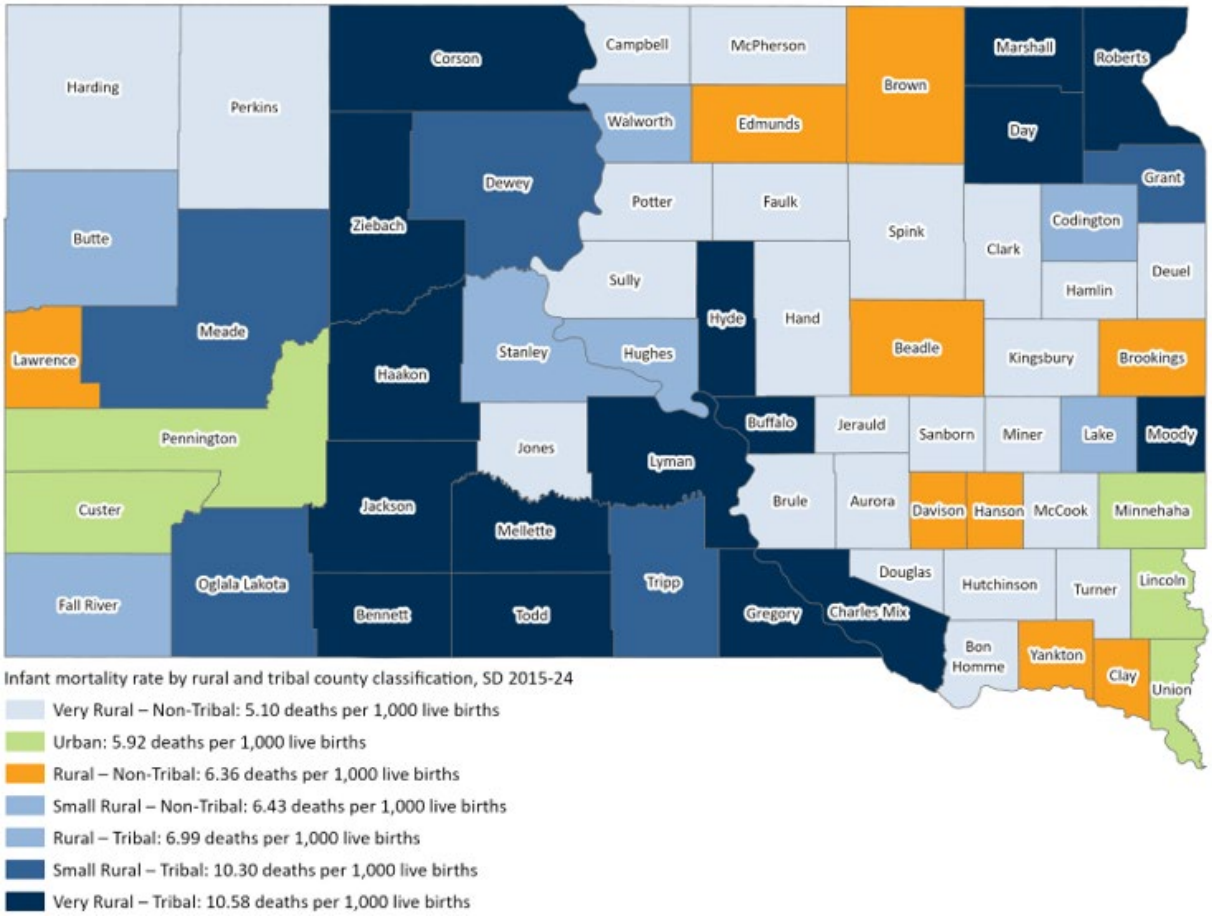
- Less than 5 deaths - rates supressed
- Rural – Non-Tribal*: 48.6 deaths per 100,000 live births
- Very Rural – Non-Tribal*: 51.96 deaths per 100,000 live births
- Urban: 56.95 deaths per 100,000 live births
- Very Rural – Tribal*: 119.25 deaths per 100,000 live births
- Small Rural – Tribal*: 148.15 deaths per 100,000 live births

Note: Please see *"How were these numbers calculated?"* for details on classification.

*Rates are unreliable due to small numbers of cases and should be considered with caution.

Source:
Birth and Death records. Office of Health Statistics, Department of Health.
Rural and tribal county classification: Office of Rural Health, Department of Health[3]

Infant mortality rate by rural and tribal county classification. South Dakota, 2015-2024.



Note: Please see *"How were these numbers calculated?"* for details on classification.

Source:
Source: Birth and Death records. Office of Health Statistics, Department of Health.
Rural and tribal county classification: Office of Rural Health, Department of Health[3]

The pregnancy-associated death rate in the Small Rural - Tribal group was three times higher than in the Rural - Non-Tribal group (148.1 vs. 48.6 per 100,000 live births). The infant mortality rate in the Very Rural- Tribal group was two times higher than in the Very Rural-Non-Tribal group (10.6 vs. 5.1 deaths per 1,000 live births). These findings emphasize the elevated mortality burden within tribal regions.

Rates of infants' deaths and pregnancy-associated deaths by rural and tribal classification category. SD, 2015-2024.

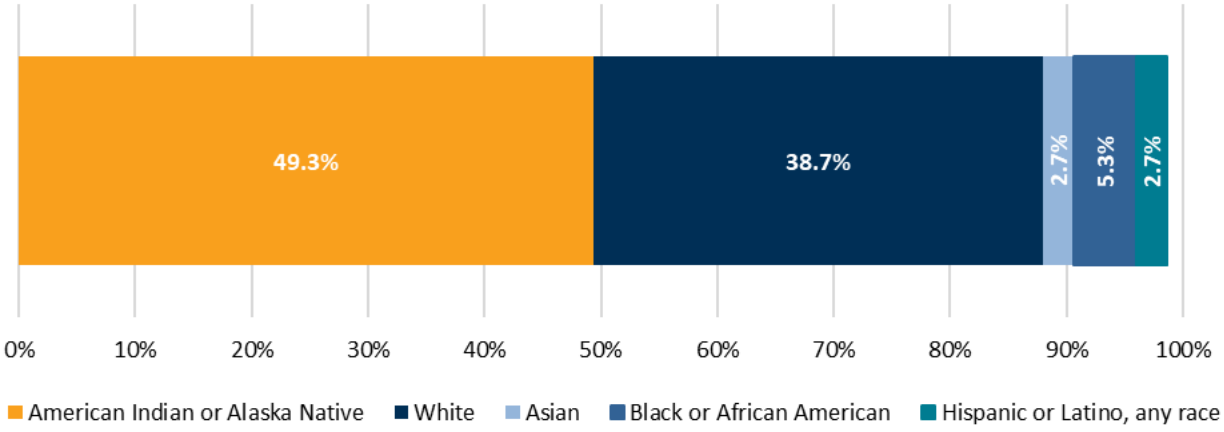
County Classification	Infant Death Rates per 1,000 live births	Pregnancy-Associated Death Rates per 100,000 live births
Very Rural – Tribal	10.6	119.3*
Small Rural – Tribal	10.3	148.1*
Rural – Tribal	7.0	**
Small Rural – Non-Tribal	6.4	**
Rural – Non-Tribal	6.4	48.6*
Urban	5.9	56.9
Very Rural – Non-Tribal	5.1	52.0*

* Rates are unreliable and should be considered with caution.
**Suppressed due to very small numbers of cases that made the rate extremely unreliable.

Race and Ethnicity

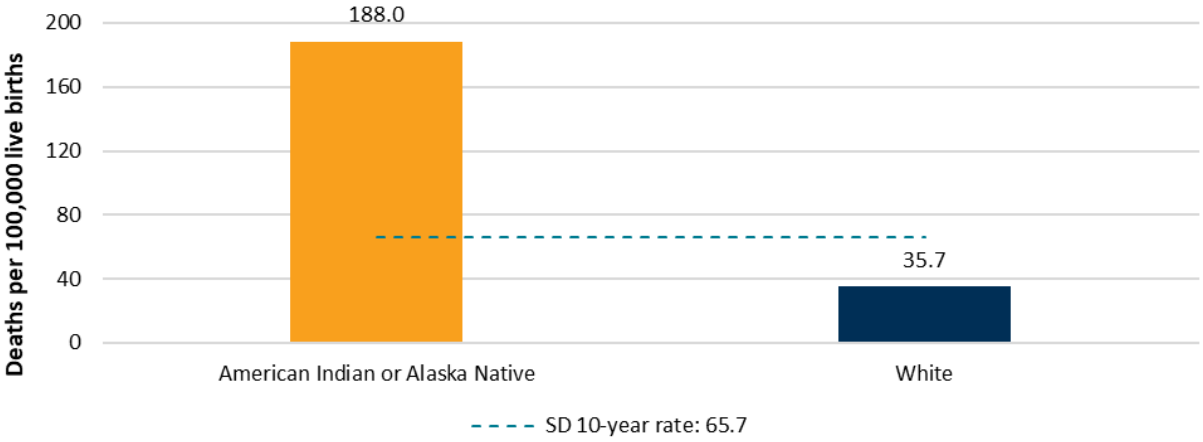
American Indian or Alaska Natives accounted for **19.5%** of all live births and **49.3%** of all pregnancy-associated deaths.

Distribution of pregnancy-associated deaths by race and ethnicity. South Dakota, 2015-2024.



Source: Birth and Death records. Office of Health Statistics, Department of Health.

Pregnancy-associated death rates were 5 times higher among American Indian or Alaska Native women than White women[¥]. South Dakota, 2015-2024.

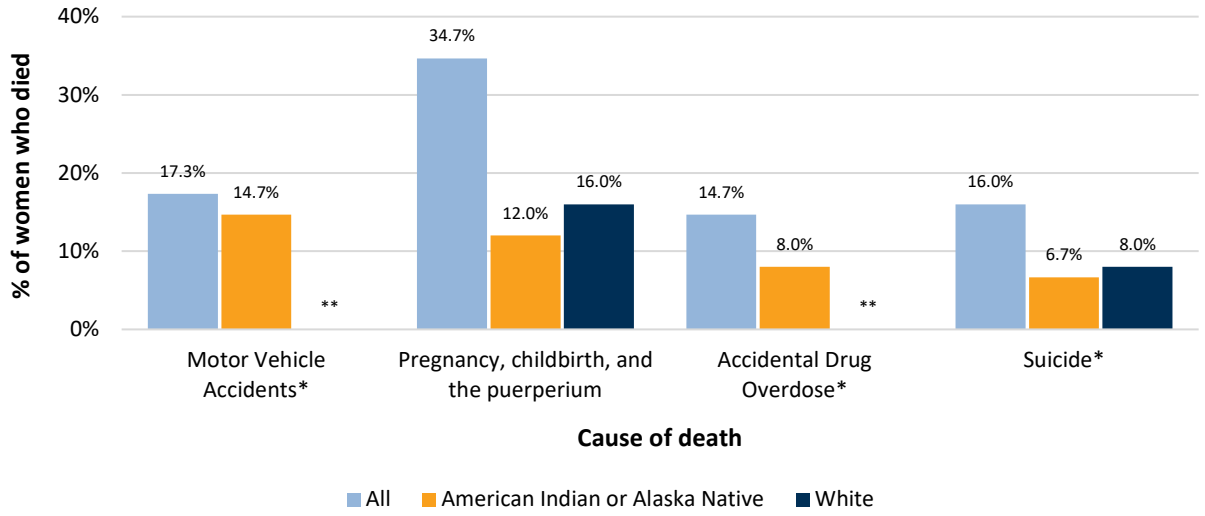


Source: Birth and Death records. Office of Health Statistics, Department of Health.

[¥] Rates for all other race and ethnicity groups were excluded due to small numbers of cases that made rates extremely unreliable.

Among American Indian or Alaskan Native women, motor vehicle accidents were the leading cause of death, while among White women, the leading cause was pregnancy, childbirth, or puerperium-related conditions (the six-week period after childbirth when the mother's reproductive organs return to their pre-pregnancy state).

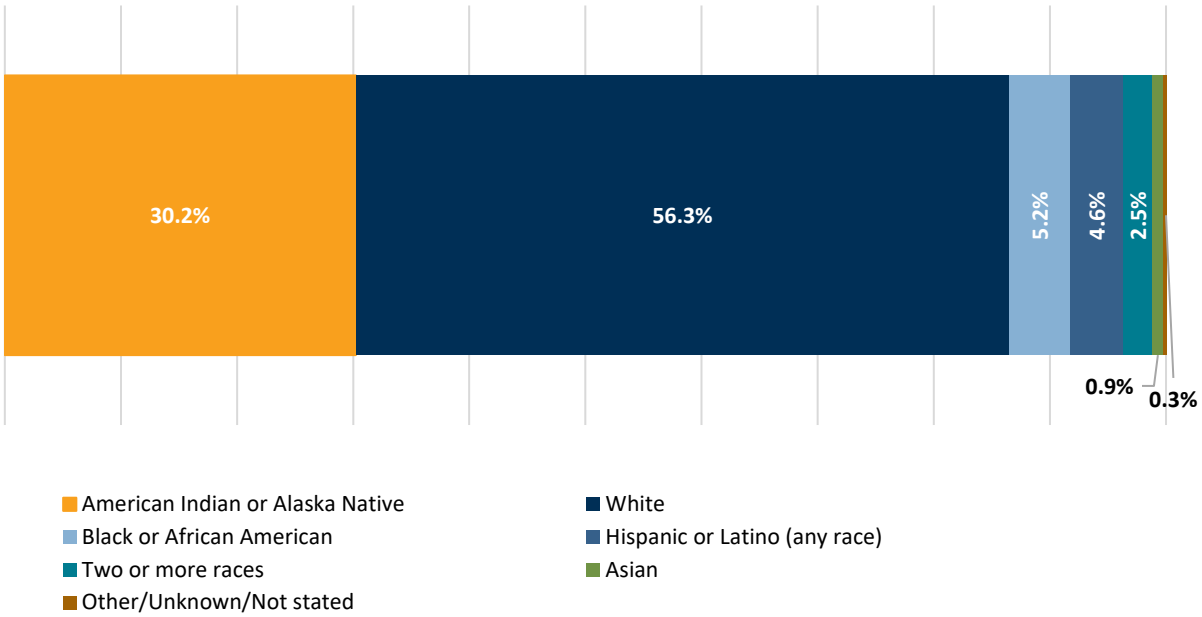
Most common causes of pregnancy-associated death: All women, American Indian or Alaska Native, and White. South Dakota, 2015-2024.



*Rates are unreliable due to small numbers of cases and should be considered with caution.
**Suppressed due to very small numbers of cases that made the rate extremely unreliable.

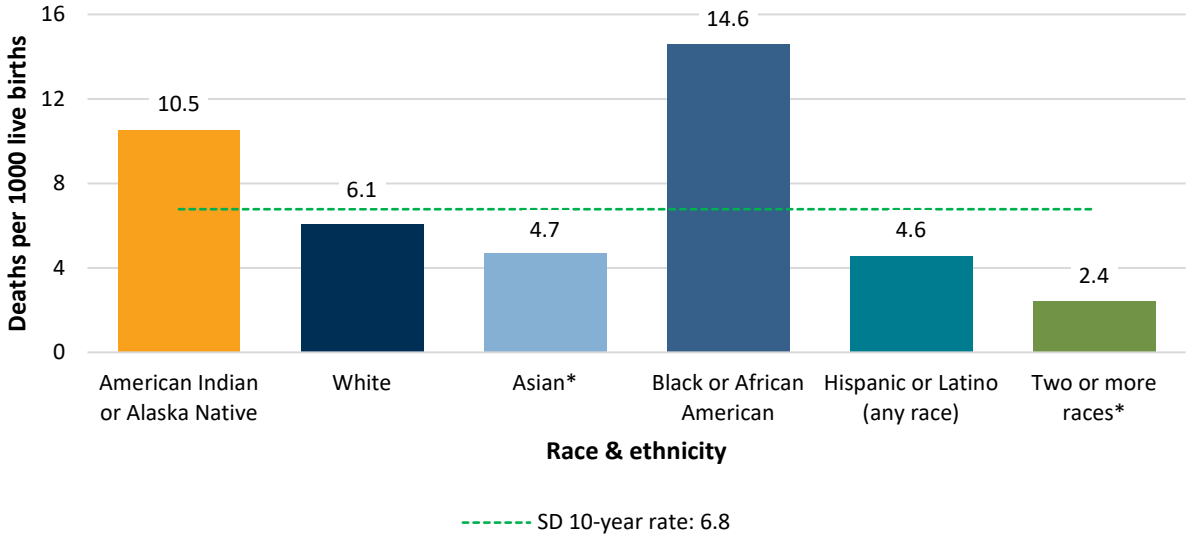
American Indian or Alaska Natives accounted for **19.5%** of all live births and **30.2%** of all infant deaths.

Distribution of infant deaths by race and ethnicity. South Dakota, 2015-2024.



Black or African American infants are the most disproportionally affected by infant deaths.

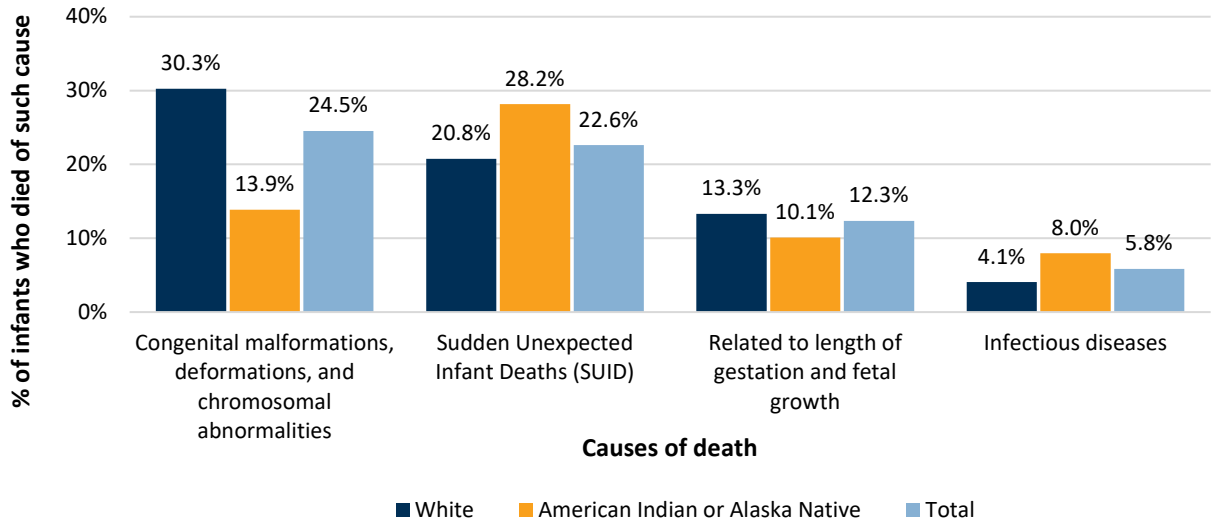
Rates of infant death by race and ethnicity. South Dakota, 2015-2024.



Source: Birth and Death records. Office of Health Statistics, Department of Health.
* Rates of deaths for Asian infants and infants of two or more races are unreliable due to a small number of cases and should be considered with caution. Race information was not available for two infants.

Among American Indian or Alaskan Native infants, Sudden Unexpected Infant Deaths (SUID) was the leading cause of death, while among White infants, the leading cause was congenital malformations, deformations, and chromosomal abnormalities.

Most common causes of infant death: All infants, American Indian or Alaska Native, and White. South Dakota, 2015-2024.

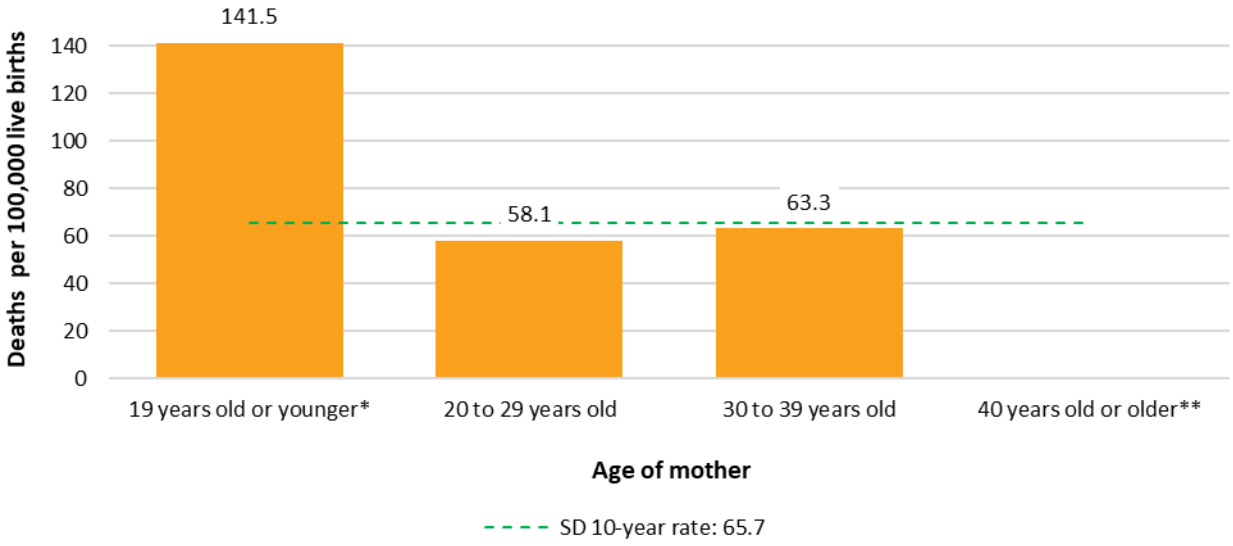


Source: Birth and Death records. Office of Health Statistics, Department of Health.

Other Demographic Characteristics

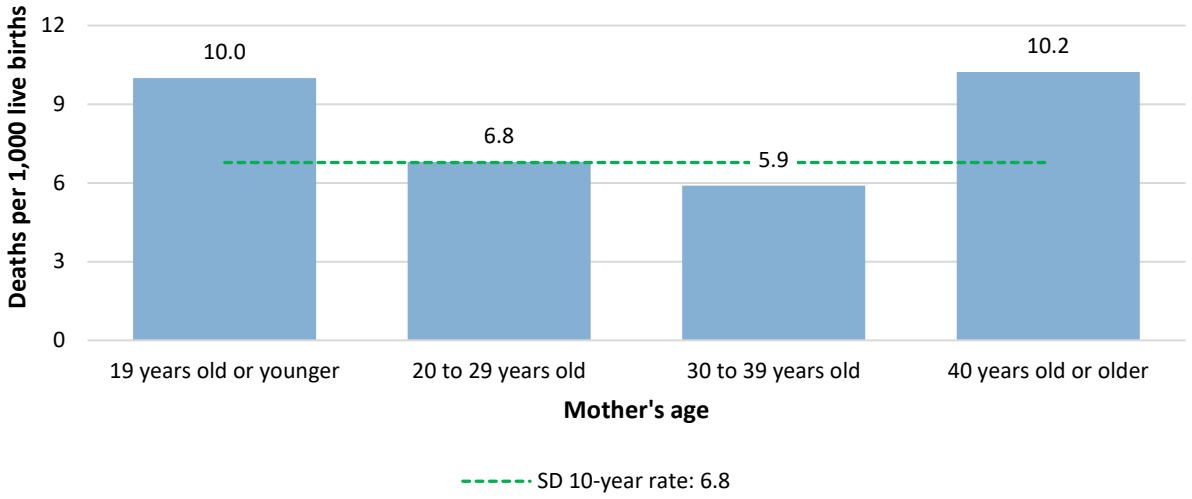
In South Dakota, the pregnancy-associated death rate was higher among younger women, whereas the national rate was higher among older women[4].

Pregnancy-associated death rates by age of mother. South Dakota, 2015-2024.



*Rate is unreliable due to the small number of cases and should be considered with caution.
**Suppressed due to very small numbers of cases that made the rate extremely unreliable.

Infant death rates by age of mother€. South Dakota, 2015-2024.

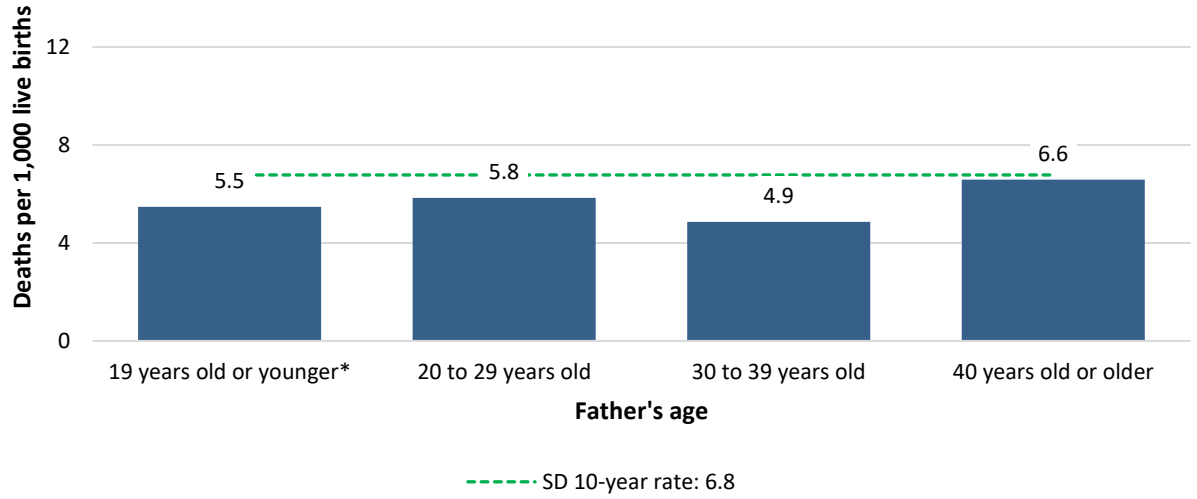


€ Information about the mother's age was not available for 13 cases (0.02%).

Some population studies and systematic review suggests that advanced maternal age is associated with congenital anomalies[5, 6] and adverse infant outcomes[7], which could explain the higher rates of infant deaths among that age group.

While the role of fathers is often overlooked in infant mortality research, the data suggest that paternal age may influence outcomes[8]. Infants born to adolescent fathers (≤19 years) and older fathers (≥40 years) experience higher mortality rates compared to those with fathers in their 30's, highlighting the need to consider paternal age when designing public health interventions. Further research is warranted to better understand these age-related risks.

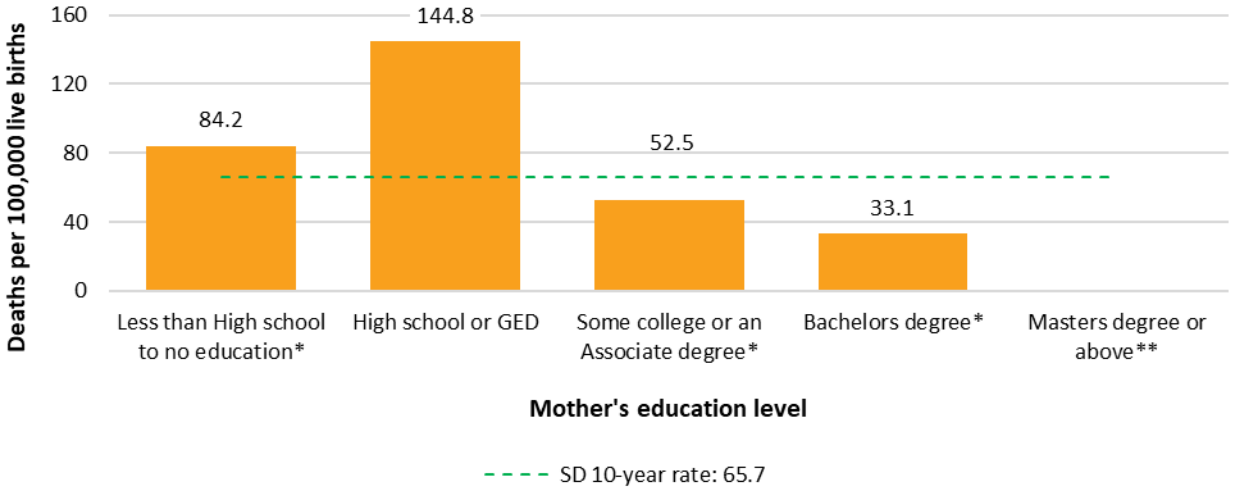
Infant death rates by father's age[f]. South Dakota, 2015-2024.



[f]Information about the father's age was not available for 223 cases (28.3%).

* Rates of deaths for infants with father's age 19 years old or younger are unreliable due to a small number of cases and should be considered with caution.

Pregnancy-associated death rates by mother's education level. South Dakota, 2015-2024.



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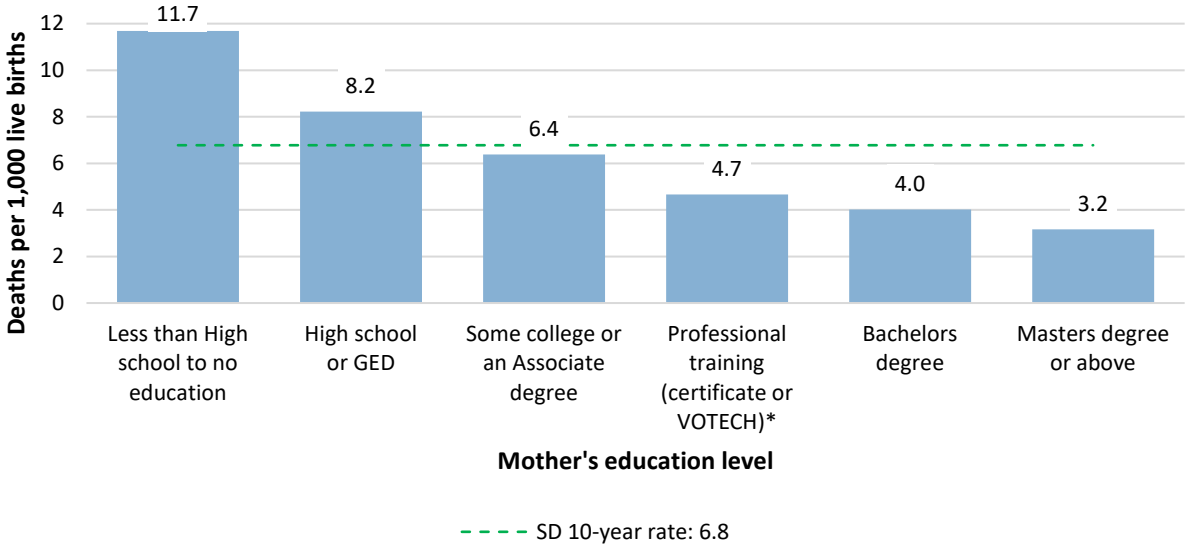
Infant death rates by mother's education level. South Dakota, 2015-2024.



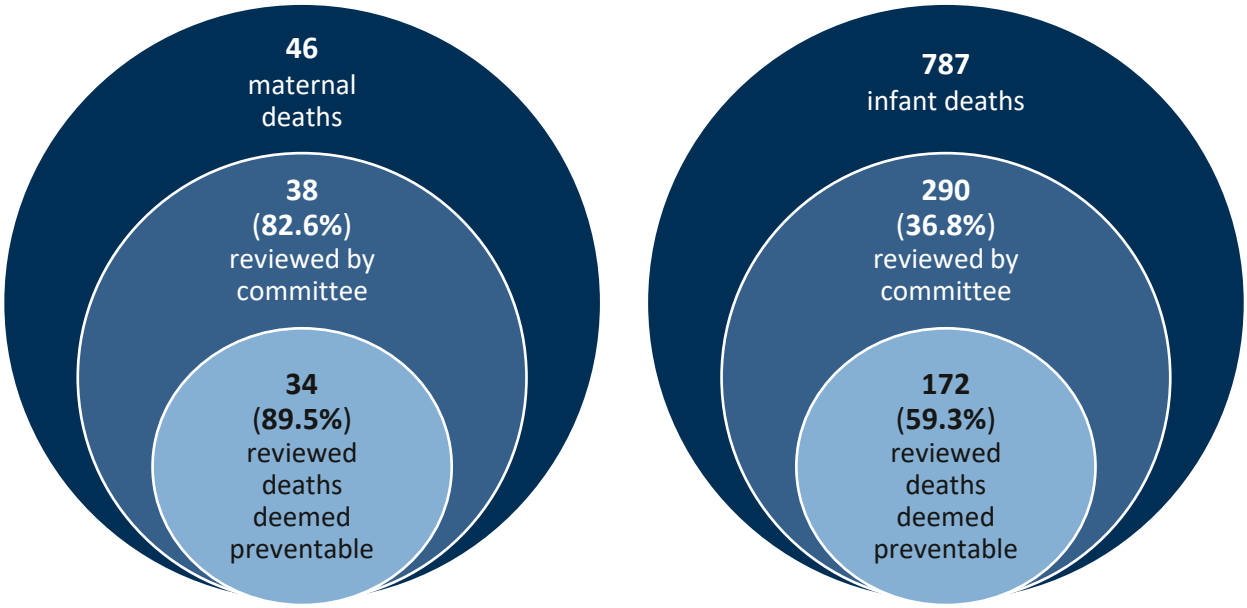
Information about the father's education was not available for 224 of 802 infants (28.4%), which prevented analysis.
Information about the mother's education level was not available for 24 infants (0.03%).

Data From Review Committees

Cases of infant mortality that took place from 2015 to 2024 and cases of maternal mortality that took place between 2018 and part of 2022 (7 of 15 reviews completed) were reviewed by a committee. The findings of those reviews are listed below.

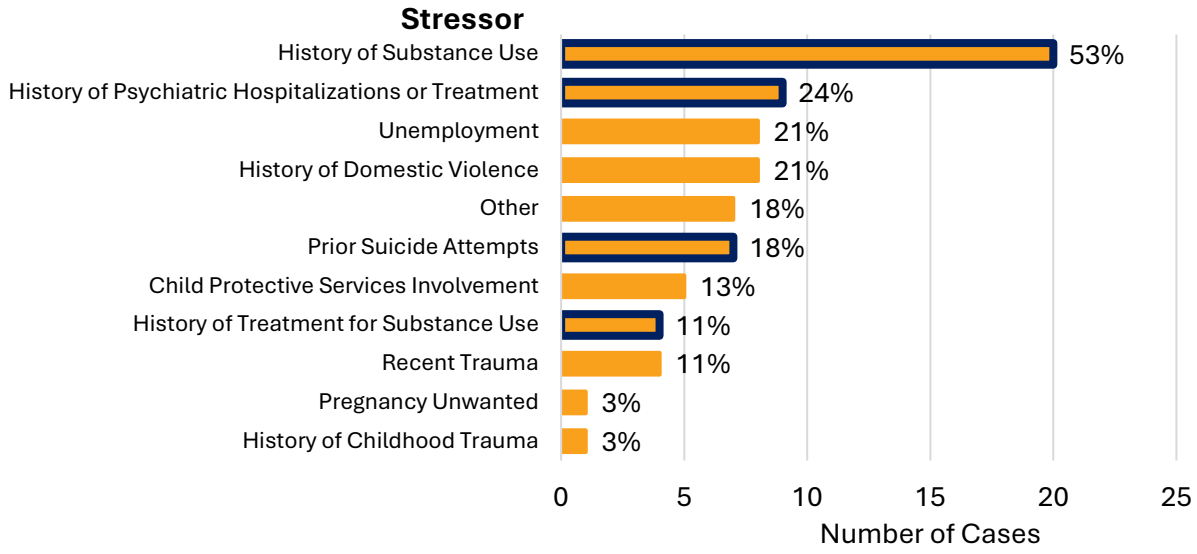
Reviewed infant deaths were limited to those occurring after hospital discharge. Most of these deaths were deemed preventable (59.3%). Most were sleep-related (67%), with the majority of sleep-related fatalities occurring in adult beds. Nearly three-quarters (72.2%) of post-discharge infant deaths occurred within the first four months of life, highlighting early infancy as a period of heightened risk.

Pregnancy-related and infant mortality: preventable cases.



Behavioral health factors are prominent. Substance use and mental health challenges were the most common stressors and were frequently identified as contributing to pregnancy-associated deaths.

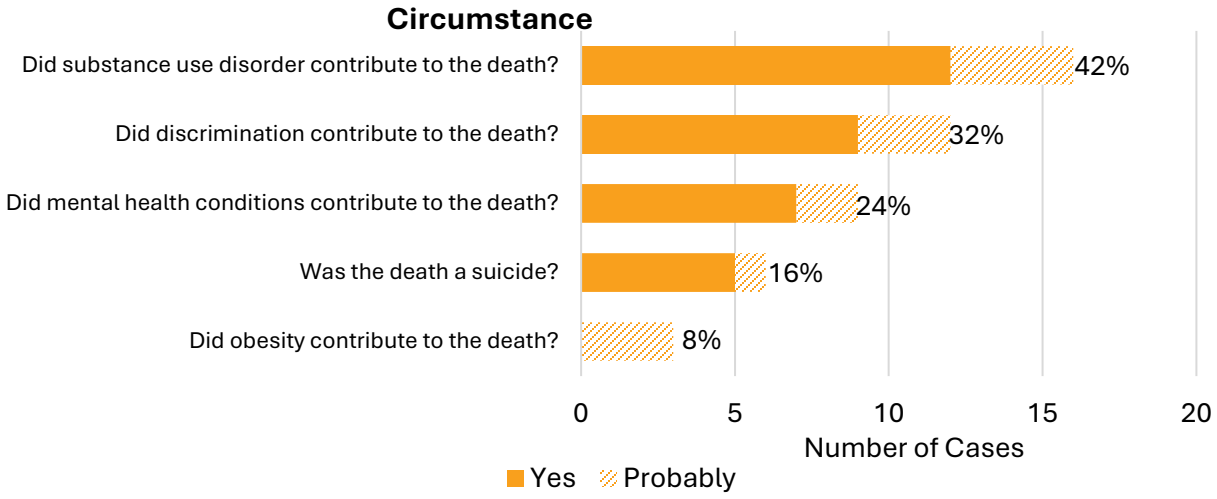
Frequency of selected stressors identified during pregnancy-associated death reviews.



Note: Dark blue outlined bars are stressors related to mental health.

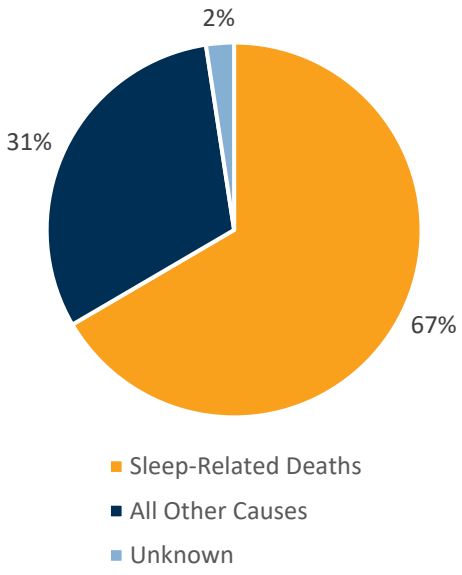
Source: Maternal Mortality Review Information Application

Committee determinations on circumstances contributing to pregnancy-associated deaths.

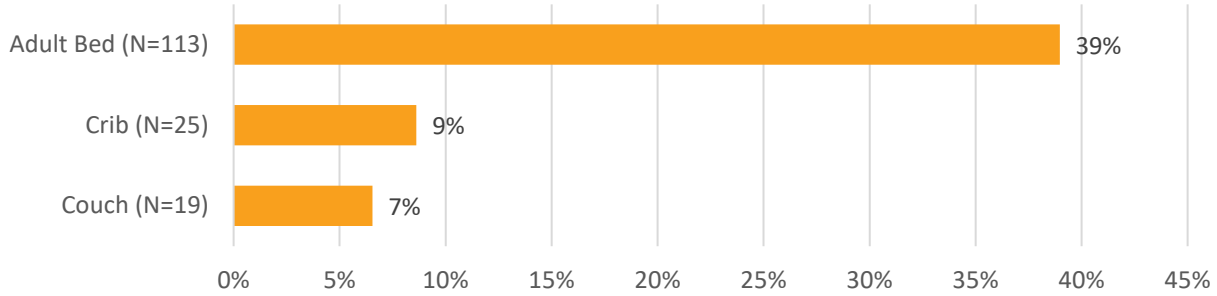


Source: Maternal Mortality Review Information Application

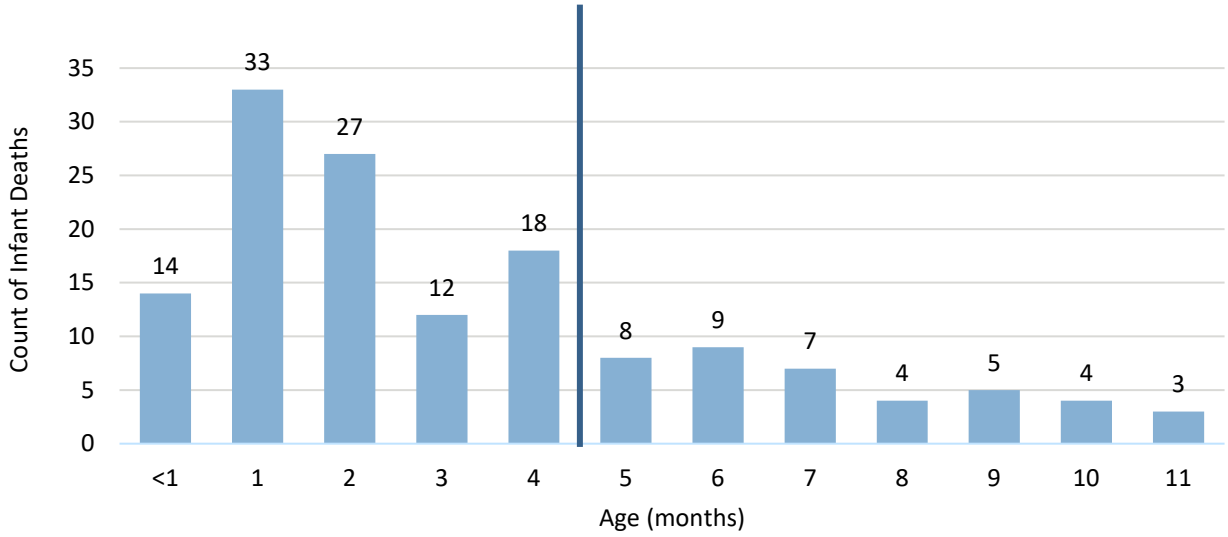
Causes for post-discharge infant deaths. South Dakota, 2015-2024.



Sleep environment where infant deaths most commonly occurred. South Dakota, 2015-2024.



Number of Post-Hospital Discharge Infant Deaths by Age. South Dakota, 2015-2024.



How Were These Numbers Calculated?

Death records of pregnancy-associated deaths were provided by the Office of Health Statistics. Whenever available, birth certificates and/or fetal death certificates of the respective infants were also provided by the Office. Likewise, death records of infants were provided by the Office of Health Statistics, along with birth certificates, whenever available.

Pregnancy-associated deaths include those of women who passed away while pregnant, during delivery, or up to a year after the end of pregnancy – independent of the cause of death, and independent of whether the fetus was delivered live or dead. Women who died in South Dakota but were residents of other states were excluded from the counts; likewise, women who lived in South Dakota but died in another state were also excluded because, in such a situation, access to information about the circumstances surrounding her death is very limited.

For all rates, the denominator was the number of resident live births – that is, infants born between January 1st, 2015, and December 31st, 2024, whose home address was in South Dakota. If a woman gave birth to twins or triplets, only one infant was counted for the live births – the second and/or third twins were excluded.

Classification of rates: reliable, unreliable, extremely unreliable.

South Dakota is a low demographic density state, and many of its counties are considered frontier or rural. As a result, many times disaggregating deaths by county race or other sociodemographic characteristic will result in very small numbers in the denominator. The smaller the denominator, the higher the possibility that the estimated rate is not accurate, but rather the product of chance – in other words, it does not represent the true reality of the state. Moreover, unreliable rates may lead to wrong conclusions and negatively impact the decisions taken in public health.

At the same time, every infant death and every maternal death is an enormous tragedy. Each death has a tremendous impact on the family and in the community where it took place, and therefore, should not be overlooked because it makes a very small number.

One of the challenges for this report was to find a balance between properly representing death rates, so that the interpretation of those rates allowed for a solid understanding of what is happening in South Dakota, without lessening the value of the “rare” deaths.

To evaluate the accuracy or reliability of the estimated rates, we calculated the standard error and relative standard error[1]. The standard error (SE) measures the accuracy of a sample distribution, while the relative standard error (RSE) compares the size of the SE against the rate itself. Estimates with a large RSE are considered less reliable than estimates with a small RSE.

There is no absolute cutoff point. For this report, we used the following criteria:

- Reliable: rates with an RSE less than or equal to 22%.
- Unreliable: rates with an RSE between 22.1 and 49.9%.
- Extremely unreliable: rates with an RSE of 50% and above. A RSE of 50 percent indicates that the standard error is half the size of the rate. Those rates were suppressed from this report.

Anytime a rate is unreliable because of a small number of cases, that rate will be marked with an Asterix. Evaluate that rate with caution!*

Race & ethnicity

In the United States, being an American Indian and/or Alaska Native AI/AN implies both a *race and a citizenship status*. Because of that and to properly represent natives in South Dakota, in this report, the selection of race followed the recommendations of the Urban Indian Health Institute [(9)]:

For pregnancy-associated deaths, AI/AN were identified as follows:

[1] https://www.health.ny.gov/diseases/chronic/ratesmall.htm

- Any woman who identified as AI/AN was defined as AI/AN.
- If a woman had two or more races listed, and one of those races was AI/AN, that woman was counted in the group of AI/AN.
- Such selection was also used for women who identified as AI/AN and Latino or Hispanic, independent of any other race listed.
- In other words, for American Indians and/or Alaska Natives, their citizenship status *trumped* other races or ethnicities in this report.

Likewise, for infant deaths and live births, AI/AN were identified as follows:

- If an infant's mother or father was identified as AI/AN, that infant was counted as AI/AN, independent of any other race or ethnicity listed on either mother's or father's side.

The second group identified for this analysis was people of Hispanic or Latino ethnicity.

- Women who identified as such were counted in this group independent of any other race listed.
- Likewise, for infant deaths and/or live births, if a father or mother identified as Hispanic or Latino, that infant was counted as such, independent of other ethnicities or races listed on either side.

The third group to be identified was people of two or more races.

- It only includes people who had not previously been selected as "AI/AN" or "Hispanic or Latino".
- For pregnancy-associated deaths, women who identified with two or more of the following races were counted in this group: Asian, Black or African American, Pacific Islander or Native Hawaiian, and White.
- For infant deaths and live births, infants who were born to a mother or father of two or more races were counted in this group. If the mother's race was different from the father's race (e.g., mother was White and father was Asian), and neither were AI/AN or Hispanic, the infant was counted as "two or more races".

Only people who were not counted this far as AI/AN or Hispanic or Latino or Two or more races were included in the groups of single races (Asian, Black or African American, Pacific Islander or Native Hawaiian, or White).

Rural and tribal county classification

Classification of counties by rurality and tribal status was provided by the Office of Rural Health[3], and comes from the report *"Strategic Analysis of South Dakota's Rural Healthcare Programs Final Recommendations Report" (October 18, 2024)*.

Rural Classification

Counties' rural status is classified according to the following criteria. Rural-Urban Commuting Area (RUCA) codes are used to define rurality by the USDA and HRSA, based on population density, urbanization, and daily commuting patterns. RUCA codes range from 1 (most urban) to 10 (most rural), providing a more nuanced understanding of geographic access to care.

- Urban: RUCA codes 1–3 (zip codes classified as urban)
- Rural: RUCA codes 4–6 (zip codes classified as rural)
- Small Rural: RUCA codes 7–9 (zip codes classified as small rural)
- Very Rural: RUCA code 10 (zip codes classified as very rural)

For counties with multiple RUCA codes, classification was based on the zip code containing most of the county's population. In some cases, zip codes that cross state boundaries were included to avoid underestimating access in shared service areas.

Tribal Classification

- Tribal classification is defined by the presence of one or more Federally Classified Reservations within a county or zip code. These Tribal Areas may include both Native and non-Native populations. All remaining counties and zip codes, excluding urban areas, are classified as Non-Tribal.

Causes of death

Causes of death were obtained from death records and are codified by the International Classification of Diseases. This classification is designed to promote international comparability in the collection, processing, classification, and presentation of mortality statistics.

"Unintentional injuries" include causes of death such as

- Drowning/submersion
- Falls
- Land Transport
- Unintentional Poisoning
- Suffocation and foreign body
- Unintentional firearm discharge
- Self-harm
- Assault, among other

"Pregnancy, childbirth, and puerperium" include causes of death such as

- Pregnancy with abortive outcome, such as an ectopic pregnancy, spontaneous abortion, complications following (induced) termination of pregnancy, among others.
- Edema, proteinuria, and hypertensive disorders in pregnancy, childbirth, and the puerperium
- Other maternal disorders predominantly related to pregnancy, such as hemorrhage in early pregnancy, diabetes mellitus in pregnancy, childbirth, and the puerperium, abnormal findings on antennal screening, among others.
- Maternal care related to the fetus and amniotic cavity and possible delivery problems, such as multiple gestation, placental disorders, and premature rupture of membranes, among others.
- Complications of labor and delivery.
- Complications predominantly related to the puerperium.
- Other obstetric conditions not elsewhere classified.

"Congenital malformations, deformations and chromosomal abnormalities" include causes of death such as:

- Congenital malformations of the nervous system.
- Congenital malformations of the eye, ear, face, and neck.
- Congenital malformations of the circulatory system.
- Congenital malformations of the respiratory system.
- Cleft lip and cleft palate.
- Other congenital malformations of the digestive system.
- Congenital malformations of genital organs.
- Congenital malformations of the urinary system.
- Congenital malformations and deformations of the musculoskeletal system.
- Other congenital malformations.
- Chromosomal abnormalities not elsewhere classified.

Infant causes of death in the group of "Sudden Unexpected Infant Deaths (SUID)" include Sudden Infant Death Syndrome (SIDS) and ill-defined or undetermined causes of death.

Infant causes of death in the group of "Related to length of gestation and fetal growth" include Extremely low birth weight, Other low birth weight, Extreme immaturity, and Other preterm infants.

Infant causes of death in the group of "Infectious diseases" include all reportable communicable diseases in South Dakota.

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