Infant mortality in South Dakota

Infant Mortality Task Force
20 June 2011
Meeting 1: Sioux Falls

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South Dakota Department of Health

Outline
• World, National, State, County rates
• Goals
• Neonatal and post-neonatal mortality
• Historical trends
• Disparities: race
• Prenatal care
• Risk factors: gestational age, birth weight, tobacco, diabetes
• Causes of infant death

“No more shall there be an infant that lives but a few days, or an old person who does not live out a lifetime.” (Is: 65: 20)
Data sources

• The SD Department of Health is legally responsible for registration of births and deaths in the state.

• Birth reports are the responsibility of the person in attendance at the birth and usually completed by medical records personnel.

• The cause of death and details are determined and documented by a local physician or coroner who submits the death certificate (ICD coded).


• Birth and Death registry files are linked and merged.
Infant mortality definitions

- **Infant death:** death of a live-born infant less than one year (365 days) of age.

- **Neonatal death:** death of a live-born infant from birth to 27 days old.

- **Post-neonatal death:** death of an infant occurring 28 days to one year of age.

- **Infant, neonatal or post-neonatal rates:** number of deaths divided by total number of live births X 1,000.
United States current rates
- Infant (under 1 year): 6.7
- Neonatal (birth to 27 days): 4.5
- Post neonatal (28 days – 1 year): 2.2

2020 Target Goals
- Infant mortality 6.0
- Neonatal mortality 4.1
- Post neonatal mortality 2.0

SOURCE: CDC/NCHS, Health, United States, 2009, Figure 17. Data from the National Vital Statistics System.
Infant Mortality Rate Worldwide

# Infant mortality rates, United States, 2004-2006

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<tr>
<td>Louisiana</td>
<td>10.0</td>
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<tr>
<td>Mississippi</td>
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United States infant mortality rate: 6.8

Ref: NCHS, NVSS, NVSR 58(17)
Infant mortality rates, South Dakota, 2000-2009

Campbell 0.0  
Haakon 0.0  
Harding 0.0  
Hyde 0.0  
Jerauld 0.0  
Miner 0.0  
Lake 2.4  
Union 2.9  
Brule 3.0  
Douglas 3.1  
Clay 3.2  
Hutchinson 3.7  
Sanborn 3.8  
Hanson 3.8  
Faulk 4.1  
Potter 4.1  
McPherson 4.6  
Edmunds 4.6  
Clark 4.7  
Codington 4.8  
Bon Homme 5.0  
Sully 5.0  
Spink 5.0  
Brookings 5.5  
Davison 5.5  
Brown 5.5  
Tripp 5.5  
Lincoln 5.5  
Turner 5.6  
Custer 5.6  
Deuel 5.8  
Walworth 6.0  
Day 6.1  
Beadle 6.1  
Hand 6.3  
Lawrence 6.3  
Minnehaha 6.5  
Aurora 6.5  
McCook 6.5  
Yankton 6.6  
Perkins 6.7  
Butte 6.9  
Hughes 6.9  
Pennington 7.0  
Total 7.0  
Kingsbury 7.1  
Hamlin 7.2  
Grant 7.6  
Bennett 7.7  
Stanley 7.8  
Jones 8.3  
Dewey 8.7  
Marshall 8.8  
Meade 9.6  
Fall River 9.7  
Gregory 9.8  
Roberts 10.1  
Buffalo 11.2  
Todd 11.2  
Moody 11.7  
Lyman 11.9  
Charles Mix 12.1  
Corson 13.8  
Shannon 15.2  
Jackson 15.7  
Ziebach 16.0  
Mellette 18.5
Births and crude birth rates
South Dakota, 1960-2010

Source: SDDOH, ODSVR
Infant mortality rates,
(infant deaths per 1,000 live births)
South Dakota, 1912 - 2010
Infant deaths and infant mortality rates, South Dakota, 1960-2010

Source: SDDOH, ODSVR


United States neonatal mortality rate:  4.5
South Dakota neonatal mortality rate:  4.3


US postneonatal mortality rate:  2.3
SD postneonatal mortality rate:  3.0

Source: NCHS. Health, United States, 2010, Table 19
www.cdc.gov/nchs/data/hus/hus10.pdf
Infant, neonatal and post-neonatal mortality rates, SD 1990 – 2010
(deaths per 1,000 live births)
Race disparity: comparing live births (113,517), to infant deaths (794) 2000-2009

All live births

White 79%
Am Indian 18%
Black 1%
Other 1%

89,777 White 79%
20,420 American Indian, 18%
1,662 Black, 1%
1,658 Other, 1%
TOTAL: 113,517

Infant deaths

White 64%
Am Indian 32%
Black 3%
Other 1%

506 White 64%
255 American Indian, 32%
26 Black, 3%
6 Other, 1%
TOTAL: 794
Infant mortality disparity, South Dakota, 2000 – 2010 (Infant deaths per 1,000 live births)

Deaths per 1000 live births

**White**

- 2000: 4.3
- 2001: 4.7
- 2002: 5.0
- 2003: 6.9
- 2004: 6.1
- 2005: 5.3
- 2006: 5.3
- 2007: 6.4
- 2008: 6.0
- 2009: 5.8
- 2010: 5.8

**Native American**

- 2000: 11.3
- 2001: 14.1
- 2002: 14.4
- 2003: 12.9
- 2004: 13.3
- 2005: 11.6
- 2006: 12.0
- 2007: 10.1
- 2008: 16.2
- 2009: 9.3
- 2010: 12.0

SD-DOH SDVSR
Neonatal and post-neonatal mortality by race, South Dakota, 1990 – 2009
(Infant deaths per 1,000 live births)

Deaths per 1,000 live births

2000 2001 2002 2003 2004 2005 2006 2007 2008 2009

SD-DOH SDVSR
Neonatal and Postneonatal mortality rates

2. SD Dept of Health DSVR.
Age at time of infant death, South Dakota, 2000-2009

39% died during their first day.
48% died during their first week.
57% died during their first month (neonatal period).
90% died during their first 6 month.
10% died during the last 6 months of their first year.

43% died during months 1-11 (post-neonatal period).
Gestational age: comparing infant deaths to all live births, 2000-2009

**Infant deaths**

- Early preterm: 44%
- Late preterm: 10%
- Full term: 46%

**All live births**

- Early preterm: 2%
- Late preterm: 7%
- Full term: 91%
Gestational age: comparing American Indian and White infants, 2000-2009

Am Indian infants

Early preterm 3%
Late preterm 7%
Full term 90%

White infants

Early preterm 2%
Late preterm 6%
Full term 92%
Birth weight by state, 2008 (percent ≥2.5kg)
National 85%

Birth Weight: comparing infant deaths to all live births, 2000-2009

Infant deaths

Very low birth weight 33.7%

Low birth weight 21.0%

Full weight 45.2%

All live births

Very low birth weight 0.5%

Low birth weight 6.1%

Full weight 93.4%
Birth Weight: comparing American Indian and White infants, 2000-2009

Am Indian infants

- Very low birth weight: 0.7%
- Low birth weight: 6.4%
- Mean birth weight: 3.37 kg
- Full weight: 92.9%

White infants

- Very low birth weight: 0.5%
- Low birth weight: 6.0%
- Mean birth weight: 3.34 kg
- Full weight: 93.6%

Mean birth weights:
- Am Indian: 3.37 kg
- White: 3.34 kg
- P <0.0001
Low birthweight (<2.5 kg) by county, South Dakota 2000 – 2009 (131,517 births)

US: 8.2% low birthweight
2020 US Target Goal: 7.8%

SD: 6.6% low birth weight
SD 5th best in the USA (AK 1, OR 2, WA 3, MN 4)
Mother risk factors for infant death, South Dakota 2000-2009

- Teenage mother (≤ 19 yr): 13% infant deaths, 9.9% all live births
- Married: 34% infant deaths, 66.0% all live births
- Smoking: 28% infant deaths, 19.0% all live births
- WIC assistance: 47% infant deaths, 39.0% all live births
- < Grade 12 education: 29% infant deaths, 16.0% all live births
- Early prenatal care: 68.0% infant deaths, 58% all live births
- Diabetic: 2.4% infant deaths, 0.4% all live births
Prenatal care, month started: comparing percent of infant deaths to all live births, 2006-2009

Infant deaths (325)

All live births (48,171)
Mothers receiving 1st trimester prenatal care 2005-9, State rate 71%

Yankton  85%
Deuel    85%
Union    85%
Codington 81%
Clay     80%
Davison  80%
Campbell 80%
Brown    79%
Hand     79%
Brookings 79%
Aurora   79%
Lincoln  79%
Sully    78%
BonHomme 78%
Jones    78%
Lawrence 78%
Sanborn  78%
Lake     78%
Harding  78%
Meade    78%
Potter   77%
Kingsbury 77%
Hyde     76%
Turner   76%
Butte    76%
Edmunds  74%
McCook   74%
Hamlin   74%
Miner    74%
Stanley  74%
Day      73%
Pennington 73%
Hughes   73%
Douglas  73%
Grant    73%
Hanson   73%
Custer   71%
Haakon   71%
Minnehaha 70%
Gregory  69%
Brule    69%
Walworth 69%
Spink    68%
Jerauld  68%
Tripp    67%
Hutchinson 65%
Perkins  65%
Moody    64%
Charles Mix 63%
McPherson 63%
Marshall 63%
Faulk    62%
Beadle   61%
Fall River 60%
Clark    60%
Dewey    58%
Lyman    57%
Jackson  55%
Shannon  55%
Roberts  54%
Ziebach  53%
Corson   51%
Buffalo  47%
Bennett  47%
Mellette 46%
Todd    41%

2010 SD Kits Count Factbook

SD-DOH Vital Stats
Prenatal care by state, 2008
percent 1\textsuperscript{st} trimester care

Vermont 83%
New Hampshire 82%
California 80%
Michigan 77%
Nebraska 74%
Montana 73%
Kansas 73%
Georgia 73%
Iowa 72%
North Dakota 72%
New York 72%
Kentucky 72%
Delaware 71%
Oregon 71%

\textbf{TOTAL 71%}
Pennsylvania 71%
Ohio 71%
Wyoming 70%
Florida 70%
Idaho 69%
South Dakota \textbf{69%}
Washington 68%
Colorado 68%
Tennessee 68%
Indiana 67%
South Carolina 67%
New Mexico 62%
Texas 59%
Correlation between prenatal visits* and infant mortality**, SD counties

Prenatal visits mean 69.6%, sd 10.5. (highest risk <59.1%)
Infant mortality rate mean 6.6, sd 4.0 (highest risk >10.6)
Pearson correlation = -0.64 (p <0.0001)

*Percent of women receiving prenatal care in first trimester **Infant deaths per 1,000 live births, 2000-2009
Age and marital status of mother: comparing percent of infant deaths to all live births

Infant deaths (790)

Married 52%
Not married 48%

All live births (48,116)

Married 66%
Not married 34%
Percent Age of mother by race: South Dakota, 2000-2009

- White mean age 27.4 yr
- Am Indian mean age 24.1 yr
  t-test, p < 0.001
Infant mortality rates by pre-pregnancy BMI of mother and weight gain during pregnancy, South Dakota 2006-2008 (births ≥37 weeks gestation; n=31,379)
Infant mortality rates by pre-pregnancy BMI of mother, South Dakota 2006-2008 (n=35,337)

Mortality rate

- Underweight (n=1,245)
- Normal (n=17,742)
- Overweight (n=8,819)
- Obese (n=7,531)

Neonatal mortality
- Underweight: 2.41
- Normal: 3.55
- Overweight: 3.4
- Obese: 6.37

Postneonatal mortality
- Underweight: 2.41
- Normal: 2.37
- Overweight: 2.72
- Obese: 2.92

Infant mortality
- Underweight: 4.82
- Normal: 5.97
- Overweight: 6.12
- Obese: 9.29
Pre-existing Diabetes of Mother and Infant Mortality, South Dakota 2006-2008

Neonatal mortality
Postneonatal mortality
Infant mortality

Not diabetic (n=35,702)
Diabetic (n=246)
Gender disparity: comparing percent of infant deaths to all live births.

\[ X^2 = 19.8, \ p < 0.0001 \]
Correlation between county infant mortality and child poverty, South Dakota

Infant Mortality, 2000-2009
Mothers who smoked during pregnancy, 2002

South Dakota (19.3%)

Overall U.S. (11.4%)

SOURCE: (MMWR 8 Oct 2004 53: 911-915) www.cdc.gov/mmwr/preview/mmwrhtml/mm5339a1.htm
Smoking during pregnancy, South Dakota, 2006-2009

Source: SD-DOH DSVR, unknowns not in denominator
Smoking during pregnancy by age, South Dakota, 2006-2009

Source: SD-DOH, unknowns not in denominator
Smoking during pregnancy by race, South Dakota, 2006-2009

- White: 16.6%
- Am Indian: 30.0%
- Black: 11.9%
- Other: 9.7%
- ALL: 18.9%
- SIDS: 45.0%

Source: SD-DOH, unknowns not in denominator
Place of infant death, South Dakota, 2000 - 2009

- Inpatient Hospital: 509 (64%)
- Outpatient Emergency Room: 90 (11%)
- Dead on arrival: 32 (4%)
- Home: 108 (14%)
- Other: 25 (3%)
- Not known: 30 (4%)
Causes of infant deaths: South Dakota and United States

Infant deaths, United States 2007
(n=29,138)

Unintentional injuries 4%
SIDS 8%
Low birth weight 17%
Congenital malformations 20%
Maternal complications 6%
All other causes 45%

Infant deaths, South Dakota 2000-2009
(n=794)

Unintentional injuries 6%
SIDS 14%
Low birth weight 10%
Congenital malformations 28%
Maternal complications 3%
All other causes 39%
Leading causes of infant death, South Dakota, 2000-2009 (n=794)

- Congenital malformations, deformations, and chromosomal abnormalities, Q00-Q99: 221
- Sudden infant death syndrome, R95: 111
- Disorders related to short gestation and low birthweight, not otherwise classified, P07: 80
- Accidents (unintentional injuries), V01-X59: 49
- Ill-defined and unknown causes, R96-R99: 28
- Maternal complications of pregnancy, P01: 27
- All other causes: 278
Infant mortality rates for the 10 leading causes, United States (2007) and South Dakota (2000-2009)

- Congenital malformations, deformations, and chromosomal abnormalities, Q00-Q09: United States 1.34, South Dakota 1.95
- Disorders related to short gestation and low birthweight, not otherwise classified, P07: United States 0.70, South Dakota 0.57
- Sudden infant death syndrome, R95: United States 0.98, South Dakota 0.41
- Newborn affected by maternal complications of pregnancy, P01: United States 0.43, South Dakota 0.41
- Accidents, V01-X59: United States 0.30, South Dakota 0.30
- Newborn affected by complications of placenta, cord and membranes, P02: United States 0.26, South Dakota 0.01
- Bacterial sepsis of newborn, P36: United States 0.19, South Dakota 0.01
- Respiratory distress of newborn, P22: United States 0.18, South Dakota 0.10
- Diseases of the circulatory system I00-I99: United States 0.14, South Dakota 0.09
- Neonatal hemorrhage, P50-P52, P54: United States 0.14, South Dakota 0.09

NVSR, 2010, 59(2), Table 8 (www.cdc.gov/nchs/data/nvsr/nvsr59/nvsr59_02.pdf)
Causes of infant death in South Dakota at rates >50% than national rates: Cause (SD #), % increased

- Whooping cough (2), +851%
- Falls (5), +692%
- Pneumonitis due to solids and liquids (2), +660%
- Birth trauma (2), +534%
- Nutritional deficiencies (1), +443%
- Spinal bifida (2), +300%
- Complications of medical and surgical care (2), +246%
- Accidents caused by exposure to smoke, fire and flames (3), +200%
- Certain intestinal infectious diseases (1), +192%
- Influenza (1), +192%
- Acute upper respiratory infections (1), +172%
- Syndrome of infant of a diabetic mother and neonatal diabetes mellitus (1), +172%
- Accidental drowning and submersion (4), 167%
- Anencephaly and similar malformations (22), +161%
- Hemolytic disease of newborn due to isoimmunization and other perinatal jaundice (1), +153%
- Atelectasis (22), +129%
- Patau's syndrome (17), +119%
- Hydrops fetalis not due to hemolytic disease (10), +115%
- Motor vehicle accidents (7), +115%
- Transport accidents (7), +110%
- Down's syndrome (4), +85%
- Pericarditis, endocarditis and myocarditis (1), +81%
- Congenital malformations and deformations of musculoskeletal system, limbs & integument (29), +77%
- Newborn affected by complications involving cord (2), +77%
- Sudden infant death syndrome (111), +72%
- Acute bronchitis and acute bronchiolitis (2), +69%
- Other congenital malformations of nervous system (17), +64%
- Newborn affected by other maternal complications of pregnancy (8), +58%
- Congenital malformations of genitourinary system (21), +55%
- Endocrine, nutritional and metabolic diseases (10), +51%
Causes of infant death in South Dakota at high rates: Cause (SD #), % increased

- Anencephaly and similar malformations (22), +161%
- Atelectasis (22), +129%
- Patau's syndrome (17), +119%
- Hydrops fetalis not due to hemolytic disease (10), +115%
- Motor vehicle accidents (7), +115%
- Congenital malformations and deformations of musculoskeletal system, limbs & integument (29), +77%
- Sudden infant death syndrome (111), +72%
- Other congenital malformations of nervous system (17), +64%
- Newborn affected by other maternal complications of pregnancy (8), +58%
- Congenital malformations of genitourinary system (21), +55%
- Endocrine, nutritional and metabolic diseases (10), +51%
Leading causes of infant death by race (number of deaths), South Dakota, 2000-2009

- Congenital malformations, deformations, and chromosomal abnormalities, Q00-Q99
  - White (506): 49
  - Am Indian (255): 8
  - Other races (33): 1

- Sudden infant death syndrome, R95
  - White (506): 50
  - Am Indian (255): 5

- Disorders related to short gestation and low birthweight, not otherwise classified, P07
  - White (506): 51
  - Am Indian (255): 24

- Accidents, V01-X59
  - White (506): 22
  - Am Indian (255): 27
  - Other races (33): 0

- Ill-defined and unknown causes, R96-R99
  - White (506): 11
  - Am Indian (255): 16

- Newborn affected by maternal complications of pregnancy, P01
  - White (506): 21
  - Am Indian (255): 5

- All other causes
  - White (506): 77
  - Am Indian (255): 14

- Total (506): 187
Leading causes of infant death by race (rate per 1,000 births), South Dakota, 2000-2009

- **Congenital malformations, deformations, and chromosomal abnormalities, Q00-Q99**
  - White (5.6)
  - Am Indian (12.5)
  - Rate: 1.8

- **Sudden infant death syndrome, R95**
  - White (5.6)
  - Am Indian (12.5)
  - Rate: 2.4

- **Disorders related to short gestation and low birthweight, not otherwise classified, P07**
  - White (5.6)
  - Am Indian (12.5)
  - Rate: 1.2

- **Accidents, V01-X59**
  - White (5.6)
  - Am Indian (12.5)
  - Rate: 1.3

- **Ill-defined and unknown causes, R96-R99**
  - White (5.6)
  - Am Indian (12.5)
  - Rate: 0.8

- **Newborn affected by maternal complications of pregnancy, P01**
  - White (5.6)
  - Am Indian (12.5)
  - Rate: 0.2

- **All other causes**
  - White (5.6)
  - Am Indian (12.5)
  - Rate: 2.1

- **Total**
  - White (5.6)
  - Am Indian (12.5)
  - Rate: 3.8
Leading causes of all infant deaths by detail, South Dakota, 2000-2009

- Sudden infant death syndrome: 111
- Extreme immaturity: 63
- Congenital heart malformation: 26
- Ill-defined and unspecified causes: 26
- Primary atelectasis of newborn: 22
- Anencephaly: 22
- Accidental suffocation and strangulation in bed: 22
- Other preterm infants: 17
- Patau’s syndrome (trisomy 13): 17
- Edwards’ syndrome (trisomy 18): 16
- Other specified general symptoms and signs: 15
- Corioamnionitis: 14
- Neonatal cardiac failure: 14
- Congenital diaphragmatic hernia: 14
- Premature rupture of membranes: 12
- Placental separation and hemorrhage: 11
- Respiratory distress syndrome of newborn: 11
- Hydrops fetalis due to hemolytic disease: 10
- Birth asphyxia: 9
- Hypoplasia and dysplasia of lung: 9
- Holoprosencephaly: 8
- Renal agenesis, unspecified: 8
All infant deaths, South Dakota, 2000 - 2009

**Race**

- White: 506 (64%)
- American Indian: 255 (32%)
- Other: 33 (4%)

**Smoking**

- Smoker: 224 (29%)
- Non-smoker: 561 (71%)

**Time of death**

- <24 hours: 306 (39%)
- Rest 1st month: 145 (18%)
- >1 month: 343 (43%)

**Gestation time**

- Early preterm: 506 (44%)
- Late preterm: 255 (10%)
- Full term: 33 (46%)

**Birth weight**

- <1 kg: 266 (34%)
- 1-2.49 kg: 166 (21%)
- >2.5 kg: 357 (45%)
Atelectasis infant deaths, South Dakota, 2000 - 2009

**Race**

- White 82%
- Am Indian 14%
- Other 4%

**Smoking**

- Smoker 27%
- Non-smoker 73%

**Time of death**

- <24 hours 95%
- Rest 1st month 5%
- >1 month 0%

**Gestation time**

- Early preterm 91%
- Late preterm 5%
- Full term 5%

**Birth weight**

- <1 kg 86%
- 1-2.49 kg 9%
- >2.5 kg 5%
Anecephaly infant deaths, South Dakota, 2000 - 2009

Race

- White: 77%
- American Indian: 18%
- Other: 5%

Smoking

- Smoker: 27%
- Non-smoker: 73%

Time of death

- <24 hours: 86%
- Rest 1st month: 14%
- >1 month: 0%

Gestation time

- Early preterm: 57%
- Late preterm: 5%
- Full term: 38%

Birth weight

- <1 kg: 41%
- 1-2.49 kg: 36%
- >2.5 kg: 23%
Patau’s syndrome infant deaths, South Dakota, 2000 - 2009

**Race**

- White: 82%
- Am Indian: 12%
- Other: 6%

**Smoking**

- Smoker: 18%
- Non-smoker: 82%

**Time of death**

- <24 hours: 53%
- Rest 1st month: 47%
- >1 month: 0%

**Gestation time**

- Early preterm: 47%
- Late preterm: 2%
- Full term: 41%

**Birth weight**

- <1 kg: 6%
- 1-2.49 kg: 59%
- >2.5 kg: 35%
SIDS, non-SIDS deaths and SIDS death rate*, US and South Dakota, 1982-2009

*SIDS deaths per 1,000 live births
SIDS deaths, South Dakota, 2000-2009
Accidental and homicide infant deaths, South Dakota, 2000-9

Race

- White 46%
- Am Indian 53%
- Other 2%

Smoking

- Smoker 45%
- Non-smoker 55%

Time of death

- <24 hours 2%
- Rest 1st month 3%
- >1 month 95%

Cause of deaths

- Suffocation and strangulation in bed 22
- Assault 8
- Motor vehicle accidents 7
- Other suffocation and strangulation 6
- Falls 5
- Drowning and submersion 4
- Exposure to smoke, fire and flames 3
- Obstruction of respiratory tract 1
- Other and unspecified accidents 1
- Discharge of firearms 0
- Poisoning and exposure to noxious substances 0
Summary

- American Indian disparity.
- High postneonatal death rate.
- Birth weights above average.
- Early prenatal care declining, geographic gaps.
- Smoking rates high.
- Mother’s less than recommended weight gain = high infant mortality.
- Obese mother have high infant mortality rates.
- High rates: SIDS, congenital malformatins, accidents.
QUESTIONS?

THANK YOU