

Prevalence and Factors Associated With Safe Infant Sleep Practices

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abstract

OBJECTIVES: To examine prevalence of safe infant sleep practices and variation by sociodemographic, behavioral, and health care characteristics, including provider advice.

METHODS: Using 2016 Pregnancy Risk Assessment Monitoring System data from 29 states, we examined maternal report of 4 safe sleep practices indicating how their infant usually slept: (1) back sleep position, (2) separate approved sleep surface, (3) room-sharing without bed-sharing, and (4) no soft objects or loose bedding as well as receipt of health care provider advice corresponding to each sleep practice.

RESULTS: Most mothers reported usually placing their infants to sleep on their backs (78.0%), followed by room-sharing without bed-sharing (57.1%). Fewer reported avoiding soft bedding (42.4%) and using a separate approved sleep surface (31.8%). Reported receipt of provider advice ranged from 48.8% (room-sharing without bed-sharing) to 92.6% (back sleep position). Differences by sociodemographic, behavioral, and health care characteristics were larger for safe sleep practices (~10–20 percentage points) than receipt of advice (~5–10 percentage points). Receipt of provider advice was associated with increased use of safe sleep practices, ranging from 12% for room-sharing without bed-sharing (adjusted prevalence ratio: 1.12; 95% confidence interval: 1.09–1.16) to 28% for back sleep position (adjusted prevalence ratio: 1.28; 95% confidence interval: 1.21–1.35). State-level differences in safe sleep practices spanned 20 to 25 percentage points and did not change substantially after adjustment for available characteristics.

CONCLUSIONS: Safe infant sleep practices, especially those other than back sleep position, are suboptimal, with demographic and state-level differences indicating improvement opportunities. Receipt of provider advice is an important modifiable factor to improve infant sleep practices.



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WHAT'S KNOWN ON THIS SUBJECT: Approximately 3500 infants die annually in the United States from sleep-related sudden unexpected causes. Previous studies have indicated suboptimal adherence to safe infant sleep recommendations and highlighted various sociodemographic disparities and connections with provider advice.

WHAT THIS STUDY ADDS: We update previous estimates of safe infant sleep and include a new composite measure assessing the use of separate approved sleep surfaces. We also explore state variation and examine associations between provider advice and each of 4 corresponding sleep-related practices.

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Approximately 3500 infants die annually in the United States from sudden unexpected infant deaths (SUIDs), including sudden infant death syndrome (SIDS), undetermined causes, and accidental suffocation and strangulation in bed.¹⁻⁴ SUID rates declined 45% from 1990 to 1998,⁴ coinciding with the 1992 American Academy of Pediatrics (AAP) recommendation that infants be placed on their backs to sleep^{5,6} and the accompanying Back to Sleep (now Safe to Sleep) campaign led by the National Institutes of Health.⁷ Since 1998, however, the SUID rate has declined <10%,⁴ whereas the prevalence of back sleep position has plateaued.⁸⁻¹⁰ To further reduce SUID, the AAP expanded safe sleep recommendations to include using a firm sleep surface (eg, crib or bassinet), room-sharing without bed-sharing, and avoiding soft objects and loose bedding.^{3,11-13} Data from the National Infant Sleep Position (NISP) study, conducted among nighttime caregivers, show that bed-sharing doubled from 1993 to 2010 (from 6.5%→13.5%),¹⁴ whereas soft bedding declined by over a third (from 85.9% to 54.7%).¹⁵

Ongoing national surveillance of adherence to the AAP safe sleep recommendations has been limited since the NISP ended in 2010. Through the Pregnancy Risk Assessment Monitoring System (PRAMS), a population-based survey of mothers with recent live births, information on sleep position has been collected in participating states since 1996 and on bed-sharing and use of soft bedding in select states since 2009. PRAMS data from 2015 showed that unsafe sleep practices were common and indicated demographic and state-level variation.⁹ However, analyses beyond sleep position were limited to <15 states. With funding from the Health Resources and Services Administration (HRSA), new PRAMS questions capturing expanded sleep-

related recommendations were added for all participating states in 2016 as part of a new national performance measure for the Title V Maternal and Child Health Services State Block Grant Program.¹⁶ Given that provider advice influences sleep practices,^{8,10,14,17} questions assessing the reported receipt of advice for sleep-related practices were also included. We analyzed 2016 PRAMS data to describe safe sleep practices aligned with the AAP recommendations and HRSA Title V national performance measure as well as associations with receipt of provider advice and other factors to identify improvement opportunities.

METHODS

Data Source

PRAMS data collection methodology has been previously described.¹⁸ Briefly, mothers are randomly sampled from birth certificate records and complete the PRAMS survey (mail or telephone) within 2 to 9 months postpartum. Twenty-nine of 39 participating states met the Centers for Disease Control and Prevention's (CDC's) response rate threshold (55%) for analysis. The weighted overall mean response rate was 61% (range: 55%–73%). Data were weighted to account for selection probability, differential nonresponse by demographic characteristics, and noncoverage, representing all births in 29 states (51% of all 2016 US births). Analysis was restricted to infants living with their mothers at survey completion (98.7%). The weighted mean infant age was 4.1 months with 97.4% ≤6 months. The CDC and each state's institutional review board approved the PRAMS protocol.

Outcomes

Safe Sleep Practices

We examined maternal report of 4 infant sleep practices: (1) back sleep position, (2) separate approved sleep

surface, (3) room-sharing without bed-sharing, and (4) no soft objects or loose bedding ("soft bedding"). "Back sleep position" was assessed by a single item regarding the position mothers most often placed their infant to sleep (ie, back versus side, stomach, or combination). "Separate approved sleep surface" was assessed with a 5-item composite indicating how the infant usually slept in the past 2 weeks: (1) separate was defined as an infant sleeping alone in their own crib or bed (always or often versus sometimes, rarely, or never) and (2) an approved sleep surface was defined as the infant usually sleeping in a crib, bassinet, or pack and play but not in a twin or larger bed, couch or armchair, or infant car seat or swing (no versus yes). "Room-sharing without bed-sharing" was assessed as a 2-item composite indicating whether the infant usually slept in the past 2 weeks: (1) alone in their own crib or bed (always or often versus sometimes, rarely, or never) and (2) in the same room as their mothers (yes versus no). Operationalization of these 2 measures offers a consistent assessment of usual practice across items, which aligns with previous national studies.^{6,8,14,15,19} We also examined report of the infant "always" versus "often, sometimes, rarely, or never" sleeping in their own crib or bed for "separate approved sleep surface" and "room-sharing without bed-sharing" to more closely reflect adherence to the AAP recommendation of separate sleep surfaces for infants. "No soft bedding" was assessed with a 3-item (no versus yes) composite indicating that the infant usually slept in the past 2 weeks without blankets, toys, cushions, or pillows and crib bumper pads.

Safe Sleep Advice

We examined reported receipt of advice from a doctor, nurse, or other health care worker corresponding to the 4 safe sleep practices. Mothers

reported whether they were told by a provider to (1) place their infant on their back to sleep; (2) place their infant to sleep in a crib, bassinet, or pack and play; (3) place infant's crib or bed in the mother's room; and (4) what items should and should not be in the infant sleep environment.

Covariates

Consistent with previous literature,^{3,8–10,14,15,19–22} we examined characteristics that may be associated with sleep practices and receipt of advice. Sociodemographic characteristics obtained from the birth certificate included maternal age, race and ethnicity, education, marital status, and state of residence as well as infant gestational age. Behavioral characteristics from the PRAMS survey included breastfeeding and smoking at time of survey. Health care characteristics obtained from the birth certificate that may influence the delivery of provider advice and sleep practices included prenatal participation in the Special Supplemental Nutrition Program for Women, Infants, and Children (WIC); timing of prenatal care initiation; and insurance coverage at delivery.

Statistical Analysis

Bivariate associations between main outcomes and covariates were examined with χ^2 tests of significance. We used multivariable logistic regression models, with each safe sleep practice as the dependent variable, to examine adjusted associations with maternal and infant characteristics, behaviors, health care characteristics, and receipt of corresponding provider advice as well as state of residence. To improve interpretation and translation, we converted estimated odds to marginal probabilities and adjusted prevalence ratios.²³ Unadjusted and model-adjusted state-level prevalence estimates were compared to assess the contribution of covariates in explaining state variation. Statistical significance was defined as a *P* value

TABLE 1 Infant Sleep Practices, 29 States, PRAMS, 2016

Infant Sleep Practice	Unweighted Sample Size	Weighted % (95% CI)
Sleep position		
Back sleep position ^a	33 397	78.0 (77.3–78.7)
Separate approved sleep surface		
Approved sleep surface and always or often separate ^b	31 962	31.8 (30.9–32.6)
Approved sleep surface and always separate ^c	31 962	26.3 (25.5–27.0)
Separate sleep surface	33 370	
Always		55.7 (54.8–56.5)
Often		18.7 (18.1–19.4)
Sometimes		9.9 (9.4–10.4)
Rarely		5.6 (5.2–6.0)
Never		10.1 (9.6–10.7)
Type of sleep surface (could choose more than 1)		
In a crib, bassinet, or pack and play	33 208	87.8 (87.2–88.4)
In an infant car seat or swing	32 606	50.7 (49.9–51.6)
On a twin or larger mattress or bed	32 544	30.9 (30.1–31.7)
On a couch or armchair	32 411	9.0 (8.5–9.5)
Only slept in a crib, bassinet, or pack and play	32 100	34.9 (34.0–35.7)
Room-sharing without bed-sharing		
Room-sharing and always or often separate ^d	33 051	57.1 (56.2–57.9)
Room-sharing and always separate ^e	33 051	41.1 (40.3–42.0)
Sleep environment		
No soft objects or loose bedding ^f	32 044	42.4 (41.6–43.3)
Type of soft objects or loose bedding		
With blanket	32 469	50.5 (49.6–51.3)
With crib bumper pads	32 322	17.6 (16.9–18.3)
With toys, cushions, or pillows, including nursing pillows	32 457	8.9 (8.4–9.4)

Data are from Alaska, Arkansas, Colorado, Connecticut, Delaware, Illinois, Iowa, Louisiana, Maine, Maryland, Massachusetts, Michigan, Missouri, Nebraska, New Hampshire, New Jersey, New Mexico, New York, Oklahoma, Pennsylvania, Rhode Island, Texas, Utah, Vermont, Virginia, Washington, West Virginia, Wisconsin, and Wyoming. CI, confidence interval.

^a Defined as most often placing their infant to sleep on the back versus side, stomach, or combination.

^b Defined as a composite of 5 items indicating how the infant usually slept in the past 2 wk: (1) alone in their own crib or bed (always or often versus sometimes, rarely, or never); (2) in a crib, bassinet, or pack and play; (3) not in a standard bed; (4) not on a couch or armchair; and (5) not in a car seat or swing (yes versus no).

^c Defined as a composite of 5 items indicating how the infant usually slept in the past 2 wk: (1) alone in their own crib or bed (always versus often, sometimes, rarely, or never); (2) in a crib, bassinet, or pack and play; (3) not in a standard bed; (4) not on a couch or armchair; and (5) not in a car seat or swing (yes versus no).

^d Defined as a composite of 2 items indicating that the infant usually slept in the past 2 wk: (1) alone in their own crib or bed (always or often versus sometimes, rarely, or never) and (2) in the same room as their mothers (yes versus no).

^e Defined as a composite of 2 items indicating that the infant usually slept in the past 2 wk: (1) alone in their own crib or bed (always versus often, sometimes, rarely, or never) and (2) in the same room as their mothers (yes versus no).

^f Defined as a composite of 3 items indicating that the infant usually slept in the past 2 wk without (1) blankets; (2) toys, cushions, or pillows; and (3) crib bumper pads (yes versus no).

<.05 with only practically meaningful differences of at least 5 percentage points highlighted within the text. Missing data ranged from 2% to 6% across outcomes. Approximately 9% of observations were missing covariate data and were excluded from regression analysis. Analyses accounted for the complex sampling design of PRAMS by using SAS-callable SUDAAN 11.0.0.

RESULTS

Overall, most (78.0%) mothers reported placing their infants to sleep

on their backs (Table 1). Although most (74.4%) usually (“always or often”) used a separate sleep surface, slightly more than half (57.1%) also reported room-sharing. A smaller proportion (41.1%) reported room-sharing and “always” using a separate sleep surface. Less than one-third of infants (31.8%) “always or often” slept separately on an approved sleep surface; a smaller proportion (26.3%) “always” slept separately on an approved sleep surface. Most mothers reported that their infants usually slept in a crib, bassinet, or pack and

play (87.8%), but these were the sole usual sleep surfaces for only 34.9%. Infant car seat or swing (50.7%), twin or larger bed (30.9%), and couch or armchair (9.0%) were less frequently reported as the usual sleep surface. Less than half of mothers (42.4%) reported using no soft bedding for infant sleep. Blankets were most commonly reported (50.5%), followed by crib bumper pads (17.6%) and toys, cushions, or pillows (8.9%).

Mothers who were older, non-Hispanic white, more educated, and married were more likely to report the following usual safe sleep practices: back sleep position, separate approved sleep surface, and no soft bedding (Table 2). In contrast, younger, Hispanic, less-educated, and unmarried mothers had a higher prevalence of usually room-sharing without bed-sharing. Racial and ethnic differences existed across all safe sleep practices. Non-Hispanic black mothers had the lowest prevalence of using the back sleep position (62.3%), Non-Hispanic Asian or Pacific Islander mothers had the lowest prevalence of using separate approved sleep surfaces (20.6%), and non-Hispanic American Indian or Alaska Native mothers had the lowest prevalence of room-sharing without bed-sharing (50.5%) and avoiding soft bedding (25.6%). There was also an age gradient for soft bedding use, with teenaged mothers having the lowest prevalence of following recommendations to avoid soft bedding (25.0%) compared with approximately half of mothers ≥ 30 years.

Mothers who reported currently breastfeeding had a higher prevalence of using the back sleep position (80.5% vs 75.2%) and no soft bedding (46.8% vs 37.5%) than mothers not breastfeeding. However, breastfeeding mothers had a lower prevalence of room-sharing without bed-sharing (53.3% vs 61.3%). Mothers currently smoking had

a lower prevalence of using separate approved sleep surfaces (25.6% vs 32.5%) and no soft bedding (31.2% vs 43.8%) than nonsmokers. Mothers who participated in WIC, received late or no prenatal care, and were Medicaid insured or uninsured generally had lower rates of safe sleep practices. However, room-sharing without bed-sharing was more common among WIC participants than nonparticipants (62.8% vs 53.5%) and among Medicaid-insured than privately insured mothers (63.2% vs 52.5%). Types of sleep surfaces and soft bedding showed similar patterns to overall indicators, with the exception of sleeping in a car seat or swing, which lacked substantial or consistent patterning (Supplemental Table 5). Infants of non-Hispanic American Indian or Alaska Native mothers had notably higher rates of sleeping on a couch or armchair (18.2% vs 9.0% overall) and with a blanket (70.3% vs 50.5% overall).

Most mothers reported receiving provider advice on placing their infant to sleep on their back (92.6%); in a crib, bassinet, or pack and play (83.5%); and about what items are appropriate in the sleep environment (85.0%) (Table 3). Only half (48.8%) reported receiving advice to room share without bed-sharing. Differences by sociodemographic, behavioral, and health care characteristics with regard to provider advice were generally smaller than for safe sleep practices (mostly within 5–10 percentage points). Receiving room-sharing without bed-sharing advice was more common among mothers who were younger, less educated, WIC participants, either Medicaid insured or uninsured, and whose race or ethnicity was not non-Hispanic white or multiple race.

After adjustment, most characteristics remained significantly related to one or more safe sleep practice, with the exception of WIC participation

(Table 4). Using a separate approved sleep surface and avoiding soft bedding had some of the largest sociodemographic differences. In particular, teenage mothers were 34% less likely than 25- to 29-year-olds to avoid soft bedding, whereas non-Hispanic Asian or Pacific Islander mothers were ~40% less likely than non-Hispanic white mothers to use separate approved sleep surfaces and avoid soft bedding. Currently breastfeeding mothers were 22% less likely than mothers not breastfeeding to use separate approved sleep surfaces, whereas mothers who were smoking were 23% less likely than nonsmokers to use separate approved sleep surfaces and 13% less likely to avoid soft bedding. Report of receiving health care provider advice was associated with an increased prevalence of safe sleep practices, ranging from 12% (room-sharing without bed-sharing) to 28% (back sleep position) higher, with absolute prevalence differences ranging from 6.0 to 17.3 percentage points.

The prevalence of each safe sleep practice varied significantly by state, ranging ~20 to 25 percentage points across outcomes (Supplemental Table 6). Back sleep position ranged from 67.4% in Louisiana to 87.7% in Iowa. Separate approved sleep surface ranged from 20.1% in New Mexico to 40.0% in West Virginia, whereas room-sharing without bed-sharing ranged from 46.8% in Alaska to 65.5% in Delaware. No soft bedding ranged from 24.7% in New Mexico to 51.8% in Michigan. States with prevalence estimates significantly higher (green) or lower (orange) than overall rates by at least 5 percentage points are highlighted in Fig 1. After adjustment for covariates, state estimates changed by <1 percentage point across outcomes on average.

TABLE 2 Usual Safe Infant Sleep Practices by Sociodemographic, Behavioral, and Health Care Characteristics, 29 States, PRAMS, 2016

	Overall Distribution (n = 34 103)	Usual Safe Infant Sleep Practice							
		Back Sleep Position ^a (n = 33 397)		Separate Approved Sleep Surface ^b (n = 31 962)		Room-Sharing Without Bed-Sharing ^c (n = 33 051)		No Soft Objects or Loose Bedding ^d (n = 32 044)	
		Weighted % (95% CI)	χ^2 P	Weighted % (95% CI)	χ^2 P	Weighted % (95% CI)	χ^2 P	Weighted % (95% CI)	χ^2 P
Total	100.0	78.0 (77.3–78.7)	—	31.8 (30.9–32.6)	—	57.1 (56.2–57.9)	—	42.4 (41.6–43.3)	—
Sociodemographic characteristics									
Maternal age, y			<.001		<.001		.012		<.001
<20	4.9	69.3 (65.2–73.1)		26.6 (22.8–30.7)		62.4 (58.2–66.5)		25.0 (21.4–29.1)	
20–24	18.7	69.2 (67.2–71.2)		26.0 (24.2–27.8)		57.6 (55.5–59.6)		30.9 (29.0–32.9)	
25–29	29.3	77.4 (76.0–78.7)		32.6 (31.1–34.1)		57.5 (55.9–59.0)		40.6 (39.0–42.2)	
30–34	29.7	83.2 (82.0–84.3)		34.5 (33.0–36.1)		55.2 (53.6–56.7)		49.6 (48.0–51.2)	
≥35	17.4	82.0 (80.4–83.5)		33.3 (31.4–35.3)		57.6 (55.6–59.6)		50.7 (48.6–52.7)	
Maternal race or ethnicity			<.001		<.001		<.001		<.001
Non-Hispanic white	54.9	83.8 (82.9–84.6)		35.3 (34.2–36.4)		54.8 (53.7–55.9)		45.7 (44.5–46.8)	
Non-Hispanic black	13.0	62.3 (59.9–64.6)		27.0 (25.0–29.2)		57.1 (54.7–59.5)		37.5 (35.1–39.8)	
Hispanic	23.4	73.8 (71.9–75.5)		29.6 (27.7–31.6)		64.0 (62.0–66.0)		40.2 (38.2–42.3)	
Non-Hispanic American Indian or Alaska Native	0.7	82.2 (79.3–84.8)		23.4 (20.4–26.8)		50.5 (46.3–54.8)		25.6 (22.4–29.1)	
Non-Hispanic Asian or Pacific Islander	6.0	75.5 (72.5–78.2)		20.6 (17.9–23.5)		53.7 (50.2–57.1)		33.3 (29.9–36.8)	
Non-Hispanic multiple races	2.0	78.0 (73.4–82.0)		24.2 (19.6–29.6)		54.3 (48.9–59.6)		39.1 (33.7–44.7)	
Maternal education			<.001		<.001		0.001		<.001
Less than high school	13.2	69.0 (66.5–71.4)		29.4 (27.0–31.9)		65.0 (62.4–67.5)		42.2 (39.6–44.9)	
High school diploma or GED	24.1	72.9 (71.2–74.5)		28.6 (26.9–30.3)		62.2 (60.3–64.0)		31.6 (29.8–33.4)	
Some college or associate's degree	26.4	75.9 (74.5–77.3)		29.2 (27.7–30.7)		56.1 (54.5–57.8)		35.7 (34.1–37.3)	
Bachelor's degree or higher	36.2	86.2 (85.2–87.2)		36.5 (35.2–37.9)		51.6 (50.2–53.0)		54.4 (53.0–55.8)	
Marital status			<.001		<.001		<.001		<.001
Married	62.4	81.9 (81.0–82.7)		34.2 (33.2–35.2)		55.4 (54.3–56.5)		47.5 (46.4–48.6)	
Unmarried	37.6	71.6 (70.2–72.9)		27.7 (26.4–29.0)		59.9 (58.5–61.4)		34.0 (32.6–35.4)	
Gestational age at delivery, wk			.398		.106		<.001		.395
<34	2.0	76.8 (73.9–79.4)		34.5 (31.5–37.7)		66.5 (63.3–69.7)		44.8 (41.4–48.2)	
34–36	6.5	76.7 (74.0–79.2)		33.6 (30.7–36.5)		60.6 (57.7–63.5)		42.1 (39.2–45.1)	
≥37	91.5	78.1 (77.4–78.9)		31.6 (30.7–32.5)		56.6 (55.7–57.5)		42.4 (41.5–43.3)	
Behavioral characteristics									
Current breastfeeding			<.001		<.001		<.001		<.001
No	46.5	75.2 (74.1–76.3)		33.7 (32.5–34.9)		61.3 (60.0–62.6)		37.5 (36.2–38.8)	
Yes	53.5	80.5 (79.5–81.4)		30.1 (29.0–31.2)		53.3 (52.1–54.5)		46.8 (45.6–48.0)	
Current maternal smoking			.111		<.001		.011		<.001
No	89.2	78.2 (77.5–79.0)		32.5 (31.6–33.4)		56.6 (55.7–57.6)		43.8 (42.8–44.7)	
Yes	10.8	76.3 (74.0–78.5)		25.6 (23.4–27.9)		60.2 (57.6–62.7)		31.2 (28.8–33.7)	
Health care characteristics									
WIC participation during pregnancy			<.001		<.001		<.001		<.001
No	62.1	82.0 (81.1–82.8)		33.8 (32.7–34.8)		53.5 (52.4–54.6)		46.9 (45.8–48.0)	
Yes	37.9	71.5 (70.2–72.8)		28.3 (27.0–29.7)		62.8 (61.4–64.2)		35.2 (33.8–36.6)	
Timing of prenatal care initiation			<.001		<.001		.002		<.001
First Trimester	86.2	79.4 (78.6–80.1)		32.9 (32.0–33.8)		56.5 (55.6–57.4)		43.9 (42.9–44.8)	
Late or no prenatal care	13.8	70.2 (67.8–72.5)		24.8 (22.7–27.1)		60.7 (58.1–63.2)		33.4 (30.9–35.9)	
Insurance coverage at delivery			<.001		<.001		<.001		<.001
Private	54.7	83.9 (83.1–84.8)		35.0 (33.9–36.1)		52.5 (51.4–53.6)		48.3 (47.2–49.5)	
Medicaid	41.7	71.5 (70.3–72.8)		28.1 (26.9–29.4)		63.2 (61.9–64.6)		34.3 (32.9–35.7)	
Uninsured	3.6	66.8 (61.2–71.9)		26.6 (21.9–31.9)		56.1 (50.5–61.6)		40.9 (35.4–46.7)	

Data are from Alaska, Arkansas, Colorado, Connecticut, Delaware, Illinois, Iowa, Louisiana, Maine, Maryland, Massachusetts, Michigan, Missouri, Nebraska, New Hampshire, New Jersey, New Mexico, New York, Oklahoma, Pennsylvania, Rhode Island, Texas, Utah, Vermont, Virginia, Washington, West Virginia, Wisconsin, and Wyoming. CI, confidence interval; GED, general equivalency diploma; —, not applicable.

^a Defined as most often placing their infant to sleep on the back versus side, stomach, or combination.

^b Defined as a composite of 5 items indicating how the infant usually slept in the past 2 wk: (1) alone in their own crib or bed (always or often versus sometimes, rarely, or never); (2) in a crib, bassinet, or pack and play; (3) not in a standard bed; (4) not in a couch or armchair; and (5) not in car seat or swing (yes versus no).

^c Defined as a composite of 2 items indicating that the infant usually slept in the past 2 wk: (1) alone in their own crib or bed (always or often versus sometimes, rarely, or never) and (2) in the same room as their mothers (yes versus no).

^d Defined as a composite of 3 items indicating that the infant usually slept in the past 2 wk without (1) blankets; (2) toys, cushions, or pillows; and (3) crib bumper pads (yes versus no).

TABLE 3 Receipt of Health Care Provider Advice by Sociodemographic, Behavioral, and Health Care Characteristics, 29 States, PRAMS, 2016

	Type of Advice Received From a Health Care Worker on Infant Sleep Practices							
	Received Advice to Place Infant on Back to Sleep (n = 33 291)		Received Advice to Place Infant to Sleep in a Crib, Bassinet, or Pack and Play (n = 33 193)		Received Advice to Place Infant's Crib or Bed in Mother's Room (n = 33 014)		Received Advice on What Should and Should Not Go in Bed With Infants (n = 33 200)	
	Weighted % (95% CI)	χ^2 P	Weighted % (95% CI)	χ^2 P	Weighted % (95% CI)	χ^2 P	Weighted % (95% CI)	χ^2 P
Total	92.6 (92.1–93.0)	—	83.5 (82.8–84.2)	—	48.8 (47.9–49.7)	—	85.0 (84.3–85.6)	—
Sociodemographic characteristics								
Maternal age, y		.023		.012		<.001		<.001
<20	89.4 (86.4–91.8)		86.6 (83.4–89.3)		56.1 (51.8–60.3)		88.1 (84.7–90.7)	
20–24	91.6 (90.2–92.7)		84.3 (82.6–85.8)		52.6 (50.5–54.6)		88.2 (86.8–89.6)	
25–29	92.8 (91.8–93.7)		84.0 (82.8–85.2)		48.7 (47.1–50.3)		85.7 (84.5–86.9)	
30–34	93.4 (92.5–94.3)		83.4 (82.1–84.6)		46.5 (45.0–48.1)		83.8 (82.6–85.0)	
≥35	92.6 (91.4–93.6)		81.3 (79.6–82.9)		46.7 (44.7–48.7)		81.4 (79.7–82.9)	
Maternal race and ethnicity		<.001		<.001		<.001		<.001
Non-Hispanic white	94.7 (94.1–95.2)		85.0 (84.2–85.8)		44.3 (43.2–45.4)		85.0 (84.2–85.9)	
Non-black	93.8 (92.4–95.0)		87.1 (85.1–88.9)		60.0 (57.6–62.3)		90.4 (88.7–91.8)	
Hispanic	89.1 (87.6–90.4)		78.9 (77.1–80.6)		52.7 (50.7–54.8)		83.3 (81.7–84.9)	
Non-Hispanic American Indian or Alaska Native	92.7 (90.9–94.2)		78.3 (74.9–81.3)		51.3 (47.0–55.5)		86.3 (83.4–88.8)	
Non-Hispanic Asian or Pacific Islander	85.1 (82.3–87.5)		80.3 (77.6–82.7)		51.5 (48.1–55.0)		79.7 (76.8–82.4)	
Non-Hispanic multiple races	93.3 (89.8–95.7)		85.7 (81.6–88.9)		44.5 (39.3–49.8)		84.6 (79.9–88.3)	
Maternal education		<.001		<.001		<.001		.078
Less than high school	86.3 (84.3–88.1)		80.2 (77.9–82.3)		59.6 (57.0–62.1)		84.5 (82.5–86.3)	
High school diploma or GED	90.5 (89.3–91.7)		82.0 (80.4–83.5)		49.9 (48.0–51.8)		84.7 (83.1–86.1)	
Some college or associate's degree	93.5 (92.6–94.4)		85.4 (84.1–86.5)		47.4 (45.7–49.0)		86.4 (85.1–87.5)	
Bachelor's degree or higher	95.5 (94.9–96.0)		84.4 (83.3–85.4)		45.3 (43.9–46.6)		84.4 (83.4–85.4)	
Marital status		.002		.005		<.001		<.001
Married	93.2 (92.6–93.8)		82.8 (81.9–83.6)		45.6 (44.6–46.7)		83.6 (82.8–84.4)	
Unmarried	91.5 (90.6–92.3)		84.8 (83.7–85.8)		54.1 (52.7–55.6)		87.2 (86.2–88.2)	
Gestational age at delivery, wk		<.001		<.001		<.001		<.001
<34	95.3 (93.9–96.4)		91.1 (89.0–92.8)		59.4 (56.1–62.6)		94.2 (92.6–95.5)	
34–36	94.8 (93.4–95.9)		87.1 (84.9–89.0)		53.5 (50.5–56.5)		87.4 (85.2–89.4)	
≥37	92.4 (91.8–92.9)		83.1 (82.4–83.8)		48.3 (47.3–49.2)		84.6 (83.9–85.3)	
Behavioral characteristics								
Current breastfeeding		<.001		.125		.090		.127
No	91.5 (90.6–92.2)		84.1 (83.1–85.1)		49.5 (48.2–50.8)		85.5 (84.5–86.4)	
Yes	93.5 (92.9–94.1)		83.0 (82.1–83.9)		48.0 (46.8–49.2)		84.5 (83.6–85.3)	
Current maternal smoking		.850		<.001		.854		.003
No	92.6 (92.0–93.1)		83.1 (82.3–83.8)		48.8 (47.9–49.8)		84.7 (84.0–85.4)	
Yes	92.7 (91.2–94.0)		87.0 (85.1–88.7)		48.6 (46.0–51.2)		87.5 (85.7–89.1)	
Health care characteristics								
WIC participation during pregnancy		<.001		.027		<.001		<.001
No	93.5 (92.8–94.0)		82.9 (82.1–83.8)		44.4 (43.3–45.5)		84.0 (83.1–84.8)	
Yes	91.2 (90.3–92.0)		84.5 (83.4–85.6)		56.1 (54.6–57.5)		86.6 (85.5–87.6)	
Timing of prenatal care initiation		<.001		<.001		.004		.002
First trimester	93.4 (92.8–93.8)		84.2 (83.5–84.9)		48.1 (47.2–49.1)		85.5 (84.8–86.1)	
Late or no prenatal care	88.0 (86.1–89.7)		79.3 (77.0–81.4)		52.2 (49.6–54.8)		82.0 (79.8–84.0)	
Insurance coverage at delivery								
Private	95.1 (94.5–95.5)	<.001	84.6 (83.7–85.4)	<.001	43.9 (42.8–45.0)	<.001	84.7 (83.8–85.5)	<.001
Medicaid	90.4 (89.4–91.2)		83.4 (82.2–84.5)		54.8 (53.4–56.2)		85.9 (84.9–86.9)	
Uninsured	81.4 (76.7–85.4)		64.5 (58.9–69.8)		49.5 (43.9–55.0)		74.2 (69.0–78.8)	

Data are from Alaska, Arkansas, Colorado, Connecticut, Delaware, Illinois, Iowa, Louisiana, Maine, Maryland, Massachusetts, Michigan, Missouri, Nebraska, New Hampshire, New Jersey, New Mexico, New York, Oklahoma, Pennsylvania, Rhode Island, Texas, Utah, Vermont, Virginia, Washington, West Virginia, Wisconsin, and Wyoming. CI, confidence interval; GED, general equivalency diploma; —, not applicable.

DISCUSSION

The findings from this 29-state PRAMS analysis indicate that most mothers place their infants to sleep

on their back (78.0%), whereas fewer room share without bed-sharing (57.1%), and less than half report using separate approved sleep

surfaces (31.8%) and avoiding soft bedding (42.4%). Common use of soft bedding, including blankets, has been previously documented^{9,15} and is

TABLE 4 Adjusted Associations With Usual Safe Infant Sleep Practices, 29 States, PRAMS, 2016

	Usual Safe Infant Sleep Practice							
	Back Sleep Position ^a (<i>n</i> = 30 358)		Separate Approved Sleep Surface ^b (<i>n</i> = 29 191)		Room-Sharing Without Bed- Sharing ^c (<i>n</i> = 29 841)		No Soft Objects or Loose Bedding ^d (<i>n</i> = 29 259)	
	Adjusted Prevalence	aPR (95% CI)	Adjusted Prevalence	aPR (95% CI)	Adjusted Prevalence	aPR (95% CI)	Adjusted Prevalence	aPR (95% CI)
Sociodemographic characteristics								
Maternal age, y								
<20	76.0	0.98 (0.93–1.03)	28.3	0.85 (0.72–1.00)	56.2	0.98 (0.89–1.07)	27.3	0.66 (0.55–0.78)
20–24	74.5	0.96 (0.93–0.99)	27.9	0.84 (0.77–0.92)	53.6	0.93 (0.89–0.98)	36.2	0.87 (0.80–0.93)
25–29	77.8	Reference	33.2	Reference	57.5	Reference	41.7	Reference
30–34	81.7	1.05 (1.03–1.08)	33.7	1.02 (0.95–1.09)	57.2	0.99 (0.95–1.04)	46.3	1.11 (1.05–1.17)
≥35	80.7	1.04 (1.01–1.07)	31.8	0.96 (0.89–1.04)	59.3	1.03 (0.98–1.08)	46.9	1.12 (1.06–1.20)
Maternal race and ethnicity								
Non-Hispanic white	81.5	Reference	34.0	Reference	56.4	Reference	43.2	Reference
Non-Hispanic black	67.0	0.82 (0.79–0.86)	28.7	0.85 (0.77–0.93)	52.2	0.93 (0.87–0.98)	42.5	0.99 (0.92–1.06)
Hispanic	80.0	0.98 (0.96–1.01)	32.1	0.94 (0.87–1.03)	61.8	1.10 (1.05–1.15)	44.5	1.03 (0.97–1.10)
Non-Hispanic American Indian or Alaska Native	85.3	1.05 (1.01–1.08)	27.1	0.80 (0.68–0.93)	51.5	0.91 (0.83–1.01)	39.2	0.91 (0.80–1.03)
Non-Hispanic Asian or Pacific Islander	73.6	0.90 (0.86–0.95)	19.7	0.58 (0.50–0.67)	55.2	0.98 (0.91–1.05)	27.1	0.63 (0.56–0.70)
Non-Hispanic multiple races	79.3	0.97 (0.92–1.03)	26.1	0.77 (0.62–0.95)	56.5	1.00 (0.90–1.11)	41.8	0.97 (0.84–1.11)
Maternal education								
Less than high school	76.0	0.92 (0.88–0.95)	32.5	0.94 (0.84–1.05)	59.8	1.11 (1.03–1.19)	48.4	1.00 (0.92–1.09)
High school diploma or GED	77.0	0.93 (0.90–0.96)	30.4	0.88 (0.80–0.96)	60.7	1.12 (1.06–1.18)	36.2	0.75 (0.69–0.81)
Some college or associate's degree	76.5	0.92 (0.90–0.95)	29.2	0.84 (0.78–0.91)	56.5	1.04 (1.00–1.09)	36.5	0.75 (0.71–0.80)
Bachelor's degree or higher	82.9	Reference	34.6	Reference	54.1	Reference	48.4	Reference
Marital status								
Married	79.2	Reference	33.0	Reference	57.9	Reference	43.8	Reference
Unmarried	77.8	0.98 (0.96–1.01)	29.9	0.90 (0.84–0.97)	55.2	0.95 (0.91–0.99)	39.7	0.90 (0.85–0.96)
Gestational age at delivery, wk								
<34	79.2	1.01 (0.97–1.04)	34.5	1.09 (0.98–1.20)	64.7	1.14 (1.08–1.21)	45.7	1.08 (1.00–1.17)
34–36	77.9	0.99 (0.96–1.02)	33.2	1.04 (0.95–1.15)	59.5	1.05 (0.99–1.11)	42.2	1.00 (0.93–1.07)
37+	78.6	Reference	31.8	Reference	56.6	Reference	42.3	Reference
Behavioral characteristics								
Current breastfeeding								
No	79.1	Reference	36.4	Reference	59.6	Reference	41.3	Reference
Yes	78.0	0.99 (0.97–1.01)	28.3	0.78 (0.73–0.82)	54.7	0.92 (0.89–0.95)	43.2	1.05 (1.00–1.10)
Current maternal smoking								
No	78.5	Reference	32.8	Reference	57.0	Reference	43.0	Reference
Yes	79.1	1.01 (0.98–1.04)	25.3	0.77 (0.70–0.86)	56.6	0.99 (0.94–1.05)	37.2	0.87 (0.80–0.94)
Health care characteristics								
WIC participation during pregnancy								
No	79.2	Reference	32.3	Reference	56.0	Reference	42.8	Reference
Yes	77.7	0.98 (0.96–1.01)	31.3	0.97 (0.90–1.04)	58.7	1.05 (1.00–1.10)	41.5	0.97 (0.91–1.03)
Timing of prenatal care initiation								
First trimester	78.8	Reference	32.4	Reference	56.9	Reference	42.9	Reference
Late or no prenatal care	77.3	0.98 (0.95–1.01)	28.7	0.89 (0.81–0.97)	57.5	1.01 (0.96–1.07)	39.0	0.91 (0.85–0.98)
Insurance coverage at delivery								
Private	80.0	Reference	32.8	Reference	54.5	Reference	43.4	Reference
Medicaid	77.7	0.97 (0.95–1.00)	30.7	0.94 (0.87–1.01)	60.5	1.11 (1.06–1.16)	40.8	0.94 (0.88–1.00)
Uninsured	72.3	0.90 (0.84–0.97)	30.1	0.92 (0.76–1.11)	55.5	1.02 (0.91–1.14)	42.4	0.98 (0.84–1.13)

TABLE 4 Continued

	Usual Safe Infant Sleep Practice							
	Back Sleep Position ^a (n = 30 358)		Separate Approved Sleep Surface ^b (n = 29 191)		Room-Sharing Without Bed-Sharing ^c (n = 29 841)		No Soft Objects or Loose Bedding ^d (n = 29 259)	
	Adjusted Prevalence	aPR (95% CI)	Adjusted Prevalence	aPR (95% CI)	Adjusted Prevalence	aPR (95% CI)	Adjusted Prevalence	aPR (95% CI)
Received advice to place infant on back to sleep								
No	62.6	Reference	—	—	—	—	—	—
Yes	79.9	1.28 (1.21–1.35)	—	—	—	—	—	—
Received advice to place infant to sleep in a crib, bassinet, or pack and play								
No	—	—	27.0	Reference	—	—	—	—
Yes	—	—	32.9	1.22 (1.12–1.32)	—	—	—	—
Received advice to place infant's crib or bed in mother's room								
No	—	—	—	—	53.8	Reference	—	—
Yes	—	—	—	—	60.3	1.12 (1.09–1.16)	—	—
Received advice on what should and should not go in bed with infants								
No	—	—	—	—	—	—	37.3	Reference
Yes	—	—	—	—	—	—	43.3	1.16 (1.08–1.24)

All models are adjusted for PRAMS state. Data are from Alaska, Arkansas, Colorado, Connecticut, Delaware, Illinois, Iowa, Louisiana, Maine, Maryland, Massachusetts, Michigan, Missouri, Nebraska, New Hampshire, New Jersey, New Mexico, New York, Oklahoma, Pennsylvania, Rhode Island, Texas, Utah, Vermont, Virginia, Washington, West Virginia, Wisconsin, and Wyoming. aPR, adjusted prevalence ratio; CI, confidence interval; GED, general equivalency diploma; —, not applicable.

^a Defined as most often placing their infant to sleep on the back versus side, stomach, or combination.

^b Defined as a composite of 5 items indicating how the infant usually slept in the past 2 wk: (1) alone in their own crib or bed (always or often versus sometimes, rarely, or never); (2) in a crib, bassinet, or pack and play; (3) not in a standard bed; (4) not on a couch or armchair; and (5) not in car seat or swing (yes versus no).

^c Defined as a composite of 2 items indicating that the infant usually slept in the past 2 wk: (1) alone in their own crib or bed (always or often versus sometimes, rarely, or never) and (2) in the same room as their mothers (yes versus no).

^d Defined as a composite of 3 items indicating that the infant usually slept in the past 2 wk without (1) blankets; (2) toys, cushions, or pillows; and (3) crib bumper pads (yes versus no).

frequently reported among SIDS and accidental suffocation and strangulation in bed cases.^{24,25} Although only 9% of mothers reported their infant usually slept on a couch or armchair, consistent with previous estimates,¹⁹ this practice is associated with a highly elevated risk of SIDS and suffocation (eg, wedging, entrapment, and overlay), especially when surface sharing with another person.^{20,25,26}

Although the Safe Infant Sleep Study of Attitudes and Factors Effecting Infant Care Practices (SAFE), the most recent national study, assessed both bed-sharing and usual sleep surface (eg, crib, bassinet, adult bed, car seat, sofa),¹⁹ we developed a composite measure to assess usual use of a separate approved (crib, bassinet, or pack and play) sleep surface. Our

estimate from the component of usual (“always or often”) sleep on a separate sleep surface (74.4%; “always”: 55.7%, “often”: 18.7%) was comparable to the not usually bed-sharing estimate from SAFE (79.3%). Although nearly 90% of mothers reported their infant usually slept in a crib, bassinet, or pack and play, only about one-third reported it as a sole usual sleep surface, which may represent an underacknowledged risk. Our estimates for usual back sleep position (78.0%) and room-sharing without bed-sharing (57.1%) were comparable to SAFE estimates (77.3%¹⁰ and 65.5%,¹⁹ respectively).

Both NISP^{6,8,14,15} and SAFE^{10,19} lacked sufficient sample size to examine all major racial and ethnic groups. We found that non-Hispanic black mothers were least likely to

report back sleep position and also had lower prevalence of using separate approved sleep surfaces and avoiding soft bedding compared with non-Hispanic white mothers. Non-Hispanic American Indian or Alaska Native mothers were least likely to avoid soft bedding, had lower use of separate approved sleep surfaces, and had doubled prevalence of couch or arm chair sleeping compared with non-Hispanic white mothers. Both racial and ethnic groups have SUID rates twice as high as non-Hispanic white mothers.²⁷ However, non-Hispanic Asian or Pacific Islander mothers had the lowest prevalence of using separate approved sleep surfaces and were less likely to report back sleep position and avoiding soft bedding yet have SUID rates less than half of non-Hispanic white mothers.²⁷

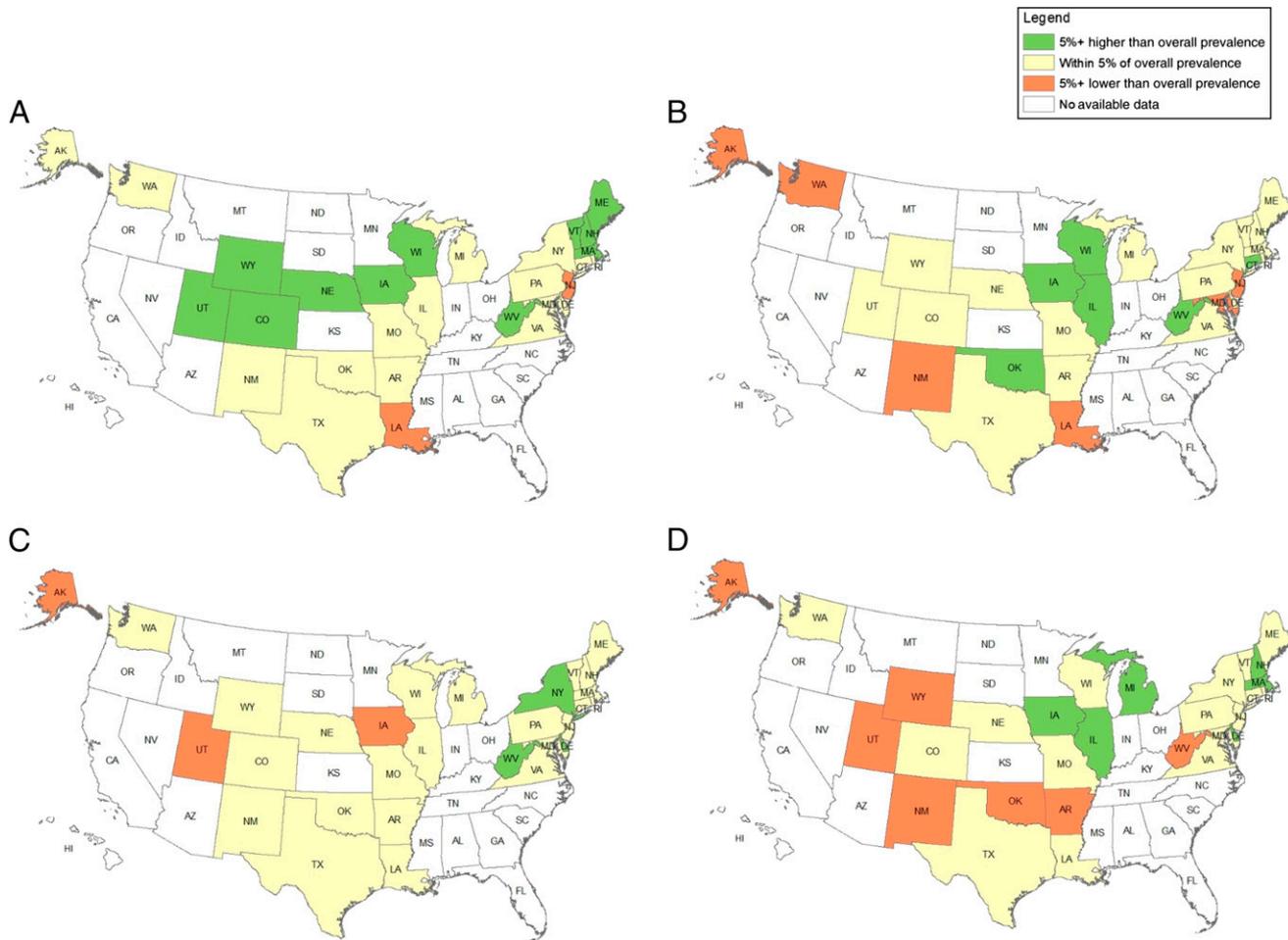


FIGURE 1

Usual safe infant sleep practice prevalence by state, PRAMS, 2016. A, Back sleep position. B, Separate approved sleep surface. C, Room-sharing without bed-sharing. D, No soft objects or loose bedding.

This paradox may arise from differences in other risk and protective factors,²⁸ such as lower smoking^{22,29} and higher breastfeeding^{30,31} rates. Although adjustment mitigated many racial and ethnic disparities, crude prevalence may be more informative in identifying a need for culturally appropriate and focused programmatic efforts.

Although breastfeeding reduces SIDS risk,^{20,32} breastfeeding was associated with lower rates of room-sharing without bed-sharing and using separate approved sleep surfaces, consistent with other literature.^{9,19–21} The AAP recognizes

women may fall asleep when breastfeeding²⁰ and recommends that if mothers fall asleep while feeding on the same surface, they should return the infant to a separate sleep surface as soon as they awoken. Smith et al¹⁹ found that receiving advice from multiple sources, such as family members and health care providers, improved room-sharing without bed-sharing without negatively affecting breastfeeding rates. By contrast, smoking is a SIDS risk factor, and risk is particularly pronounced when combined with bed-sharing.^{20,33,34} Current smoking was associated with lower rates of using separate approved sleep surfaces and avoiding soft bedding even after adjustment for demographic characteristics,

suggesting a need for enhanced counseling among women with smoking histories.

Reported receipt of provider advice was associated with increased prevalence of each corresponding safe sleep practice. Yet, 15% of mothers reported not receiving advice to use a separate sleep surface and avoid soft bedding, whereas over half reported not receiving advice to room share without bed-sharing. Before 2005, the AAP recommended room-sharing only as an alternative to bed-sharing, which may explain lower rates of provider advice. However, previous studies have reported lower estimates of provider advice for other safe sleep

practices,^{8,10,14,17,35} indicating a general need to improve messaging beyond room-sharing without bed-sharing. A previous national survey of pediatricians and family physicians also corroborates improvement opportunities in provider knowledge and practice regarding safe sleep recommendations.³⁶ Several HRSA-funded initiatives^{37,38} and the National Institutes of Health-funded Safe to Sleep campaign⁷ include provider training modules that integrate effective behavior change methods, such as motivational interviewing. New mobile health message interventions,³⁹ clinical decision support tools,⁴⁰⁻⁴² and quality improvement initiatives,⁴³⁻⁴⁶ including CDC-funded perinatal quality collaborative initiatives,⁴⁷ also show promise to improve safe sleep practices.

State-level differences in safe sleep practices spanned ~20 to 25 percentage points and did not substantially change after adjustment to promote comparability across demographic, behavioral, and health care characteristics. The average change across outcomes, before and after adjustment, was <1 percentage point. This suggests state-level differences in sleep practices are not heavily influenced by sociodemographic characteristics and reflect state or regional norms as well as the impact of programmatic efforts, such as the Collaborative Innovation and Improvement Network to reduce infant mortality.^{48,49} In future analyses, researchers could explore the range of risk and protective factors that may explain state-level SUID variation.

Although this analysis offers a recent, population-based assessment of safe sleep practices and provider advice, the analysis was limited to 29 states and lacks representation from southeastern states, which have some of the highest SUID rates in the nation.^{4,50} Thus, our 29-state range in safe sleep practices may be narrower than the total US state range.

Additionally, our estimates of usual practice do not represent consistent adherence to AAP recommendations. Although we compared “always” versus “always or often” sleeping separately, it is unclear whether “often” responses reflected bed-sharing with a sleeping parent versus incidental infant sleep while feeding or bonding with an awake adult. Bed-sharing was not specifically assessed either in the measurement of the outcome or provider advice. Similarly, our measure of separate approved sleep surface did not distinguish between intentional versus incidental sleep in a car seat or swing. For example, infants may fall asleep during usual commuting without being intentionally placed to sleep in a car seat. Our estimate of separate approved sleep surface increases from 31.8% to 56.2% if usual sleep in a car seat or swing is excluded. Further, cribs, bassinets, and pack and plays were presumed “approved” but may not meet safety standards.

CONCLUSIONS

The safest place for infants to sleep is on their backs, on separate, firm sleep surfaces without any soft bedding and in the same room as caregivers.³ Safe sleep practices, especially those

other than back sleep position, are suboptimal, with demographic and state-level differences indicating improvement opportunities. Provider advice is an important, modifiable factor to improve safe sleep practice. Expanded efforts to reach population groups with multiple overlapping SUID risks, such as smoking, soft bedding, and shared sleep surfaces, are needed. Ongoing collection and analysis of PRAMS and other data are essential to inform and evaluate both national and state-specific efforts.

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ABBREVIATIONS

- AAP: American Academy of Pediatrics
- CDC: Centers for Disease Control and Prevention
- HRSA: Health Resources and Services Administration
- NISP: National Infant Sleep Position
- PRAMS: Pregnancy Risk Assessment Monitoring System
- SAFE: Safe Infant Sleep Study of Attitudes and Factors Effecting Infant Care Practices
- SIDS: sudden infant death syndrome
- SUID: sudden unexpected infant death
- WIC: Special Supplemental Nutrition Program for Women, Infants, and Children

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