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Safe Sleep Behaviors Among South Dakota Mothers and the Role of the Healthcare Provider

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Abstract

Introduction: The purpose of this report was to determine the prevalence of safe sleep practices among South Dakota mothers, and the impact that education from their healthcare provider had on infant safe sleep practices as defined by the American Academy of Pediatrics (AAP).

Method: A population-based survey was administered to a random sample of mothers delivering in 2017. Data were weighted to obtain statewide and race-specific (white, non-Hispanic; American Indian; other races) prevalence rates.

Results: Weighted response rate was 67 percent, with 9.9 percent of mothers giving birth in 2017 completing a survey. Greater than 85 percent of mothers met recommendations regarding placing their infant on their back, breastfeeding, not consuming alcohol or illicit drugs during pregnancy, and attending 80 percent or more of prenatal visits. Less than 85 percent met recommendations regarding infant *always* sleeping alone on an approved sleep surface (30.8 percent), room-sharing without bed-sharing (44.3 percent), keeping soft objects and loose bedding out of crib (47.7 percent), and avoiding smoke exposure during and after pregnancy (82.1 percent). Only 7.7 percent of mothers met all eight recommendations. Healthcare providers talking to the mother about placing the infant to sleep in a crib and placing the crib in the mother's room were associated with a higher percent of mothers meeting these recommendations (both, $p<0.001$). Although the health care provider asking the mother if she was going to breastfeed was not associated with ever breastfeeding ($p=0.95$), if the mother received information from the doctor about breastfeeding she was slightly more likely to breastfeed than if she did not receive information (90.3 vs. 85.0 percent, $p=0.06$)

Conclusions: A low percentage of South Dakota mothers met all eight AAP safe sleep recommendations that could be assessed using these data. Health care providers can influence a mother's compliance with some of the safe sleeping recommendations.

Introduction

Sudden unexpected infant death (SUID) is a term used to describe any sudden and unexpected death, whether explained or unexplained. The majority of SUID cases include sudden infant death syndrome (SIDS, ICD-10 R95), accidental suffocation and strangulation in bed (ICD-10 W75), and ill-defined and unknown causes of death (ICD-10 R99).[1] Although the rate of SIDS in the U.S. has decreased from 130.3 deaths per 100,000 live births in 1990 to 38.0 deaths per 100,000 live births in 2016, deaths from both unknown causes and accidental suffocation/strangulation have been increasing since 1997.[2] In 2016, the unknown cause and accidental suffocation/strangulation mortality rates were 31.6 and 21.8 deaths per 100,000 live births, respectively.[2] The 2013-2015 SUID rate for the U.S. was 89.2/100,000 live births with a rate in South Dakota of 157.3/100,000 live births, resulting in a rank of 46th out of 50 states.[3]

Due to the similarities in many of the risk factors for SIDS and suffocation-related infant deaths, the American Academy of Pediatrics (AAP) expanded its recommendations to focus not only on SIDS, but also on a safe sleep

environment to reduce the risk of all types of sleep-related deaths. In November of 2016, the AAP's Task Force on Sudden Infant Death Syndrome released updated recommendations for a safe sleep environment to reduce SIDS and sleep-related infant deaths related to suffocation and entrapment based on available data.[4] These recommendations included three levels of recommendations based on the quality of the published evidence ranging from A-level recommendations that are based on good-quality patient-oriented evidence (see Table 1) to C-level recommendations that are based on consensus or case series.

Public health surveillance surveys are often used to assess the health of South Dakotans. Surveys such as the Behavioral Risk Factor Surveillance System (BRFSS) and Youth Risk Behavior Surveillance System (YRBSS) provide information that is used by public health professionals, advocacy groups, health care organizations, and policy makers to develop initiatives to improve the health of the population. In addition to a high SUID rate, South Dakota also has a high infant mortality rate (6.47 per 1,000 births in 2013-2017),[5] ranking 33rd out of 50 states in 2017.[6] However, until recently there have been little statewide data available on health behaviors and attitudes of mothers that can ultimately influence birth outcomes. The Pregnancy Risk Assessment Monitoring System (PRAMS) survey is a Centers for Disease Control and Prevention (CDC) recommended surveillance tool that was designed to provide this information.

Table 1. Summary of American Academy of Pediatrics (AAP) Level A Recommendations with Strength of Recommendation[1]

- ***Back to sleep for every sleep***[2]
- ***Use a firm sleep surface***
- ***Room-sharing without bed-sharing is recommended***
- ***Keep soft objects and loose bedding out of the crib***
- ***Breastfeeding is recommended***
- Consider offering a pacifier at nap time and bedtime
- ***Avoid smoke exposure during pregnancy and after birth***
- ***Avoid alcohol and illicit drug use during pregnancy and after birth***
- Avoid overheating
- *Pregnant women should receive regular prenatal care*
- Infants should be immunized in accordance with recommendations of the AAP and Centers for Disease Control and Prevention
- Do not use home cardiorespiratory monitors as a strategy for reducing the risk of SIDS
- Health care professionals, staff in newborn nurseries and NICUs, and child care providers should endorse and model the SIDS risk-reduction recommendations from birth
- Media and manufacturers should follow safe-sleep guidelines in their messaging and advertising
- Continue the "Safe to Sleep" campaign, focusing on ways to reduce the risk of all sleep-related infant death, including SIDS, suffocation, and other unintentional deaths. Pediatricians and other primary care providers should actively participate in this campaign.
- There is no evidence to recommend swaddling as a strategy to reduce the risk of SIDS.

1 Taken from the American Academy of Pediatrics recommendations for safe sleep. Recommendations were based on the Strength-of-Recommendation Taxonomy (SORT). Level A indicated there was good-quality patient-oriented evidence.

2 Recommendations that are italicized could be addressed with the 2017 SD PRAMS-like survey data and bolded italicized recommendations had information about whether the mother recalled the healthcare provider discussing this topic.

The CDC established the PRAMS in 1987 to obtain information about maternal behavior and experiences that may be associated with adverse birth outcomes, and the survey is disseminated to women who recently gave birth to live-born infants. The South Dakota Department of Health contracted with the EA Martin Program at South Dakota State University to conduct the first statewide PRAMS-like surveys in 2014 and 2016 and participate in the CDC PRAMS beginning with 2017 births. The goal of these surveys was to assess overall pregnancy experiences and maternal health behaviors of South Dakota mothers, and provide the state with data that could be used to develop, modify or evaluate programs for new mothers and their children.

The 2016 AAP recommendations included 15 A-level safe sleep recommendations based on results of studies deemed to be of high quality (Table 1).[4] The 2017 SD PRAMS survey addressed several of these recommendations including not only whether the mothers met these recommendations, but also whether her healthcare provider talked to her about specific behaviors within the recommendations (see bolded items in Table 1). The purpose of the current analyses was to 1.) determine the prevalence of safe sleep practices, as defined in the AAP recommendations, among South Dakota mothers delivering a live-born infant in 2017, and 2.) determine whether mothers who recalled being talked to by their healthcare provider about specific safe sleep topics defined in the recommendations had different infant safe sleep practices than mothers who did not recall being talked to by their healthcare provider. The eight recommendations that were investigated included back to sleep, sleeping on an approved firm sleep surface, room-sharing without bed-sharing, keeping soft objects or loose bedding out of the crib, breastfeeding, avoiding smoke exposure during and after pregnancy, avoiding alcohol and illicit drugs during pregnancy, and receiving regular prenatal care.

Methods

The 2017 SD PRAMS survey was a population-based survey administered to a random sample of South Dakota mothers delivering a live-born infant in 2017. The methodology for the CDC PRAMS survey is described in detail elsewhere.[7] Briefly, births to South Dakota mothers who delivered a live-born infant in South Dakota in 2017 were randomly sampled each month at a rate of approximately 8 percent for white non-Hispanic race mothers, 32 percent for American Indian mothers, and 43 percent for mothers in the other race category (all other races than white non-Hispanic and American Indian). Only one infant from twin and triplet births was included in the sampling frame in order to ensure that mothers with multiple births were sampled at the same rate as a mother with a singleton birth. Sampling rates were determined a priori to ensure that sufficient numbers of surveys would be returned to obtain reliable prevalence estimates within a 5 percent margin of error. American Indian mothers and mothers of other races were oversampled in order to obtain prevalence estimates within these race strata. Mothers were asked to complete the survey via a mailed survey with telephone follow-up for mail non-respondents. Multiple attempts to contact the mothers were made both by mail (up to 5 mail contacts) and phone (at least 15 call attempts). Mailed contact with the mother began at about two months postpartum and attempts were made to obtain the completed survey back before six months postpartum, although surveys would be accepted up to nine months postpartum.

In order for the survey results to be generalized to represent the population of all women giving birth in 2017 in South Dakota a process of weighting was used. A weight is assigned to each mother and can be interpreted as the number of women in the population that the respondent represents. For the 2017 SD PRAMS, three sample weights were calculated: sampling, non-response and non-coverage. Sampling weights take into account the different sampling rates for the race strata. Non-response weights compensate for lower response rates among women with certain demographic characteristics, such as lower education. Women with these demographic characteristics are assumed to provide similar survey answers and therefore are given higher non-response weights since their answers will represent more women. Non-coverage weights account for births omitted from the survey that actually met eligibility requirements. The 2017 birth file was provided to CDC for comparison to the sampling frame to produce non-coverage weights. The sampling, non-response and non-coverage weights were multiplied to yield an analysis weight for each respondent. Weighting thereby allows for the calculations of statewide and race-specific rates representing live births to eligible South Dakota mothers in 2017 (n=11,434). IRB approval was obtained through the South Dakota State University Institutional Review Board, and participation in the survey was voluntary.

In order to evaluate attendance at prenatal care visits, the ratio of observed to expected prenatal visits, adjusting for when prenatal care began and the gestational age at delivery, was calculated using vital records data.[8] Confidence intervals (95 percent) around the prevalence estimates were calculated; a finite population correction factor was used in the calculation of confidence intervals due to the high percentage of the population that was sampled without

Table 2. Demographic characteristics of eligible births to South Dakota mothers in 2017 and mothers completing the survey.

	Eligible population	Survey
Characteristics	**% (N)**	**% of women (95% CI, N)***
Total number	11,460	1,131
Maternal race strata		
White, non-Hispanic	71.2 (8161)	71.3 (70.6-71.9, 460)
American Indian	17.7 (2027)	17.6 (16.9-18.3, 382)
Other races	11.1 (1272)	11.1 (11.0-11.3, 289)
Maternal age (years)		
Less than 20	5.2 (591)	5.9 (4.6-7.5, 80)
20 – 24	20.6 (2,358)	20.3 (17.7-23.2 249)
25 – 34	61.2 (7,012)	61.7 (584-64.9, 667)
35+	13.1 (1,499)	12.2 (10.2-14.5, 135)
Maternal education		
Less than high school	15.6 (1,784)	14.4 (12.6-16.5, 236)
High school	24.4 (2,791)	24.7 (21.9-27.7, 291)
More than high school	59.9 (6,846)	60.9 (57.7-63.9, 597)
Marital status at infant's birth		
Married	62.9 (7,213)	64.6 (61.6-67.4, 606)
Not married	37.1 (4,247)	35.4 (32.6-38.4, 525)
Birthweight		
Low birth weight (< 2500 g)	6.0 (683)	6.3 (4.9-8.1, 69)
Birthweight greater than 2500 g	94.0 (10,776)	93.7 (91.9-95.1, 1,062)
Parity		
1st birth	32.7 (2741)	35.5 (32.3-38.8, 368)
2nd or later	67.3 (7,716)	64.5 (61.2-67.7, 763)

* Figures for population size and percent are compiled from state birth certificate data. Survey percentages are weighted for strata, non-response and non-coverage. Survey sample sizes may not total n=1,131 if there were missing data.

replacement.[9] Differences in prevalence rates among races were determined using logistic regression analyses with contrasts. Associations between healthcare provider information received by the mothers and the mother's behaviors were assessed using hi-square analysis.

Results

Of the eligible South Dakota mothers giving birth in 2017, 9.9 percent (1,131/11,460) completed a survey. The overall weighted response rate was 67 percent with 75 percent of white mothers responding, 44 percent of American Indian mothers, and 53 percent of mothers of other races. The demographic characteristics of eligible births to South Dakota mothers in 2017 and the weighted survey results are given in Table 2 and shows that the weighted distributions of the population surveyed are representative of the eligible population. The average days postpartum that the survey was completed was 122 days, with the means by race ranging from 116 to 141 days (Table 3).

Prevalence of Safe Sleep Practices Among South Dakota Mothers

Back to sleep for every sleep: In 2017, 87.6 percent of South Dakota mothers placed their infant on their back to sleep (Figure 1). Mothers of other races were less likely to place their infant to sleep on their back compared to white mothers and American Indian mothers (Table 3).

Use a firm sleep surface: The infant *always* sleeping alone is part of the definition of an approved sleep surface and only 62.4 percent of mothers stated that their infant *always* slept alone; American Indian mothers were less likely to state this than white mothers or mothers of other races (Table 3). A large percentage (92.0 percent) of mothers stated that their baby often slept in a crib, bassinet or pack-and-play (Table 3), but 53.8 percent of mothers stated that their infant did not often sleep in an infant car seat or swing. Only 30.8 percent of South Dakota infants born in 2017 slept on an approved sleep surface defined as *always* sleeping alone in their own crib, bassinet or pack-and-play and *not* in a standard bed, couch, armchair, car seat or swing (Table 3). White mothers were more likely to place their infants on an approved sleep surface compared to American Indian mothers.

Room-sharing without bed-sharing is recommended: Although 76.5 percent of mothers stated that their infant's crib or bed was in the same room as they slept, only 62.4 percent of mothers stated that their infant *always* slept alone resulting in 44.3 percent of the mothers stating that their infant *always* slept alone in his or her own crib or bed *and* in the same room that she slept (Figure 1). A higher percentage of mothers of other races met this recommendation compared to both white mothers and American Indian mothers (Table 3).

Keep soft objects and loose bedding out of the crib: Among South Dakota infants born in 2017, 43.6 percent slept in a sleep sack and 47.7 percent slept *without* blankets, toys, cushions, pillows, or crib bumper pads (Figure 1). For individual items, 52.6 percent of infants did *not* sleep with a blanket, 93.3 percent did *not* sleep with toys, cushions or pillows (including nursing pillows), and 89.9 percent did *not* use crib bumper pads. A higher percentage of white mothers and mothers of other races kept soft objects and loose bedding out of the infant's crib than American Indian mothers due to the lower rate of American Indian infants sleeping without a blanket (Table 3).

Breastfeeding is recommended: Overall, 89.4 percent of South Dakota mothers breastfed or pumped breast milk even for a short time (Figure 1), with white mothers and mothers of other races having the highest rate followed by American Indian mothers (Table 3).

Avoid smoke exposure during pregnancy and after birth: The mother's smoking habits and the

Implications for Providers

Although all the safe sleep recommendations are important, encouraging parents to do the following will address some of the areas where South Dakota can improve:

- *Always* place their infant to sleep in his or her own crib or bed.
- Do not use a car seat or swing for infant sleep.
- Do not place blankets in the infant's crib or bed – use a sleeping sack or wearable blanket.
- Do not smoke during or after pregnancy.

Department of Health Resources

- Cribs for Kids program – helps ensure babies have access to a safe sleep environment (safe sleep kit includes a pack-and-play, a sleep sack, and a fitted sheet among other items).
- WIC services – helps mothers with breastfeeding, access to healthy foods, education, and referrals.
- Certified lactation counselors and consultants at Community Health Offices – provide education to mothers on breastfeeding and safe sleep environments.
- Pregnancy Services – prenatal and postpartum assessments, education, and referrals.
- Nurse Home Visiting – regular home visits with a primary nurse during pregnancy and until the childis two years of age.
- For Baby's Sake website and Facebook page – information and resources to help women have healthy pregnancies and healthy babies.
- South Dakota QuitLine – coaching calls and gift card incentives to help pregnant women quit using tobacco.
- Illicit drug and alcohol use prevention – Community Behavioral Health Services or South Dakota Opioid Resource Hotline.

infant's exposure to environmental smoke were used to assess compliance with this recommendation. Overall, 90.4 percent of mothers did *not* smoke during the last three months of pregnancy, decreasing to 85.8 percent at the time the survey was completed (2-9 months postpartum) (Table 3). Statewide, 84.4 percent of mothers did not smoke either during the last three months of pregnancy or at the time of the survey. Mothers of other races were the most likely not to smoke followed by white mothers then American Indian mothers (Table 3). A high percent of mothers (97.6 percent) reported that their infant was never in the same room or vehicle with someone who was smoking (Table 3). In total, 82.1 percent of mothers did not smoke the last three months of pregnancy or after pregnancy and their infants were not exposed to environmental cigarette smoke (Figure 1). A higher percent of mothers of other races met this recommendation followed by white mothers then American Indian mothers (Table 3).

Figure 1. Percentage of South Dakota mothers giving birth in 2017 meeting specific AAP sleep recommendations. * Significant race differences (refer to Table 3) ^ Firm sleep surface defined as the mother stating that her baby always slept alone in a crib, bassinet or pack-and-play and not in a standard bed, couch, armchair, car seat or swing; history o f smoking and alcohol use during pregnancy was based on the last three months only; smoking after pregnancy was based on smoking at the time the survey was completed; and receipt of regular prenatal care was based on attending 80 percent or more of prenatal visits adjusted for gestational age that prenatal care began.

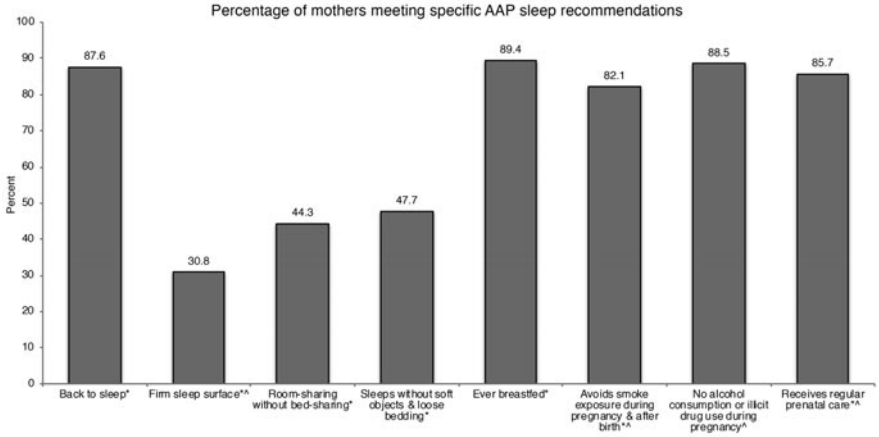
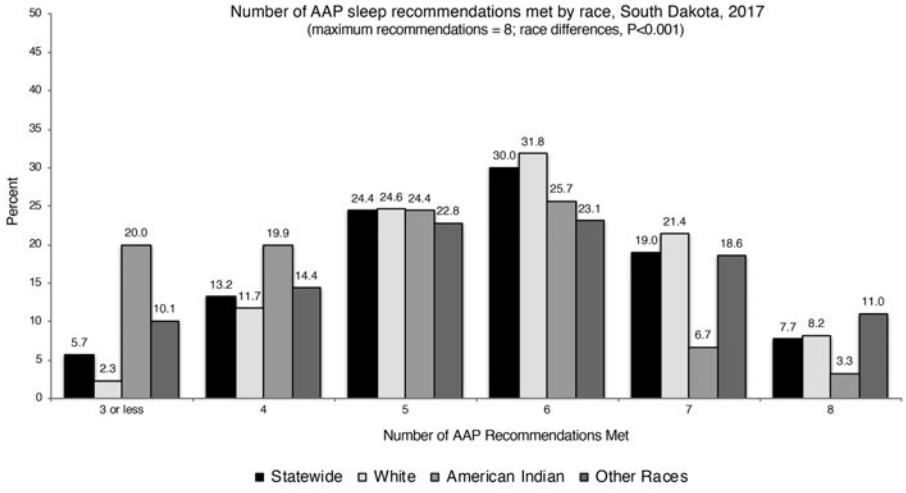


Figure 2. Number of AAP sleep recommendations that South Dakota mothers giving birth in 2017 met, by race. The maximum number of recommendations was 8. There were significant race differences in the distribution of AAP recommendations that were met (p<0.001).



Avoid alcohol and illicit drug use during pregnancy and after birth: A high percentage of South Dakota mothers did not consume alcohol (91.7 percent) or use illicit drugs (96.7 percent) during pregnancy (Table 3). Overall, 88.5 percent of mothers reported *not* consuming alcohol the last three months of pregnancy or using illicit drugs during pregnancy (Figure 1). There were no race differences in the percentages of mothers meeting this recommendation (Table 3).

Pregnant women should receive regular prenatal care: Among South Dakota mothers giving birth in 2017, 85.7 percent attended 80 percent or more of their prenatal visits (Figure 1). White mothers attended a greater percentage of visits followed by mothers of other races then American Indian mothers (Table 3).

Number of AAP sleep recommendations met by South Dakota mothers: Seventy-three percent of the mothers completed all 18 questions used to determine whether the mother met all eight AAP recommendations. Overall, 7.7 percent of South Dakota mothers giving birth in 2017 met all eight of the AAP recommendations regarding safe sleep and 18.9 percent met four or fewer of the eight recommendations. The distribution of these mothers by the number of AAP recommendations that were met shows a shift to fewer

Table 3.Prevalence rates for meeting AAP safe sleep recommendations for South Dakota mothers delivering a live infant in 2017 and advice provided by health care providers, by race

	Statewide	White	American Indian	Other races	P value[1]	# Missing (out of 1,131)
Days postpartum survey was completed	122 (119-125)	116 (113-119) [ab]	141 (136-146) [ac]	130 (125-134) [bc]	<0.001	0
Back to Sleep for Every Sleep						
In which one position do you most often lay your baby down to sleep now?						
% On his or her back	87.6 (85.4-89.8)	89.0 (86.1-91.9) [a]	87.1 (83.4-90.8) [b]	79.5 (75.4-83.7) [ab]	0.003	14
Use a Firm Sleep Surface						
In the past 2 weeks, how often has your new baby slept alone in his or her own crib or bed?						
Always	62.4 (59.1-65.6)	66.1 (61.8-70.4) [a]	48.7 (43.5-53.9) [ab]	59.6 (54.5-64.7) [b]	<0.001[3]	18
Often	18.7 (16.0-21.4)	18.7 (15.1-22.2)	20.4 (16.2-24.6)	16.3 (12.5-20.1)		
Sometimes	6.9 (5.3-8.5)	5.1 (3.2-7.1)	11.9 (8.2-15.5)	10.6 (7.4-13.8)		
Rarely	4.6 (3.2-6.0)	4.1 (2.3-6.0)	6.2 (3.6-8.9)	5.1 (2.9-7.3)		
Never	7.4 (5.7-9.1)	6.0 (3.8-8.2, 478)	12.9 (9.4-16.3)	8.4 (5.6-11.3)		
Please tell us how your new baby most often slept in the past 2 weeks:[2]						
% in a crib, bassinet, or pack-n-play	92.0 (90.3-93.8)	93.7 (91.5-95.9) [a]	87.1 (83.8-90.5) [a]	89.0 (85.8-92.3)	0.001	28
% *not* on a twin or larger mattress/bed	77.0 (74.3-79.8)	82.5 (78.9-86.0) [ab]	61.9 (56.7-67.0) [a]	64.5 (59.2-69.7) [b]	<0.001	64
% *not* on a couch, sofa or armchair	90.4 (88.4-92.4)	91.9 (89.4-94.5) [a]	85.6 (81.7-89.4) [a]	87.9 (84.3-91.4)	0.006	68
% *not* in an infant car seat or swing	53.8 (50.3-57.2)	52.7 (48.1-57.3)	55.7 (50.4-61.0)	57.7 (52.4-63.1)	0.37	63
Total % of infants who always slept alone and on an approved surface[4]	30.8 (27.6-34.0)	32.8 (24.5-37.0) [a]	24.0 (19.6-28.4) [a]	28.7 (23.8-33.5)	0.04	71
Room-sharing						
When your new baby sleeps alone, is his or her crib or bed in the same room where you sleep?						
% in same room	76.5 (73.3-79.7)	70.6 (66.3-74.9) [a]	93.5 (91.0-96.1) [a]	90.0 (86.8-93.2)	<0.001	33
In the past 2 weeks, how often has your new baby slept alone in his or her own crib or bed?						
Always	62.4 (59.1-65.6)	66.1 (61.8-70.4) [a]	48.7 (43.5-53.9) [ab]	59.6 (54.5-64.7) [b]	<0.001[3]	18
Total % of infants who always slept alone and in the mother's room:[5]	44.3 (40.9-47.7)	42.3 (37.8-46.8) [a]	45.1 (39.9-50.3) [b]	56.0 (50.8-61.2) [ab]	0.003	66
Keep Soft Objects and Loose Bedding Out of the Crib						
Please tell us how your new baby most often slept in the past 2 weeks: [2]						
% in sleeping sack or wearable blanket	43.6 (40.2-47.1)	47.4 (42.8-52.0) [a]	35.1 (30.0-40.3)	31.2 (26.2-36.3) [a]	<0.001	76
% *not* with a blanket	52.6 (43.9-50.8)	55.2 (50.6-59.8) [a]	40.7 (35.5-45.9) [ab]	54.3 (48.9-59.8) [b]	<0.001	69
% *not* with toys, cushions, or pillows	93.3 (91.5-95.0)	94.0 (91.7-96.2)	91.2 (88.1-94.3)	91.7 (88.6-94.7)	0.22	71
% *not* with crib bumper pads	89.9 (87.8-92.0)	90.4 (87.6-93.2)	89.8 (86.4-93.2)	86.4 (82.6-90.2)	0.33	76
Total percent of infants who slept without blankets, toys, cushions, pillows or crib bumper pads:	47.7 (44.2-51.2)	50.7 (46.1-55.3) [a]	35.1 (30.0-40.1) [ab]	47.6 (42.2-53.1) [b]	<0.001	99
Breastfeeding						
Did you ever breastfeed or pump breast milk to feed your new baby, even for a short period of time?						
% ever breastfed	89.4 (87.6-91.3)	93.2 (91.0-95.5) [a]	76.2 (71.7-80.8) [ab]	85.1 (81.3-88.8) [b]	<0.001	12
Avoid Smoke Exposure During Pregnancy and After Birth						
Maternal smoking						
% of mothers who did *not* smoke during the last three months of pregnancy	90.4 (88.5-92.3)	92.8 (90.4-95.2) [ab]	78.5 (74.3-82.6) [ac]	94.0 (91.4-96.5) [bc]	<0.001	25
% of mothers who did *not* smoke at the time the survey was completed	85.8 (83.6-88.0)	90.1 (87.4-92.9) [ab]	63.1 (58.2-68.1) [ac]	93.7 (91.2-96.3) [bc]	<0.001	25

Percent of mothers who did *not* smoke either during the last three months of pregnancy or at the time the survey was completed	84.4 (82.1-86.6)	88.9 (86.0-91.8) [ab]	60.4 (55.3-65.4) [ac]	92.9 (90.2-95.6) [bc]	<0.001	26
Environmental smoke exposure						
My baby is never in an enclosed space, such as a room or a vehicle with someone who is smoking	97.6 (96.5-98.7)	97.8 (96.5-99.2)	96.3 (93.9-98.8)	97.7 (96.1-99.3)	0.46	41
Total % of mothers who did *not smoke* either during the last three months of pregnancy or at the time of the survey and whose infant is *not exposed* to environmental smoke.	82.1 (79.7-84.5)	87.9 (84.8-90.9) [ab]	52.6 (47.3-57.8) [ac]	90.1 (86.8-93.3) [bc]	<0.001	65
Avoid Alcohol and Illicit Drug Use During Pregnancy and After Birth						
% of mothers who did *not* consume alcohol during the last three months of pregnancy	91.7 (89.8-93.6)	91.3 (88.8-93.8)	92.9 (89.8-96.0)	92.7 (90.1-95.4)	0.62	9
% of mothers who did *not* use illicit drugs during their recent pregnancy [6]	96.7 (95.6-97.7)	97.9 (96.6-99.2) [a]	91.0 (88.2-93.7) [ab]	97.2 (95.4-99.0) [b]	<0.001	40
Total % of mothers who did *not* consume alcohol the last three months of pregnancy or use illicit drugs during their recent pregnancy	88.5 (86.4-90.7)	89.3 (86.5-92.1)	84.0 (80.1-88.0)	90.0 (86.8-93.1)	0.06	43
Pregnant Women Should Receive Prenatal Care						
% of mothers attending 80% or more of their prenatal visits [7]	85.7 (83.7-87.8)	92.1 (89.6-94.6) [ab]	61.4 (56.4-66.4) [ac]	81.8 (77.8-85.8) [bc]	<0.001	21
Advice Provided by Health Care Provider						
Place infant on his or her back to sleep	96.6 (95.4-97.7)	97.3 (95.8-98.8)	94.2 (91.5-97.0)	95.3 (93.1-97.5)	0.05[8]	22
Place infant to sleep in a crib, bassinet, or pack-and-play	91.4 (89.5-93.3)	92.0 (89.5-94.4)	89.6 (86.3-92.8)	90.6 (87.6-93.7)	0.43	26
Place infant's crib in mother's room	52.1 (48.7-55.6)	48.9 (44.4-53.5) [a]	57.1 (52.0-62.2) [b]	65.5 (60.5-70.5) [ab]	<0.001	32
What things should and should not go in bed with infant	89.8 (87.7-91.8)	89.5 (86.8-92.2)	90.2 (87.0-93.4)	91.0 (88.0-94.0)	0.80	30
Provider asked if the mother was: smoking cigarettes	97.9 (97.1-98.7)	98.7 (97.7-99.7) [a]	96.6 (94.7-98.5)	94.4 (92.0-96.8) [a]	0.002	19
drinking alcohol	96.9 (95.8-98.0)	97.4 (96.1-98.8)	96.1 (94.2-97.9)	94.4 (92.0-96.9)	0.08	24
using drugs such as marijuana, cocaine, crack or meth	82.5 (79.8-85.2)	80.6 (77.0-84.1) [a]	90.2 (87.1-93.3) [ab]	83.1 (79.2-87.1) [b]	<0.001	23
Planning to breastfeed her baby	95.2 (93.8-96.7)	95.4 (93.5-97.3)	95.6 (93.6-97.5)	93.6 (91.1-96.1)	0.55	19
Doctor provided information on breastfeeding	83.7 (81.2-86.2)	84.3 (81.1-87.6)	82.8 (78.8-86.7)	80.9 (76.7-85.1)	0.48	36

1 Similar letters indicate a significant difference at p<0.05 between races using contrasts.

2 Mothers checked no if it doesn't usually apply to their baby or yes if it does; mothers were able to check more than one response.

3 P value and race differences based on always vs. not always.

4 Defined as a composite of five items indicating how the infant usually slept in the past 2 weeks: 1) alone in their own crib or bed (always versus often/ sometimes/rarely/never); 2) in a crib, bassinet, or pack-and-play; 3) not in a standard bed; 4) not in a couch or armchair; 5) not in car seat or swing.

5 Defined as a composite of two items indicating that the infant usually slept 1) alone in their own crib or bed (always versus often/sometimes/rarely/never) and 2) in the same room as their mother.

6 Illicit drugs that were asked about included marijuana, synthetic marijuana, methadone, heroin, amphetamines (including meth), cocaine, tranquilizers (downers, ludes), hallucinogens, and sniffing gasoline, glue, aerosol sprays to get high.

7 Determined using Kotelchuck program to calculate the percentage of prenatal visits that were attended, using data from vital records (see Methods).

8 No race differences were significant by contrasts.

recommendations met among American Indian mothers compared to white mothers and mothers of other races (Figure 2).

Association between Discussions with the Healthcare Provider and the Mother's Behavior

There were several questions on the survey that asked the mother if she recalled her doctor, nurse or other healthcare provider talking to her about specific topics, several of which related to the AAP safe sleep recommendations. Discussions with the healthcare provider about placing the infant to sleep on their back and about what items should and should not go in the bed with the baby were not significantly associated with a higher percent of mothers meeting these recommendations. In regard to placing the infant to sleep on their back, 87.7 percent of mothers who were talked to about laying the infant on his or her back actually laid the infant on their back compared to 83.9 percent who were not talked to by a healthcare provider (p=0.52). In regard to items that should or should not go in the baby's bed, 47.6 percent of mothers who were talked to about what should go in the baby's bed did not put blankets, toys, cushions, pillow or crib bumper pads in the bed compared to 47.4 percent of mothers who were not talked to (p=0.97). The prevalence of smoking or drinking alcohol the last three months of pregnancy or the use of illicit drugs at any time during pregnancy did not differ between those mothers whose health care provider asked them if they were smoking, drinking or using illicit drugs, respectively vs. those who did not ask (data not shown).

Discussions with the healthcare provider about placing the infant to sleep in a crib and about the crib being placed in the mother's room were associated with sleep behaviors (Figure 3). Of the mothers who stated that a healthcare provider talked to them about placing their infant to sleep in a crib, bassinet, or pack-and-play 93.3 percent stated that their infant most often slept in a crib, bassinet, or pack-and-play compared to 80.6 percent who did not recall their healthcare provider telling them where to place their infant to sleep (Figure 3). Of the mothers who stated that their health care provider talked to them about placing the crib in the mother's room, 87.3 percent of the infants slept in the same room as the mother compared to 65.2 percent of the infants of mothers who did not recall their health care provider talking to them about placing the crib in her room. There was no association between a mother being asked by the healthcare provider if she was going to breastfeed and the actual prevalence of breastfeeding (Figure 4). However, mothers who recalled information about breastfeeding

Figure 3. Percentage of South Dakota mothers giving birth in 2017 who practiced infant safe sleep practices by whether or not their healthcare provider told them to place their baby to sleep in a crib, bassinet or pack-and-play and to place the infant's crib in the mother's room.

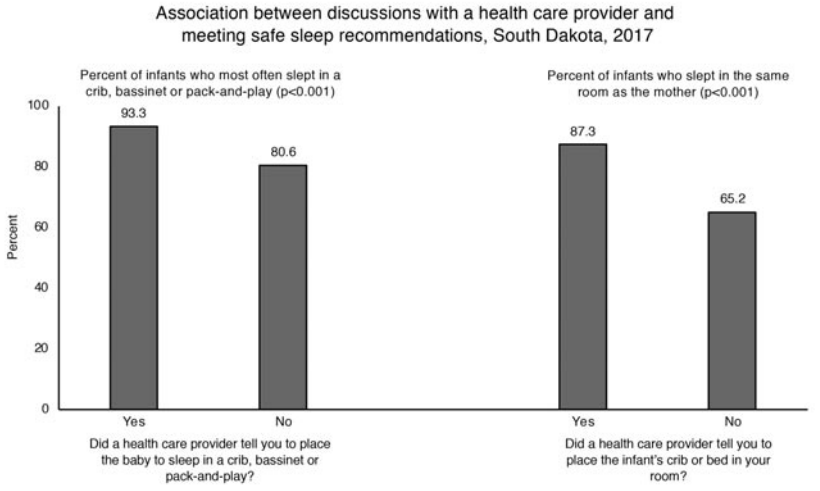
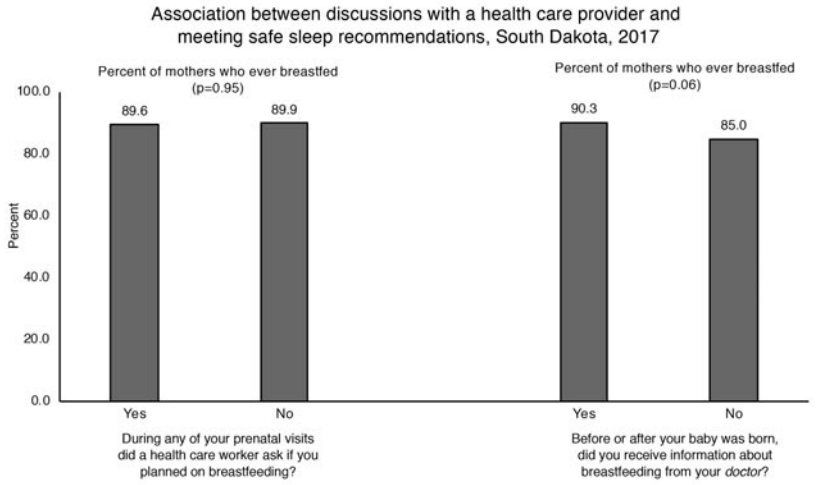


Figure 4. Percentage of South Dakota mothers giving birth in 2017 who ever breastfed or pumped milk at any time by whether or not their healthcare provider asked them if they were going to breastfeed and whether their doctor provided them with information about breastfeeding. Mothers who received information about breastfeeding from their doctor, but not being asked whether they were going to breastfed, was associated with the mother being more likely to breastfeed (p=0.06).



being given to her by her doctor were slightly more likely to breastfeed than if the information was not given to them by their doctor (p=0.06, Figure 4).

Discussion

South Dakota has one of the highest SUID rates in the U.S., ranking 46th among the 50 states in 2013-2015,[3] making the 2016 AAP safe sleep recommendations of particular importance in informing South Dakota healthcare providers, public health proponents, and parents on methods to reduce the number of sleep-related deaths. The South Dakota 2017 PRAMS survey allowed for the determination of prevalence rates for eight of the 15 AAP A-level recommendations as well as identifying areas where discussions by healthcare providers are associated with recommended safe sleep behaviors. More than 85 percent of South Dakota mothers were following recommendations regarding placing their infant on his or her back for every sleep, breastfeeding the infant even for a short time, avoiding alcohol or illicit drugs during pregnancy, and receiving regular prenatal care. There were four areas where less than 85 percent of the mothers met the AAP recommendations. These included: always sleeping on an approved sleep surface, room-sharing without bed-sharing, keeping soft objects and loose bedding out of the crib, and avoiding smoke exposure during pregnancy and after birth. Mothers who reported their healthcare provider spoke to them about placing the infant to sleep in a crib, bassinet or pack-and-play and placing the infant's crib or bed in the mother's room were more likely to meet those recommendations than mothers who reported that their provider did not talk to them about these topics.

The AAP recommends that infants sleep in the parents' room but on a separate surface designed for infants for at least the first six months of life and preferably for the first year.[4] The AAP cites several case-control studies indicating that an infant sleeping in the parents' room, but on a separate sleep surface, could decrease the risk of SIDS by as much as 50 percent.[10,11] This recommendation was only met by 44.3 percent of South Dakota mothers based on questions related to whether the baby sleeps in the same room as the mother and whether the baby *always* sleeps alone in his or her own crib or bassinet. The use of sitting devices, such as car seats and swings, as routine sleeping environments is discouraged due to the possibility of the infant assuming a position that might lead to airway obstruction. Although a high percentage of mothers reported that their infant often slept in a crib or bassinet, almost 50 percent of South Dakota mothers also stated that their baby often slept in either an infant car seat or an infant swing which would exclude them from being counted as always sleeping on an approved sleep surface. Sleeping on couches and armchairs is extremely dangerous and places infants at high risk of death through entrapment or wedging between seat cushions. Numerous cross-sectional studies have reported that couch-sharing is the largest environmental risk associated with SUID.[10-13] Close to 10 percent of South Dakota mothers stated that their new baby slept on a couch, sofa or armchair in the previous two weeks.

Soft objects and loose bedding may increase the risk of suffocation by obstructing an infant's nose and mouth. The AAP recommends that all soft objects and loose bedding be removed from an infant's sleep area and that infants sleep in clothing such as a wearable blanket rather than have loose blankets in the sleep area.[4] Less than half of the infant's used a sleeping sack or wearable blanket, and blankets were placed in about 50 percent of infants' sleeping area. Encouraging the use of wearable blankets and removing loose blankets would significantly increase the percent of South Dakota mothers who meet this recommendation since this was the most common soft object or loose bedding item that was reported in the infants' sleep area.

Recommendations state that mothers should not smoke during pregnancy or after the infant's birth and that there should be no smoking near pregnant women or their infants due to an increased risk of SIDS.[4] Smoking during pregnancy is associated with impaired autonomic function, arousal and cardiovascular reflexes that may increase an infant's susceptibility to sudden infant death.[14-16] Based on the 2017 BRFSS survey, South Dakota ranks 39th in the U.S. in terms of current cigarette use with 19.3 percent of the population smoking[17] and 55 percent of adult South Dakotans report drinking alcohol in the past 30 days.[18] Although it is commonly believed that American Indians have a greater alcohol intake than whites,[19] our previous report of a greater alcohol intake before pregnancy among white mothers than American Indian mothers in South Dakota is consistent with other studies that challenge this belief.[20,21] Efforts to decrease smoking, alcohol and illicit drug use rates, especially among women of reproductive age, should lead to reduced rates of SUID as would ensuring that South Dakota women receive adequate prenatal care. Receipt of adequate prenatal care also should increase the amount of prenatal education that the mother receives. Obtaining regular prenatal care is important not just for prevention of SUID but to improve other birth outcomes as well.[22,23]

Healthcare providers play an important role in influencing mothers' behaviors regarding safe sleep practice, but cultural differences are also important. Whether the infant slept most often in a crib or bassinet or whether the infant's crib was placed in the same room as the mother were topics discussed by the healthcare providers that lead to a significant impact on whether the mother followed recommendations relating to placing the infant to sleep in a crib or bassinet or room-sharing. Although questioning by a health care provider on whether the mother was going to breastfeed was not associated with the mother breastfeeding, there was a tendency for mothers who received information about breastfeeding from their doctor to be more likely to breastfeed than those mothers who did not receive information from their doctor. Whether this is a result of the doctor providing the mother with the information on breastfeeding or whether it is a reflection of women who were already considering breastfeeding who asked for the information from their doctor could not be determined. Cultural differences also are important and it has been suggested that the reason many minority mothers are non-compliant with safe sleep recommendations is that they do not understand the rationale for the recommendation and that perceived safety, convenience and infant sleep quality are the main reasons for not following medical advice.[24] Family advice also has been found to supersede clinical advice in many instances, showing the importance of educating the entire family and the difficulty with changing ingrained social beliefs.[24]

There are several limitations. First, the survey was based on self-report so recall bias or reporting bias are possible. This may be particularly relevant with regard to discussions during prenatal visits that occurred months before the survey was completed. However, we did observe associations between some of the topics that the mothers' reported were discussed during prenatal visits and infant sleep practices. Second, the wording of the PRAMS core question regarding where the infant most often slept in the past two weeks also is difficult to interpret. Although the question states specifically where the infant *most often* slept, the mother was able to check all locations that applied. An example of what may occur is the infant who falls asleep in their car seat while they are being transported, but is placed to sleep in a crib or bassinet. It is possible that the mother of this infant would check both crib/bassinet as well as car seat, which would result in that infant not meeting the recommendation of sleeping on an approved surface. The survey did not include information on smoking and alcohol use for the entire prenatal period, but only for the last three months of pregnancy. Although it is likely that women who smoked or drank the last three months of pregnancy also smoked or drank throughout pregnancy, this is not known. Missing data also may be a limitation; however, of the individual questions reported in Table 3 the percentage missing averaged 3.6 percent with a range of 0.8 to 8.8 percent.

In summary, a low percentage of South Dakota mothers met all eight of the AAP safe sleep recommendations that could be assessed using data from the 2017 South Dakota PRAMS. Health care providers can influence a mother's compliance with safe sleeping recommendations.

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