



SOUTH DAKOTA DEPARTMENT OF HEALTH

Pregnancy-Associated and Infant Deaths in SD: 2012-2021

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Purpose

The following report aims to describe the characteristics of mothers who died during pregnancy or up to a year after the pregnancy had ended, and the characteristics of children who passed away before their first birthday, in South Dakota, from 2012 to 2021. We will refer to those cases as pregnancy-associated and as infant deaths.

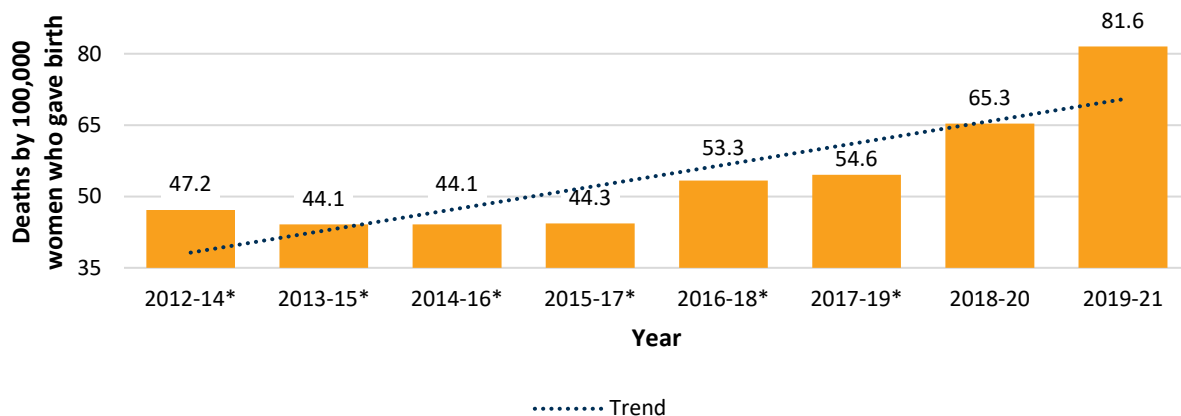
There were 802 infant deaths during those 10 years, and 68 pregnancy-associated deaths.

Those numbers tell a story. These deaths serve as indicators of the healthy status of pregnancies in South Dakota. The healthier the 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, though, we also need to compare them to the number of live births in the same period. Between 2012 and 2022, 116,900 women gave birth to 118,930 babies in South Dakota. For every thousand live births, **6.7** infants died. For every one-hundred thousand women who gave birth, **58.2** died.

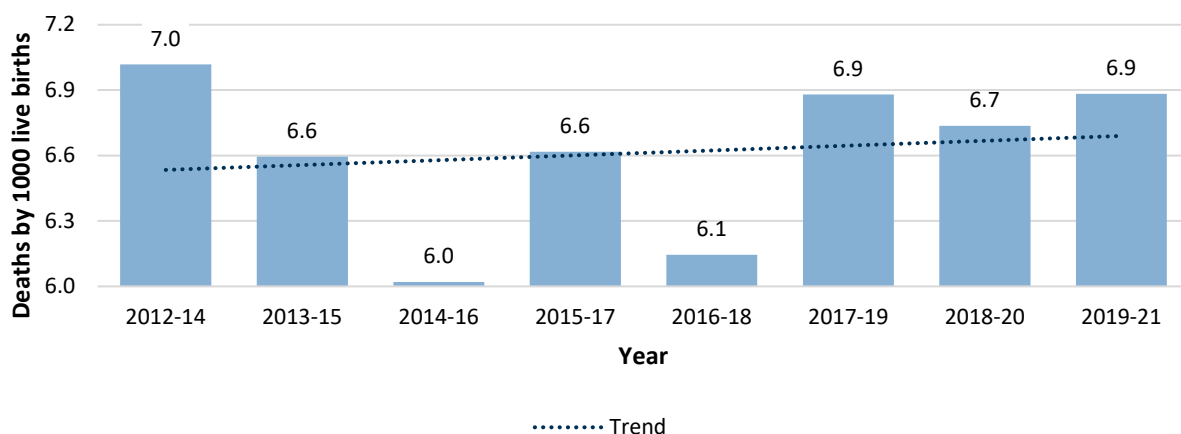
Rates and Trends of Deaths

Rates of pregnancy-associated death continually increased in the last 10 years. South Dakota, 2012-2021.



Source: Birth and Death records. Office of Health Statistics, Department of Health.
*Rates are unstable and should be considered with caution.

Infant death rates varied in the last 10 years but continue to increase. South Dakota, 2012-2021.

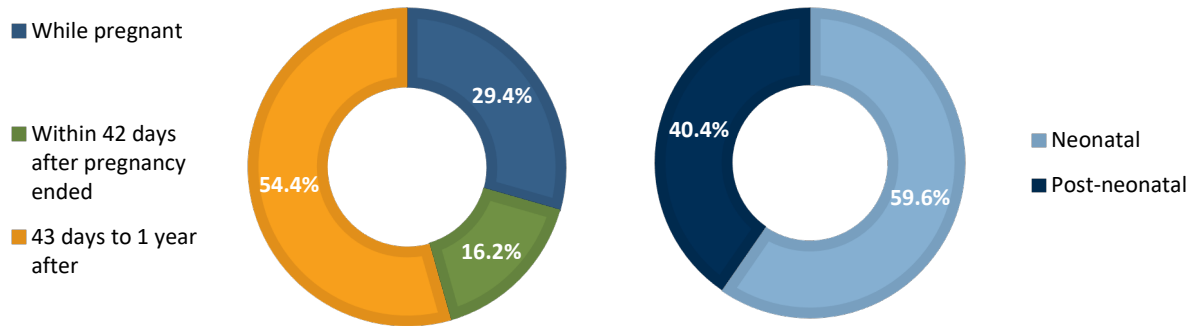


Source: Birth and Death records. Office of Health Statistics, Department of Health.

Time of Death

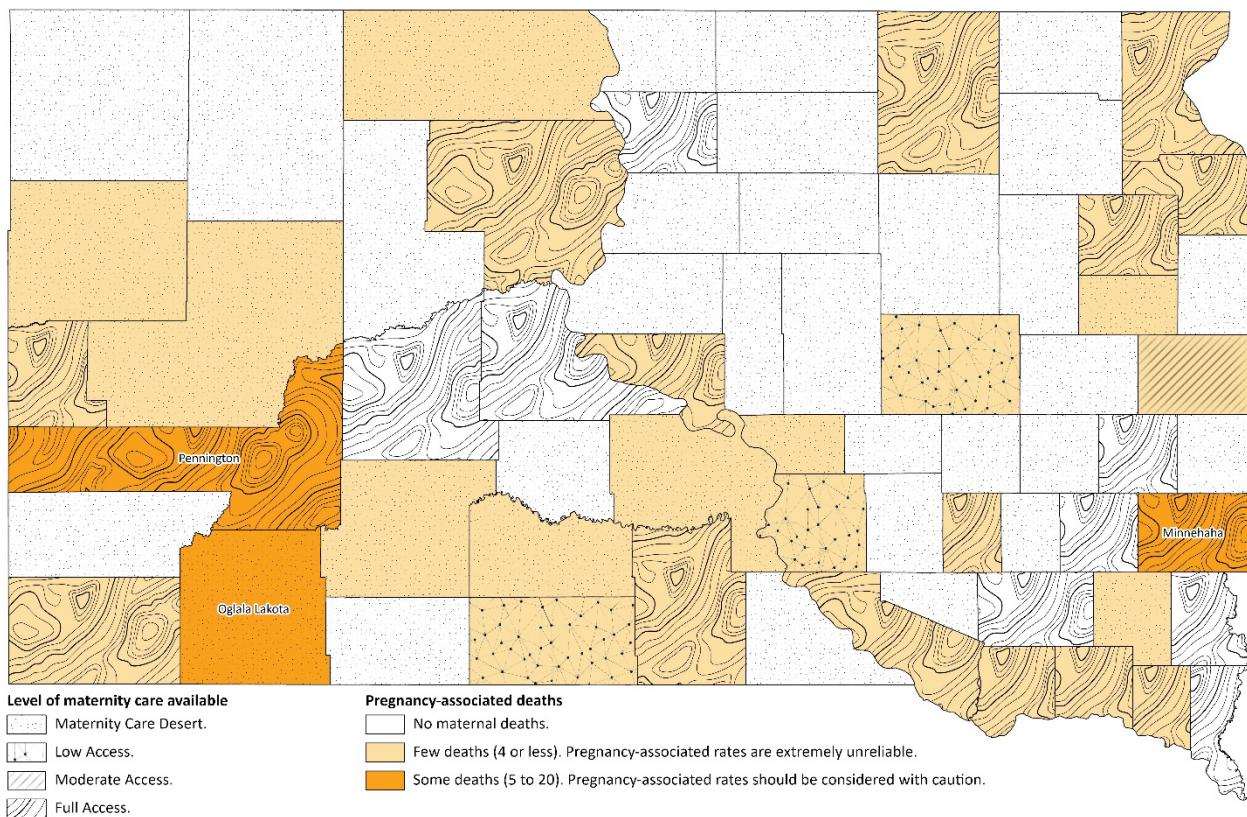
More than half of the infant deaths take place shortly after birth, in the first 4 weeks. In contrast to that, more than half of the pregnancy-associated deaths happen 6 weeks or more after the end of the pregnancy – in other words, after the postpartum follow-up has taken place.

Time of death *versus* end of pregnancy: pregnancy-associated & infant cases. South Dakota, 2012-2021.



Where are those deaths taking place?

Distribution of pregnancy-associated deaths by county of residence, compared to the level of maternity care available. South Dakota, 2012-2021.



Source: Pregnancy-associated deaths: Birth and Death records. Office of Health Statistics, Department of Health. Maternity care level: March of Dimes Report⁽³⁾. County of residence was not known for one case.

Pregnancy-associated and Infant deaths in South Dakota: 2012-2021

The pregnancy-associated death rate of Oglala Lakota County is 2.9x higher than SD's rate (58.2 per 100,000 live births) and 5.4x higher than Minnehaha County's.

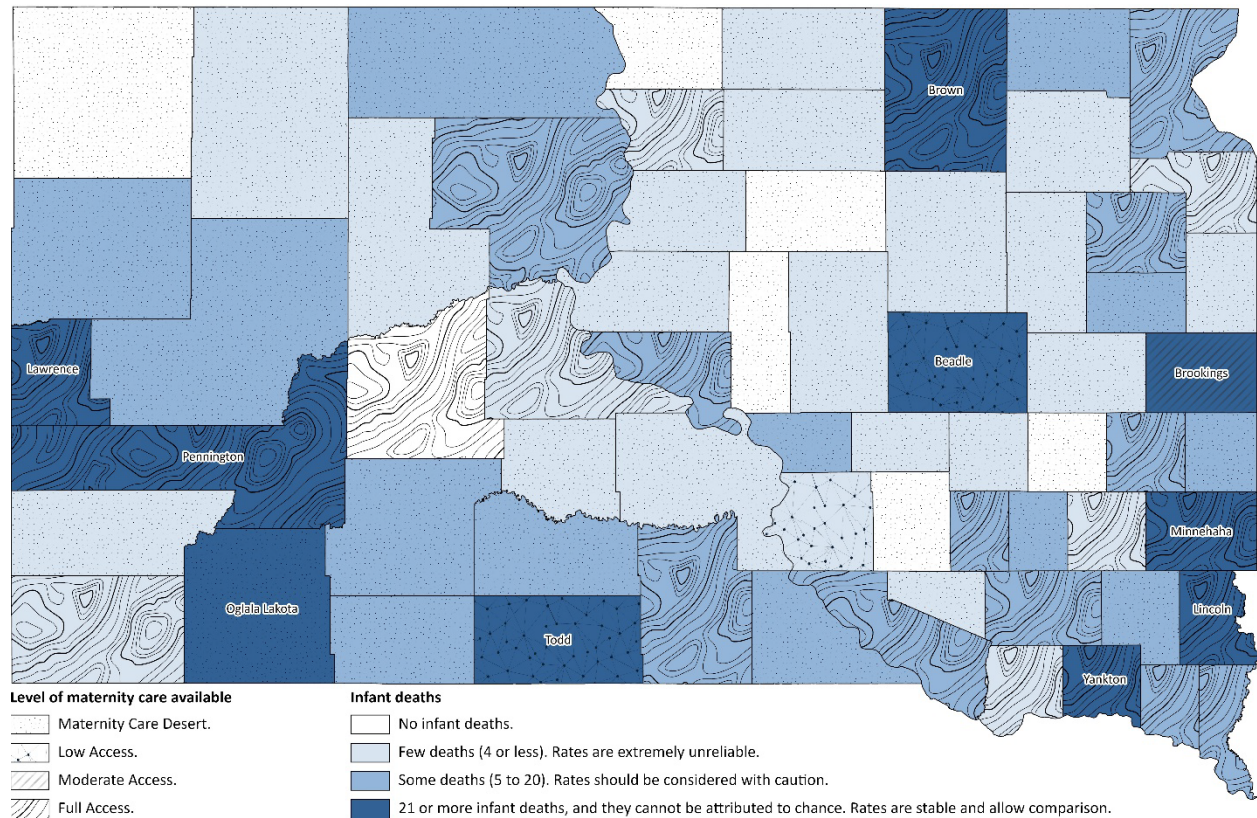
Pregnancy-associated death rates by county of residence. South Dakota, 2012-2023.

County	Rate per 100,000 live births
Oglala Lakota*	170.7
Pennington*	81.4
Minnehaha*	31.9

*Rates are unstable due to the small number of cases and should be considered with caution.

Oglala Lakota is also the county with the highest rate of infant deaths.

Distribution of infant deaths by county of residence, compared to the level of maternity care available. South Dakota, 2012-2021.



Source:
 Infant deaths: Birth and Death records. Office of Health Statistics, Department of Health.
 Maternity care level: March of Dimes Report⁽³⁾.

Pregnancy-associated and Infant deaths in South Dakota: 2012-2021

The infant death rates by counties are presented below. Pregnancy-associated death rates of counties with rates that were extremely unstable due to a very small number of cases were omitted.

Rates of infants' deaths by county. SD, 2012-2021.

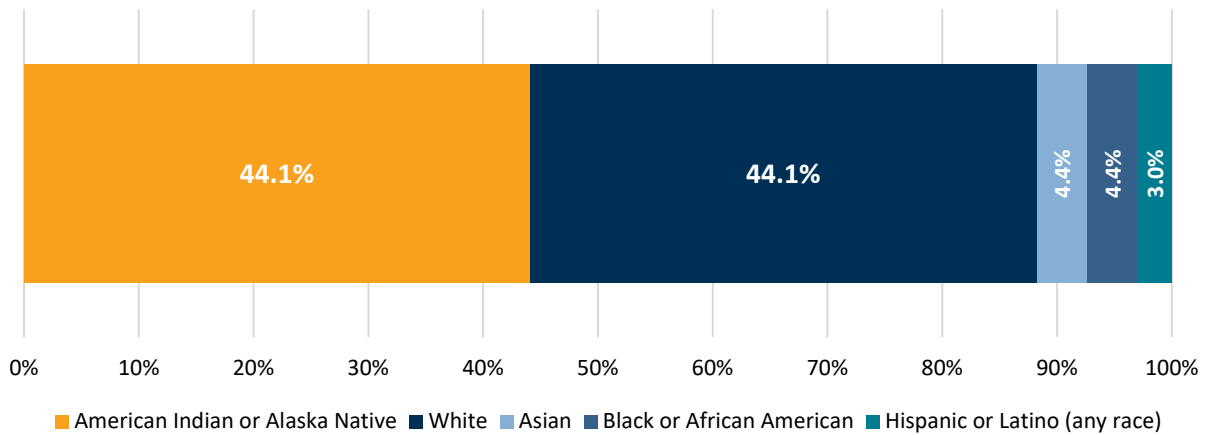
County	Rates per 1000 live births
Oglala Lakota	18.2
Mellette*	17.3
Bennett*	15.0
Hanson*	13.9
Todd	13.7
Tripp*	13.4
Gregory*	12.1
Buffalo*	11.4
Corson*	11.0
Lawrence	9.9
Jackson*	9.3
Marshall*	9.0
Turner*	8.8
Hughes*	8.6
Dewey*	7.9
Beadle	7.9
Yankton	7.8
Lake*	7.8
Hutchinson*	7.6
Brookings	7.2
Moody*	6.8
Charles Mix*	6.5
Minnehaha	6.3
Pennington	6.1
Roberts*	6.0
Meade*	5.7
Union*	5.4
Butte*	5.4
Davison*	5.2
Lincoln	4.9
Hamlin*	4.8
Brown	4.8
Codington*	4.3
Clay*	3.5

* Rates are unstable and should be considered with caution.

Race and Ethnicity

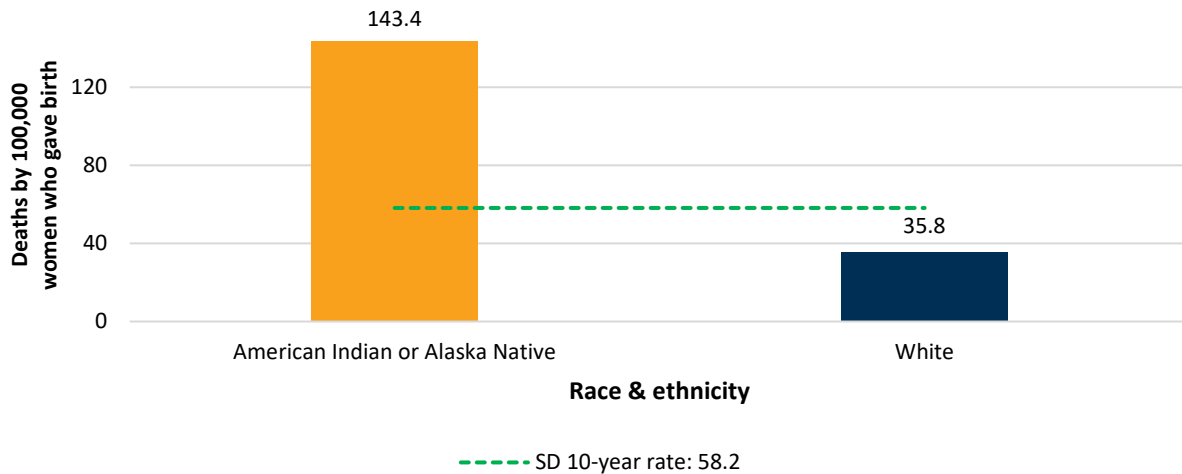
American Indians were **20.2%** of all live births and **44.1%** of all pregnancy-associated deaths.

Distribution of pregnancy-associated death cases by race and ethnicity. South Dakota, 2012-2021.



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

Rates of pregnancy-associated death among American Indians were four times higher than among White women[‡]. South Dakota, 2012-2021.



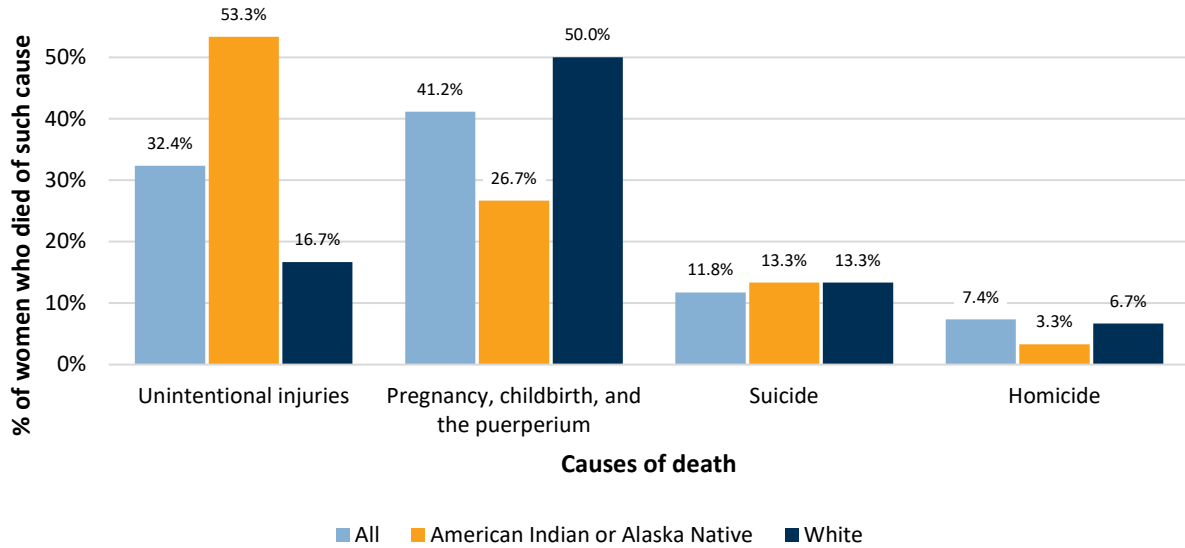
Source: Birth and Death records. Office of Health Statistics, Department of Health.

[‡] Rates of pregnancy-associated deaths for Asians, Black or African Americans, and Hispanic or Latinas (any race) were extremely unreliable because of a small number of cases and thus are not presented.

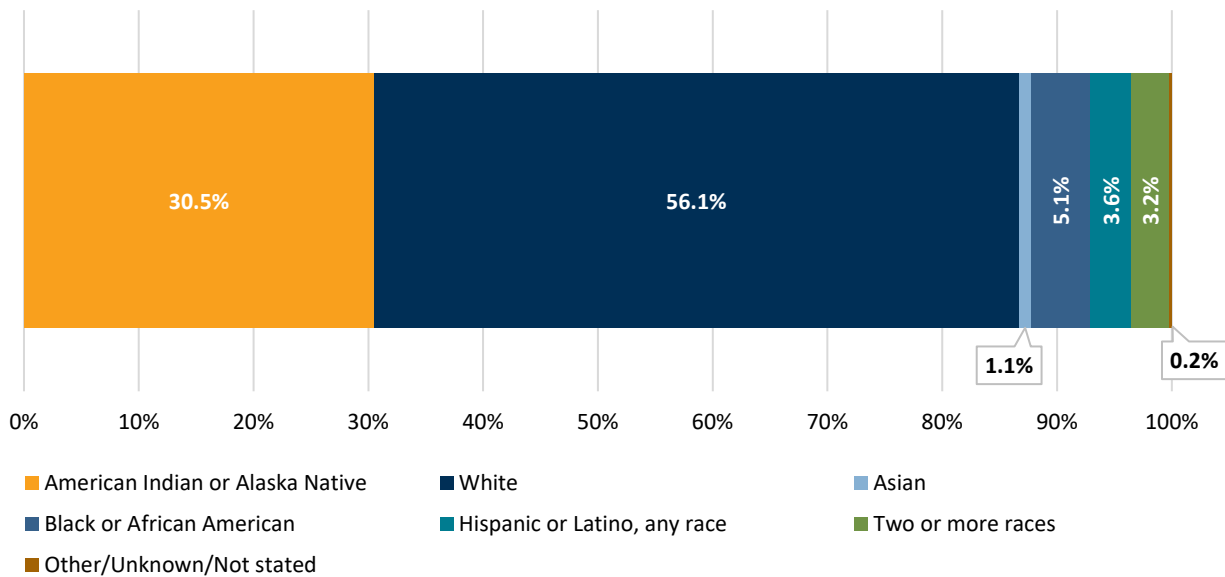
Pregnancy-associated and Infant deaths in South Dakota: 2012-2021

The most common causes of pregnancy-associated deaths among American Indians were related to unintentional injuries, while for White women they were related to pregnancy, childbirth, or the puerperium (the period of about six weeks after childbirth during which the mother's reproductive organs return to their original nonpregnant condition).

Most common causes, by group, of pregnancy-associated deaths: all women, American Indian or Alaska Native, and White. South Dakota, 2012-2021.



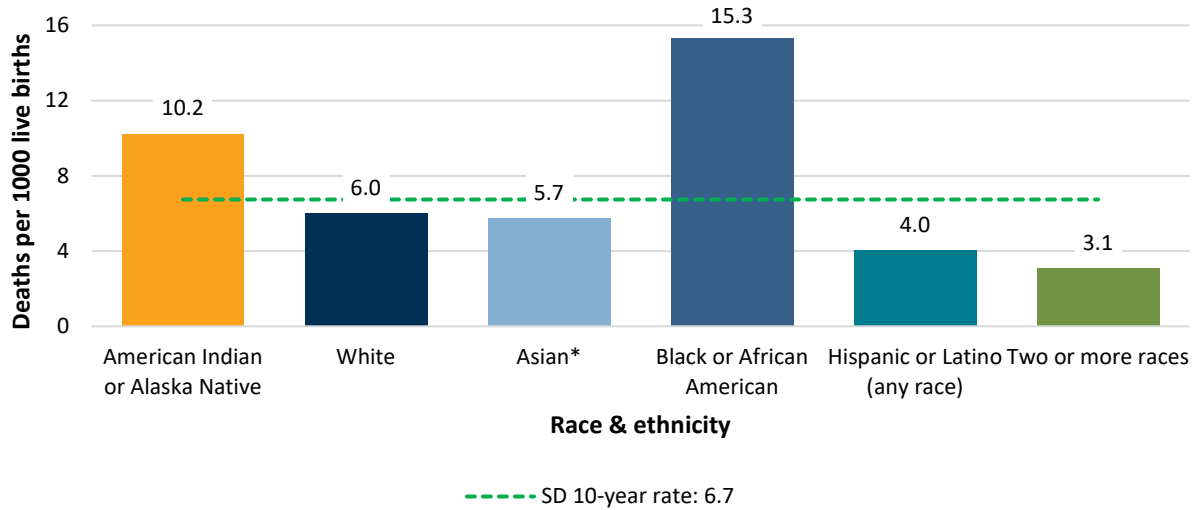
Distribution of Infant deaths by race and ethnicity. South Dakota, 2012-21.



Pregnancy-associated and Infant deaths in South Dakota: 2012-2021

The highest rate of infant deaths was observed among Black or African American infants.

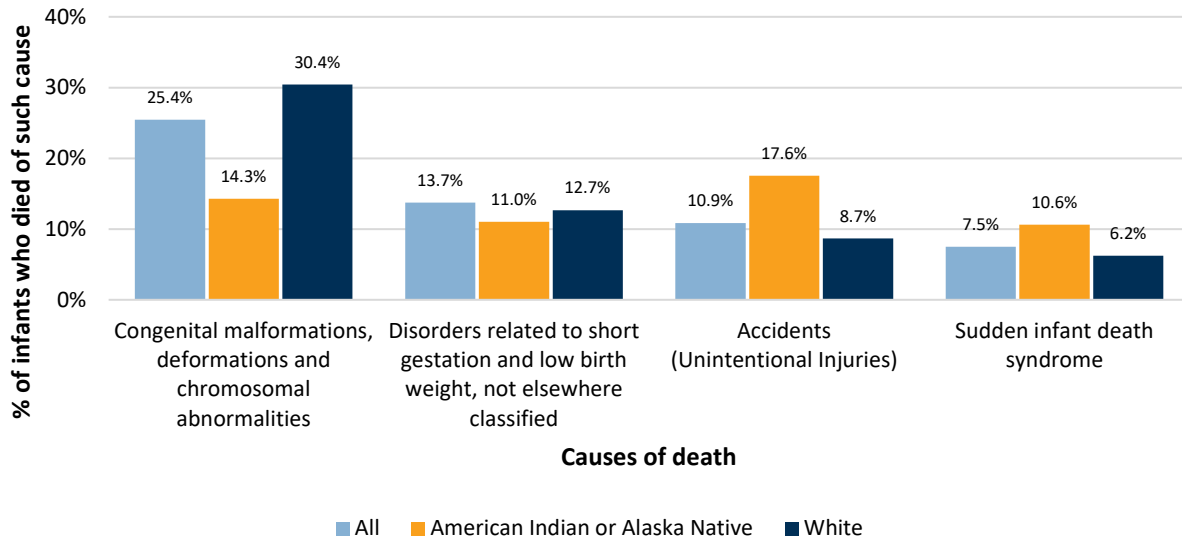
Rates of Infant death by race and ethnicity. South Dakota, 2012-2021.



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

* Rates of deaths for Asian infants are unreliable due to a small number of cases and should be considered with caution. Race information was not available for two infants.

Most common causes, by group, of Infant deaths: all infants, American Indian or Alaska Native, and White. South Dakota, 2012-2021.

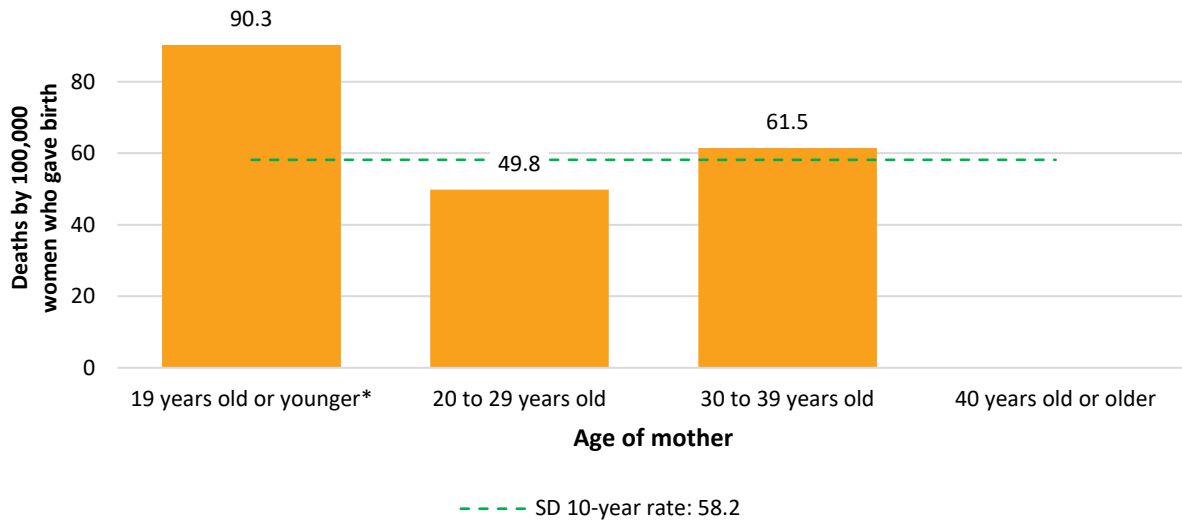


Source: Birth and Death records. Office of Health Statistics, Department of Health.

Other Demographic Characteristics

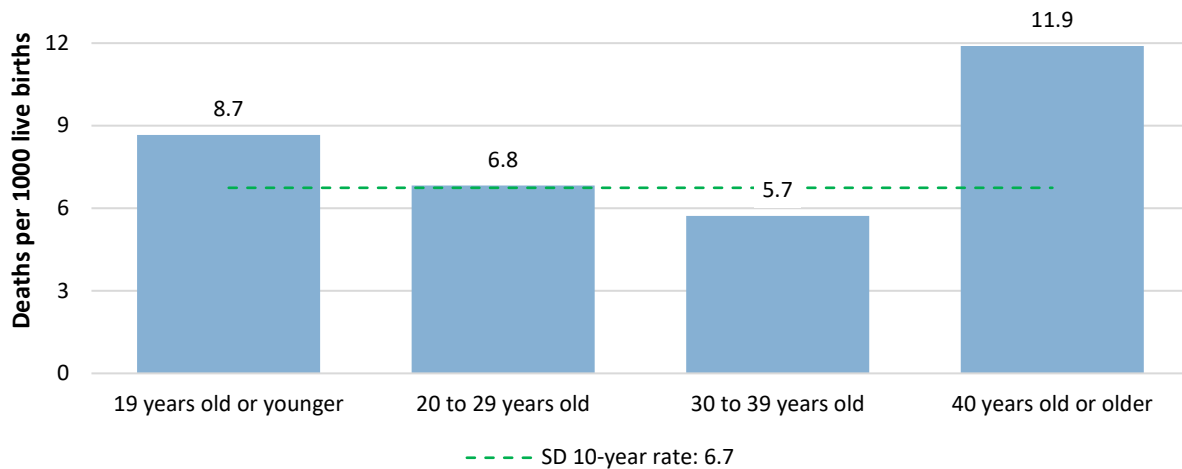
In SD, rates of pregnancy-associated deaths were higher among younger women. That is different from the rest of the country, where rates increase with maternal age⁽⁴⁾.

Pregnancy-associated death rates by age of mother. South Dakota, 2012-2021.



*Rate for women 19 years old and younger are unreliable due to the small number of cases and should be considered with caution.
∞Rate for women 40 years old and older are extremely unreliable and were omitted.

Infant death rates by age of mother[€]. South Dakota, 2012-2021.



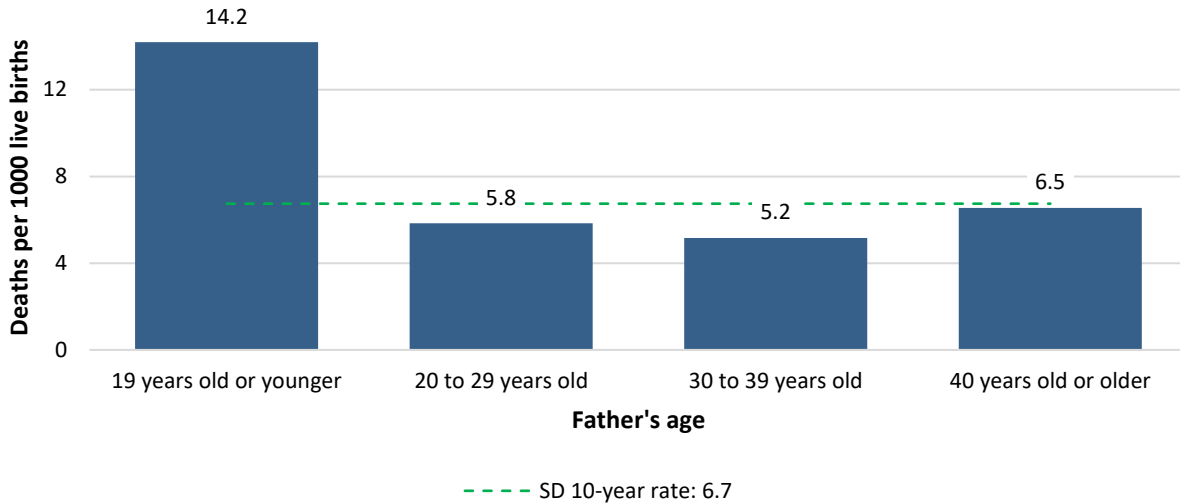
€ Information about the mother's age was not available for 19 cases (2.4%).

Some 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.

Pregnancy-associated and Infant deaths in South Dakota: 2012-2021

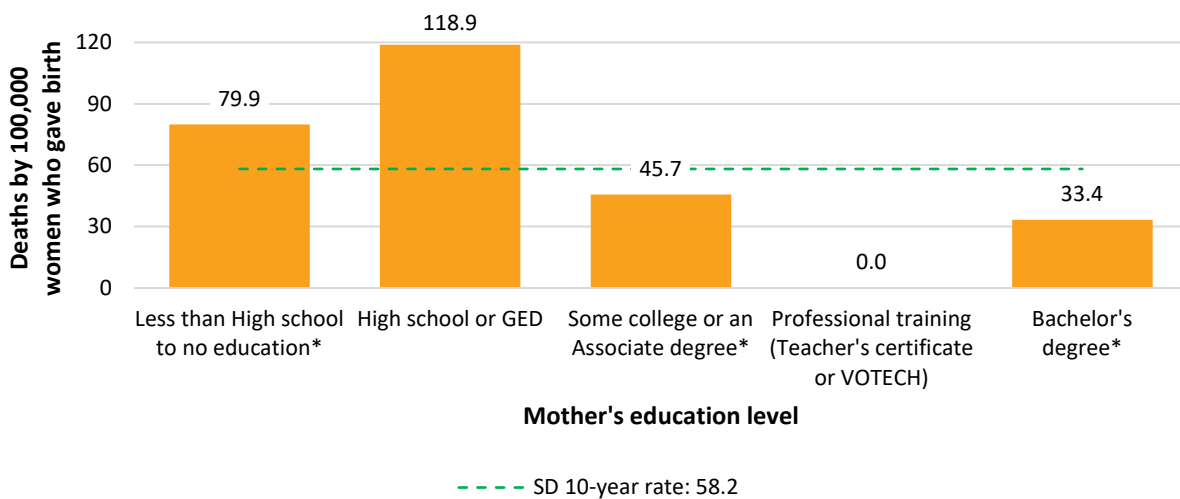
Very often, the role and influence of the father is not considered when analyzing infant deaths; Literature suggests that adolescent fathers add to the risk of infant mortality⁽⁸⁾, and that should be taken into consideration when thinking about public health interventions to prevent such deaths. Unfortunately, the number of studies on the topic are limited and more research is needed to understand the impact of paternal age on infant mortality.

Infant death rates by father's age^f. South Dakota, 2012-2021.



^fInformation about the father's age was not available for 18 cases (2.2%).

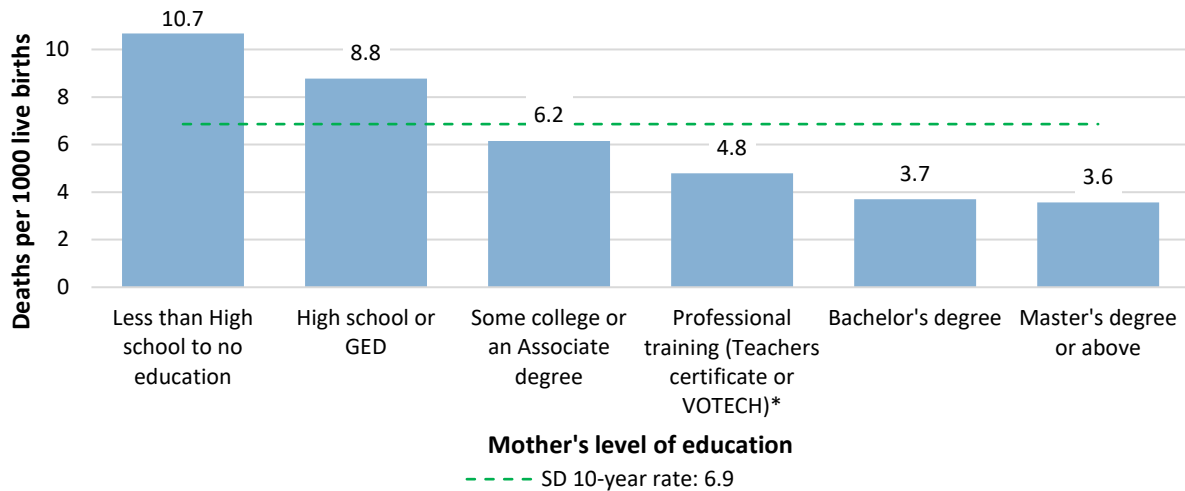
Pregnancy-associated death rates by mother's education level. South Dakota, 2012-2021.



*Rate for education levels other than high school are unreliable due to the small number of cases and should be considered with caution. Although there were cases of pregnancy-associated deaths of women with master's degree or above, the rate was extremely unreliable and thus was not presented. None of the decedents had professional training (teacher's certificate or VOTECH).

Pregnancy-associated and Infant deaths in South Dakota: 2012-2021

Infant death rates by mother's education level. South Dakota, 2012-2021.



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 27 infants (3.4%).

Data From Review Committees

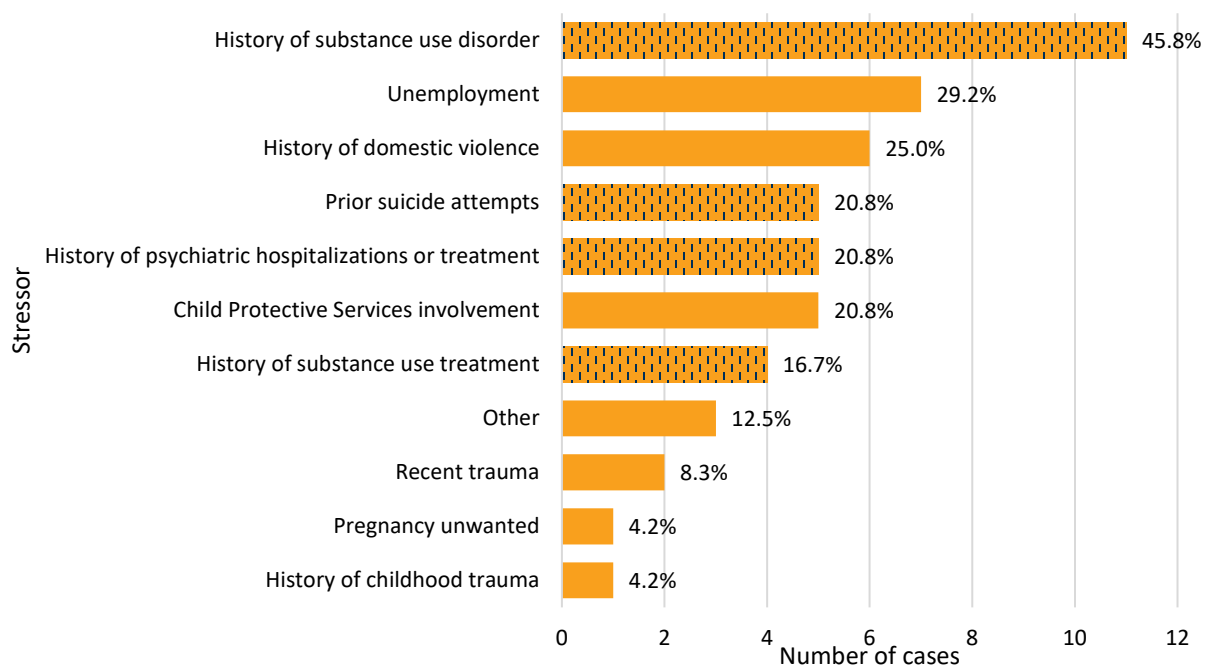
We presented data obtained from reviews by the Child Death Review (CDR) and the Maternal Mortality Review (MMRC) committees below. Those include cases of infant deaths that took place from 2018 to 2022 and cases of pregnancy-associated deaths that took place between 2018 and 2021.

Pregnancy-related and infant mortality – preventable cases.

	All reviewed cases	Preventable cases	Percentage preventable
Infant	145	100	69.0
Pregnancy-associated	24	20	83.3

Stressors related to mental health were frequently observed among the cases reviewed – please note highlights in dark blue dash in the following graphic.

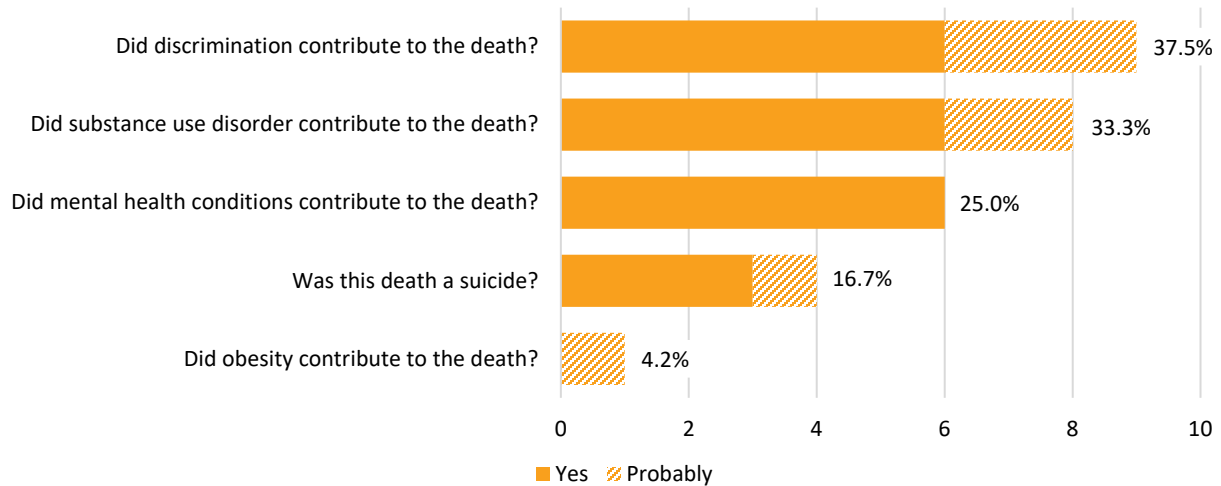
Frequency of selected stressors identified during pregnancy-associated death reviews.



Source: Maternal Mortality Review Information Application.

Pregnancy-associated and Infant deaths in South Dakota: 2012-2021

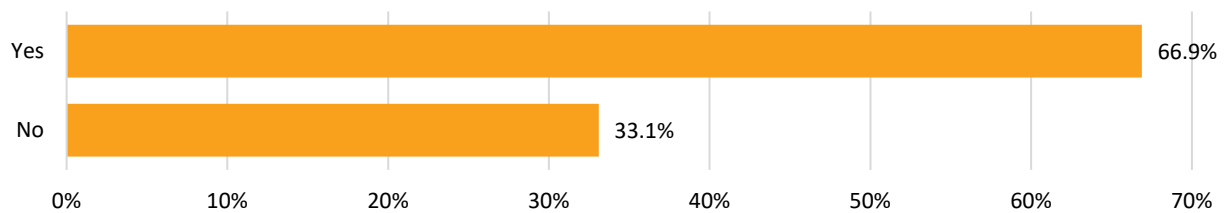
Selected committee determinations on circumstances surrounding pregnancy-associated deaths.



Source: Maternal Mortality Review Information Application.

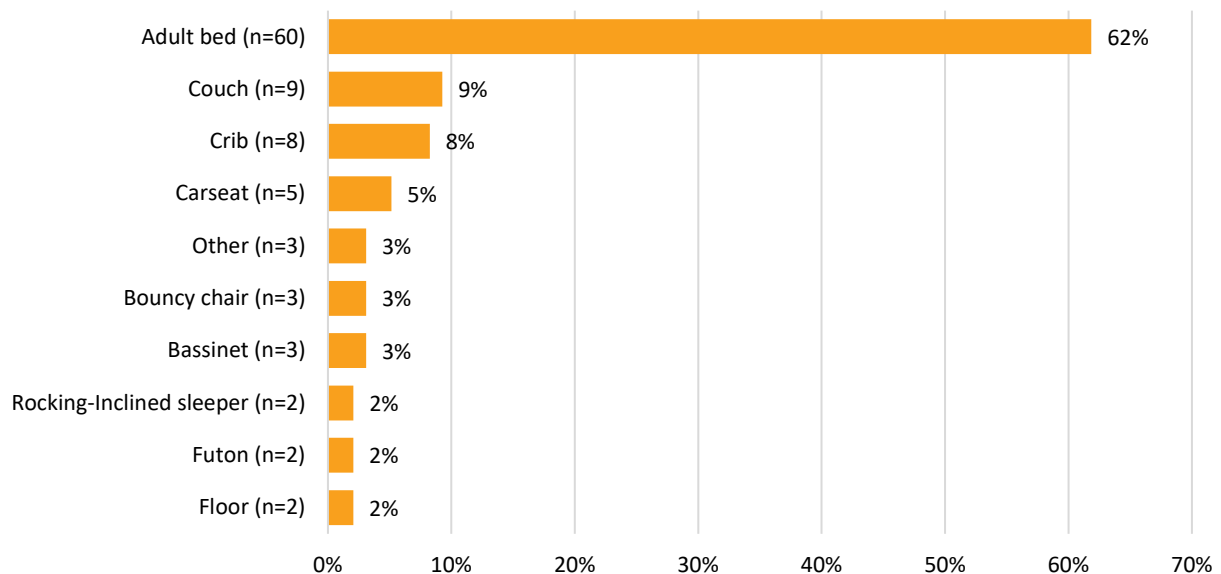
Where the infant sleeps continue to be a very important risk factor among infants' deaths. Of the 145 infant deaths, 97 were sleep-related. Among the cases of infants whose death was sleep-related, more than of the infants were sharing a sleep surface with an adult and/or child when found – please see graph below. Moreover, most frequently infants were bed sharing in an **adult bed** with an adult and/or child when found.

Percentage of Infant Deaths Reviewed that are Related to Sleeping or the Sleep Environment (n=97)



Source: National Fatality Review-Case Reporting System.

Sleep Place Where the Infant Deaths Occurred.



Source: National Fatality Review-Case Reporting System.

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 SD but were residents of other states were excluded from the counts; likewise, women who lived in South Dakota but died in another state were excluded because, in such a situation, access to information about the circumstances surrounding her death is very limited.

When calculating *pregnancy-associated death* rates, the denominator was the number of women who reside in South Dakota and gave birth to a live baby between January 1st, 2012, and December 31st, 2021. Even if a woman gave birth to twins or triplets, she was counted only once.

For *infant deaths*, the denominator was the number of resident live births – that is, all infants born in that same period, whose home address was in South Dakota. Twins and triplets were included in the denominator.

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, disaggregating deaths by county or race or other sociodemographic characteristic will frequently 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 error¹. 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.

For this report, we used the following criteria to classify the RSE:

- **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 unstable 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*⁽⁹⁾. 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⁽¹⁰⁾:

¹ <https://www.health.ny.gov/diseases/chronic/ratesmall.htm>

Pregnancy-associated and Infant deaths in South Dakota: 2012-2021

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

- 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: if an infant was born to a mother or father who were, themselves, of two or more races, the infant was counted as such. Also, 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).

Level of maternity care available

Classification of counties was provided by the March of Dimes ⁽¹¹⁾, and comes from the report "Nowhere to Go: Maternity Care Deserts Across the US. (2022 Report)". Counties' level of maternity care access was classified by the following criterion:

- **Maternity care desert:** no hospitals providing obstetric care, no birth centers, no obstetricians, no certified nurse midwives, and no family practice physicians.
- **Low access:** less than 2 hospitals or birthing centers offering obstetric services and fewer than 60 obstetric providers per 10,000 births, and the proportion of women without health insurance was 10 percent or greater.
- **Moderate access:** less than 2 hospitals or birthing centers offering obstetric services and fewer than 60 obstetric providers per 10,000 births, and the proportion of women without health insurance was less than 10 percent.
- **Full access:** two or more hospitals or birthing centers offering obstetric services or more than 60 obstetric providers per 10,000 births.

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.

Pregnancy-associated and Infant deaths in South Dakota: 2012-2021

“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 antenatal 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 “Disorders related to short gestation and low birth weight, not elsewhere classified” include Extremely low birth weight, Other low birth weight, Extreme immaturity, and Other preterm infants.

Infant causes of death in the group of “Accidents (Unintentional Injuries)” include drowning, poisoning, suffocation, and transport, among others.

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