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Sleep Environment, Positional, Lifestyle, and Demographic Characteristics Associated With Bed Sharing in Sudden Infant Death Syndrome Cases: A Population-Based Study

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ABSTRACT

BACKGROUND. In 2005, the American Academy of Pediatrics Task Force on Sudden Infant Death Syndrome recommended that infants not bed share during sleep.

OBJECTIVE. Our goal was to characterize the profile of risk factors associated with bed sharing in sudden infant death syndrome cases.

DESIGN/METHODS. We conducted a population-based retrospective review of sudden infant death syndrome cases in New Jersey (1996–2000) dichotomized by bed-sharing status and compared demographic, lifestyle, bedding-environment, and sleep-position status.

RESULTS. Bed-sharing status was reported in 239 of 251 cases, with sharing in 39%. Bed-sharing cases had a higher percentage of bedding risks (44.1% vs 24.7%), exposure to bedding risks in infants discovered prone (57.1% vs 28.2%), and lateral sleep placement (28.9% vs 17.8%). The prone position was more common for bed-sharing and non-bed-sharing cases at placement (45.8% and 51.1%, respectively) and discovery (59.0% and 64.4%, respectively). In multivariable logistic-regression analyses, black race, mother <19 years, gravida >2, and maternal smoking were associated with bed sharing. There was a trend toward less breastfeeding in bed-sharing cases (22% vs 35%). In bed-sharing cases, those breastfed were younger than those who were not and somewhat more exposed to bedding risks (64.7% vs 45.1%) but less likely to be placed prone (11.8% vs 52.9%) or have maternal smoking (33% vs 66%).

CONCLUSIONS. Bed-sharing cases were more likely to have had bedding-environment and sleep-position risks and higher ratios of demographic and lifestyle risk factors. Bed-sharing subjects who breastfed had a risk profile distinct from those who were not breastfed cases. Risk and situational profiles can be used to identify families in greater need of early guidance and to prepare educational content to promote safe sleep.

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Key Words

sudden infant death syndrome, bed sharing, maternal smoking

Abbreviations

SIDS—sudden infant death syndrome
SCNJ—SIDS Center of New Jersey
OR—odds ratio
CI—confidence interval
AOR—adjusted odds ratio
AAP—American Academy of Pediatrics;

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THE PRACTICE OF bed sharing with infants is common and growing. In the National Infant Sleep Position Study, Willinger et al¹ reported that 45% of infants spent a portion of their sleep time in an adult bed in the 2 weeks preceding the study interview and that bed sharing as a usual practice was increasing, from 5.5% in 1993 to 12.8% in 2000. The probability of this practice was greater in populations typically found to be at higher risk for sudden infant death syndrome (SIDS), such as adolescent parents or maternal race reported as black. In a cohort of infants born to families in the United States with a sociodemographic profile associated with a higher risk for SIDS, 48% reported routine sleeping of an infant with a parent or other adult.² In contrast, in the International Child Care Practices Study, Nelson et al noted that “[r]ates of bedsharing . . . appeared to be more common in the samples with a lower awareness of SIDS, but not necessarily a high SIDS rate,”^{3(p43)} reflecting the diversity in how bed sharing is practiced across cultures and the challenge of defining what is safe.

Bed sharing has been shown to facilitate breastfeeding.^{4,5} However, the association between bed sharing and breastfeeding is more likely to be found in racial groups already at lower risk for SIDS.⁶ In a population at higher risk for SIDS,⁷ Flick et al noted no differences in breastfeeding rates between infants who slept alone and those who were bed sharing but, instead, a greater likelihood of finding risk elevating bedding and sleep positions in the bed-sharing group. Bed sharing has been identified as a risk in association with such conditions as maternal smoking,⁸ use of a sofa as a sleep surface,⁹ an infant younger than 11 weeks,⁹ or the presence of individuals other than a parent, such as another child.¹⁰ Adding to the complexity, findings vary. For example, although Blair et al¹¹ did not find an association between bed sharing and SIDS among parents who do not smoke, Tappin et al⁹ found that bed sharing remained a risk even if the mother did not smoke.

Bed sharing with respect to SIDS is a controversial topic.¹² Although bed sharing has been described not a risk factor per se but as an environment in which specific risk factors may be present,¹¹ the policy statement of the Task Force on Infant Sleep Position and Sudden Infant Death Syndrome issued in 2000 stated: “No epidemiologic evidence exists that bed sharing is protective.”^{13(p651)} And, in the policy statement of 2005 the Task Force indicated that “the evidence is growing that bed sharing . . . is more hazardous than the infant sleeping on a separate surface and, therefore, recommends that infants not bed share during sleep.”^{14(p1252)}

It is likely, however, that bed sharing will continue to be a topic of discussion. We therefore undertook a retrospective, population-based study of New Jersey SIDS cases to further characterize the profile of risk factors associated with bed sharing. We hypothesized that bed-sharing cases of SIDS differ from nonsharing cases with

respect to their demographic profile and lifestyle behaviors and have a distinct sleep environment with respect to sleep position and characteristics of the bedding environment.

METHODS

SIDS Cases

Under a grant from the New Jersey Department of Health and Senior Services, the SIDS Center of New Jersey (SCNJ) receives data on all SIDS cases in New Jersey. Using the information reported to the SCNJ of all deaths finalized as SIDS from 1996 to 2000, we retrospectively reviewed data for bed-sharing status, age at death, gestational age, birth weight, breastfeeding status, race, maternal age, marital status, maternal smoking status, gravida, and use of prenatal care.^{7,13,15–17} To determine whether the sleeping environment differed as a function of bed-sharing status, we compared the bed-sharing and non-bed-sharing cases with respect to bedding-environment risks (presence of quilts, pillows, and similar soft surfaces, presence of other children, and use of sofa as a sleep surface) and position of the infant at last sleep and at discovery. We also examined these risk factors in bed-sharing infants dichotomized by breastfeeding status. To determine whether the population of bed sharers was distinct from that of non-bed sharers with respect to demographic and lifestyle risk factors, we compared sharing status with respect to birth weight, race, maternal age, marital status, gravida, maternal smoking (prenatal or postnatal status not specified), prenatal care, and breastfeeding status. Bed sharing was defined as a shared sleep surface consisting of either a bed or sofa. All data were deidentified. The diagnosis of SIDS in New Jersey by a regional or county medical examiner is based on autopsy findings, the clinical history, and the death-scene investigation, with the final coding reported by the New Jersey Center for Health Statistics. The institutional review boards of the relevant institutions approved this study as meeting the standards for exempt status.

Statistical Methods

Continuous data are presented as the median (25th and 75th quartiles). Discrete data are provided as number of cases and percentages. Differences were assessed by χ^2 analysis or Fisher’s exact test for categorical data and by the Mann-Whitney *U* test for continuous data. Analyses were performed by comparing the percentage of black racial identity, birth weight (<1801, 1801–2499, or >2499 g), mother’s age (<19, 19–25, or >35 years old) single mothers, gravida >2, mothers who were smokers, absence of prenatal care, and absence of breastfeeding in SIDS cases with and without bed sharing. Logistic-regression analysis was used to obtain unadjusted odds ratios (ORs) for each variable. Because of the multiple

variables that were significantly associated with bed sharing, modeling was performed by using multivariable logistic analyses, and adjusted OR (AOR) estimates and 95% confidence intervals (CIs) were obtained. Significant differences between 2 independent proportions were assessed by using the *z* ratio. Two-tailed probabilities were calculated for all tests. *P* < .05 was considered statistically significant. Analyses were completed by using Statistical 5.5 (StatSoft, Inc, Tulsa, OK)

RESULTS

Descriptive Data for SIDS Cases

From 1996 to 2000, 251 SIDS cases occurred in New Jersey. Of these, 244 were prospectively reported to the SCNJ. Table 1 contains descriptive data on the 239 cases for which information on bed-sharing status was recorded and on a subset of 152 cases (64%) for which there were no missing data in the demographic and lifestyle variables under study. The subset was comparable to the larger group with respect to the percentage of cases containing the specified risk factors. In the 239 cases, 38.9% reported bed sharing, 13.3% had birth weight <1801 g, 49.4% self-reported race as black, 15.6% had mothers <19 years of age, 63.9% had single parents, 45.5% had gravida >2, 43% noted maternal smoking, 10% reported an absence of prenatal care, and 71.6% did not breastfeed. The respective medians (25th and 75th quartiles) for the larger data set and subgroup were also comparable for age at death in days, 90 (54, 122) and 94 (55, 127); birth weight in grams, 3005 (2252, 3430) and 3005 (2285, 3459); and gestational age in weeks, 40 (36, 40) and 40 (36, 40).

Bedding-Environment Risks

Both the bed-sharing and non-bed-sharing groups were comparable in the use of nonsupine sleep (prone and lateral), and for both, it was more common than supine sleep (Table 2). Bed-sharing cases had a higher percentage of lateral placement (28.9% vs 17.8%; OR: 1.88; 95% CI: 0.99–3.58), a position that resulted in a com-

parable shift-to-prone at discovery within 41.7% of the bed sharers and 54.2% of the non-bed sharers (*P* = .38). Fewer shifts to prone occurred with infants placed to sleep in the supine position. Such shifts were noted in 15% of bed-sharing and 21.4% of non-bed-sharing infants (*P* = .55). The shifts from lateral or supine to prone resulted in a higher percentage of prone infants at discovery than at placement. However, as with placement, the positions of the infant at the time of discovery are comparable for the bed-sharing and non-bed-sharing groups, again with prone the most common (Table 2).

Bedding-environment risks were higher in the bed-sharing group (44.1% vs 24.7%; OR: 2.41; 95% CI: 1.37–4.22). These risks in the 93 bed-sharing cases were comprised of 10 cases of sofa use (10.8%), 14 cases of the presence of another child (15.15%), and 17 cases of proximity to pillows, quilts, blankets, or other soft surfaces (18.3%). In the 142 non-bed-sharing cases, these risks were comprised of 8 cases of sofa use (5.63%) and 27 cases of pillows, etc (19%). These data were then reviewed for cases for which the positions at sleep and at discovery were recorded. For each body position at discovery, Fig 1 presents the proportion of cases that contained bedding-environment risks. For both the bed-sharing and non-bed-sharing groups, the prone position had the highest proportion of risk compared with the lateral and supine positions. However, the bed-sharing-prone cases had the highest percentage of bedding-environment risk of any group and significantly more risk than the non-bed-sharing-prone cases (57.1% vs 28.2%; OR: 3.39; 95% CI: 1.52–7.07). Of the 49 bed-sharing infants found prone, 14% used a sofa, 20.4% had another child present, and 22.4% had pillows, etc. Of the 85 non-bed-sharing infants found prone, 4.7% used a sofa and 23.5% had pillows, etc.

Sociodemographic and Lifestyle Risks

In the univariate analyses (Table 3), bed-sharing cases had a significantly greater percentage of infants with a

TABLE 1 Characteristics of SIDS Cases

Variable	Cases With Bed Sharing Status Identified			Subset of Cases With Complete Data on All Variables		
	<i>n</i> (%)	95% CI	<i>N</i> ^a	<i>n</i> (%)	95% CI	<i>N</i> ^a
Bed sharing: yes	93 (38.9)	32.9–45.2	239	59 (38.8)	31.4–46.7	152
Birth weight: <1801 g	29 (13.3)	7.4–18.3	218	18 (11.8)	9.3–18.7	152
Race: black	118 (49.4)	43.1–55.7	239	72 (47.4)	39.6–55.3	152
Maternal age: <19 y	33 (15.6)	11.4–21.2	211	23 (15.1)	10.3–21.7	152
Relationship: single mother	145 (63.9)	57.4–69.9	227	93 (61.2)	53.3–68.6	152
Gravida >2	95 (45.5)	38.8–52.2	209	69 (45.4)	37.7–53.3	152
Maternal smoking: yes	92 (43.0)	36.5–49.7	214	66 (43.4)	35.8–51.4	152
Prenatal care status: no	18 (10.0)	6.5–15.3	179	15 (9.9)	6.1–15.6	152
Breastfeeding: no	131 (71.6)	64.7–77.6	183	106 (69.7)	62.0–76.5	152

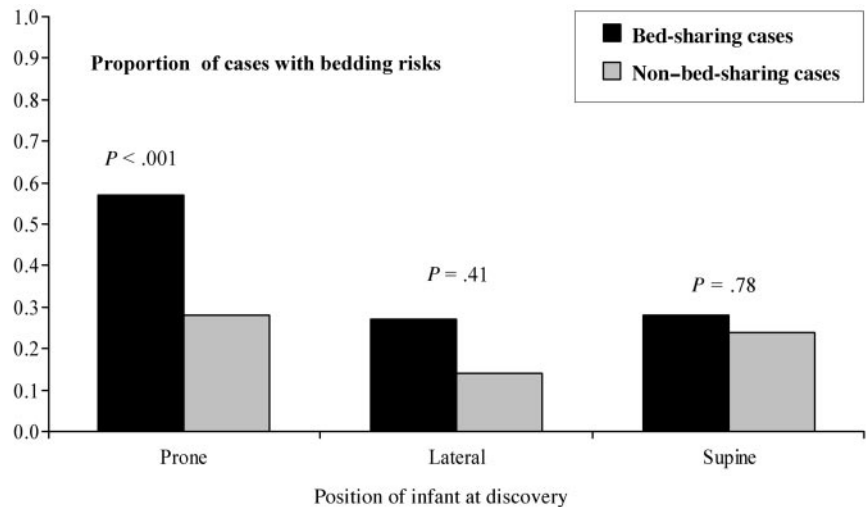
^a Number of cases for which data were available on variable indicated.

TABLE 2 Sleep Position According to Bed-Sharing Status

	Bed-Sharing Cases (<i>n</i> = 83), <i>n</i> (%)	Non-Bed-Sharing Cases (<i>n</i> = 135), <i>n</i> (%)	<i>P</i>
Position placed to sleep			
Prone	38 (45.8)	69 (51.1)	.44
Lateral	24 (28.9)	24 (17.8)	.054
Supine	21 (25.3)	42 (31.1)	.36
Position at discovery			
Prone	49 (59.0)	87 (64.4)	.42
Lateral	15 (18.1)	14 (10.4)	.10
Supine	18 (21.7)	34 (25.2)	.56

FIGURE 1

Bedding risks in bed-sharing and non-bed-sharing cases, stratified according to position at discovery. Bed-sharing cases: prone, *n* = 49; lateral, *n* = 15; supine, *n* = 18. Non-bed-sharing cases: prone, *n* = 85; lateral, *n* = 14; supine, *n* = 33.

**TABLE 3 Univariate Analyses: Associations Between Demographic and Lifestyle SIDS Risk Factors With Bed Sharing**

Risk Factors	Bed-Sharing Cases, <i>n</i> / <i>N</i> (%)	Non-Bed-Sharing Cases, <i>n</i> / <i>N</i> (%)	Univariate Analysis, OR (95%CI)
Birth weight			
<1801 g	17/81 (21)	12/137 (9)	2.69 (1.89–6.11) ^a
1801–2499 g	13/81 (16)	28/137 (20)	0.88 (0.42–1.86)
>2499 g	51/81 (63)	97/137 (71)	1.00
Race: black	61/93 (66)	57/146 (39)	2.98 (1.73–5.13) ^b
Maternal age			
<19 y	18/82 (22)	15/129 (12)	2.18 (1.02–4.65) ^a
19–35 y	59/82 (72)	107/129 (83)	1.00
>35 y	5/82 (6)	7/129 (5)	1.30 (0.39–4.29)
Single mother	69/89 (78)	76/138 (55)	2.81 (1.54–5.15) ^b
Gravida >2	45/79 (57)	50/130 (39)	2.12 (1.20–3.74) ^b
Maternal smoking	43/81 (53)	49/133 (37)	1.94 (1.10–3.41) ^a
No prenatal care	7/70 (10)	11/109 (10)	0.99 (0.36–2.69)
No breastfeeding	55/72 (76)	76/111 (68)	1.48 (0.76–2.92)

Analysis was based on 239 cases with bed-sharing status identified (bed sharing: *n* = 93; non-bed sharing: *n* = 146). Most variables have missing data. Therefore, for each variable the actual number of cases on which the analysis is based is specified in the denominator of each fraction.

^a *P* < .05.

^b *P* < .01.

birth weight of <1801 g, black race, maternal age <19 years, single mother, gravida >2, and maternal smoking.

The multivariable logistic-regression analyses (Table 4) were conducted on the 152 cases with no missing data. As noted in Table 1, the distribution of risks in this

subgroup was comparable to that for the 239 cases on which the univariate analyses were based, and the univariate analyses repeated for this subgroup (Table 4) resulted in a pattern of statistical significance comparable to that obtained for the larger cohort (Table 3), with

TABLE 4 Multivariable Analyses: Demographic and Lifestyle SIDS Risk Factors Associated With Bed Sharing

Risk Factors	Bed Sharing (N = 59), n (%)	No Sharing (N = 93), n (%)	Univariate Analysis, OR (95%CI)	Model 1, AOR (95%CI)	Model 2, AOR (95%CI)	Model 3, AOR (95%CI)
Birth weight						
<1801 g	11 (19)	7 (8)	2.93 (1.04–8.27) ^b	2.16 (0.68–6.86)	2.18 (0.69–6.90)	
1801–2499 g	11 (19)	17 (18)	1.21 (0.51–2.86)	0.91 (0.35–2.37)	0.91 (0.35–2.38)	
>2499 g	37 (63)	69 (74)	1.00	1.00	1.00	
Black race	39 (66)	33 (36)	3.55 (1.77–7.08) ^c	2.76 (1.18–6.47) ^b	2.73 (1.17–6.40) ^b	3.02 (1.36–6.67) ^c
Maternal age						
<19 y	15 (25)	8 (9)	3.80 (1.47–9.80) ^c	3.31 (1.09–9.99) ^b	3.35 (1.11–10.11) ^b	3.56 (1.23–10.29) ^b
19–35 y	39 (66)	79 (85)	1.00	1.00	1.00	1.00
>35 y	5 (8)	6 (7)	1.69 (0.48–5.94)	3.26 (0.78–13.71) ^a	3.40 (0.82–14.07) ^a	3.16 (0.79–12.62) ^a
Single mother	44 (75)	49 (53)	2.63 (1.28–5.41) ^c	1.23 (0.49–3.06)	1.22 (0.49–3.01)	
Gravida >2	33 (56)	36 (38)	2.01 (1.03–3.92) ^b	2.39 (1.06–5.42) ^b	2.20 (1.01–4.78) ^b	2.26 (1.04–4.89) ^b
Maternal smoking	35 (59)	31 (33)	2.92 (1.48–5.76) ^c	2.05 (0.92–4.56) ^a	1.97 (0.90–4.34) ^a	2.30 (1.10–4.79) ^b
No prenatal care	7 (12)	8 (9)	1.43 (0.49–4.21)	0.63 (0.18–2.26)		
No breastfeeding	46 (78)	60 (65)	1.95 (0.92–4.13) ^a	1.54 (0.64–3.69)	1.45 (0.61–3.43)	

Analyses were based on 152 cases with no missing data. Model 1 ($\chi^2_{10} = 34.46; P = .00016$) includes all variables assessed in univariate analysis; model 2 ($\chi^2_9 = 33.95; P = .00009$) includes only those variables with $P \leq .10$ in univariate analysis; model 3 ($\chi^2_3 = 31.002; P = .00001$) includes only those variables with $P \leq .10$ in multivariable analysis

^a $P \leq .10$.

^b $P < .05$.

^c $P < .01$.

the addition of a nonsignificant trend toward less breastfeeding in the bed-sharing group ($P = .079$). In the final multivariable logistic-regression model, black race (AOR: 3.02; 95% CI: 1.35–6.67), maternal age <19 years (AOR: 3.56; 95% CI: 1.23–10.29), gravida >2 (AOR: 2.26; 95% CI: 1.04–4.89), and maternal smoking (AOR: 2.30; 95% CI: 1.10–4.79) were significantly associated with bed sharing.

For age at death in days, there were no differences between the respective medians (25th, 75th quartiles) for the bed-sharing and non-bed-sharing cases for either the larger group (84 [45, 119] and 90 [58, 127]; $P = .09$), or the subgroup (90 [45, 120] and 96.5 [59.5, 129.5]; $P = .22$). There also were no differences between bed-sharing and non-bed-sharing cases, respectively, for gestational age in weeks in either the larger group (40 [34, 40] and 40 [36.5, 40]; $P = .49$) or the subset (40 [34, 40] and 40 [37, 40]; $P = .62$). However, birth weight in grams was lower in the bed-sharing group for both the larger group (2835 [2070, 3118] and 3090 [2410, 3487]; $P < .01$) and the subgroup (2821 [2126, 3090] and 3118 [2495, 3544]; $P < .01$).

Bed Sharing With and Without Breastfeeding

We examined the association between position and breastfeeding in the 68 bed-sharing cases for which both data points were available. Breastfed infants were less likely to be placed prone. For the 17 breastfed infants, 11.8% were placed in the prone position, 41.2% in the lateral, and 47.1% in the supine. In contrast, in the 51 nonbreastfed infants, 52.9% were placed prone, 25.5% in the lateral, and 21.6% in the supine ($P < .01$). With respect to the presence of bedding risks, 64.7% of the breastfed group compared with 45.1% of the nonbreastfed group had these risks present; however, the differ-

ence was not significant (OR: 2.23; 95% CI: 0.72–6.96). For the breastfed infants, the most common risk was related to pillows, blankets, or other soft surfaces, which were experienced by 7 of the 11 infants with bedding risks. For the nonbreastfed group, the most common risk was the presence of other children, which was experienced by 8 of the 23 with bedding risks. Maternal smoking status was available in 65 of the 68 of the bed-sharing cases reviewed for position and bedding risks. There was more maternal smoking in the nonbreastfed group (66% vs 33%; OR: 3.88; 95% CI: 1.1–13.5). Of bed-sharing infants, the median age (25, 75th quartiles) at death in days was lower for breastfed infants than for nonbreastfed infants (45 [33, 86] vs 97 [58, 123]; $P = .003$).

DISCUSSION

Overview

In this population-based study of infants who died of SIDS in New Jersey from 1996 to 2000, we found that bed sharing defines a group with a higher proportion of risk factors for SIDS. Specifically, bed-sharing infants were more likely to have bedding characteristics that have been associated with a higher risk of SIDS^{9,10} and to have a higher proportion of infants placed to sleep laterally, an unstable sleep position.^{18,19} Sofa use was doubled in the bed-sharing group. Although comparable with respect to the preponderance of infants placed prone, the more common position in placement and at discovery, the bed-sharing infants had a higher proportion of bedding risks among infants found prone than did non-bed-sharing infants. Univariate analyses of sociodemographic risk factors for SIDS demonstrated that bed-sharing cases had a greater proportion of infants

with black racial designation, adolescent mothers, single mothers, gravida >2, and mothers who smoked.^{10,11,13,15-17} Black race, adolescent mother, high gravida, and maternal smoking remained significantly associated with bed sharing on multivariable analysis. In contrast to some living cohorts, in which there are associations between bed sharing and breastfeeding,⁶ we found that in SIDS cases higher breastfeeding rates were not associated with bed sharing. Rather, there was a nonsignificant trend toward lower levels of breastfeeding in the bed-sharing group. Within the bed-sharing group, risk patterns varied by breastfeeding status. In bed sharing, breastfed compared with nonbreastfed infants were younger at death, with a median age of 45 days and the 75th quartile of 86 days falling within the young high-risk age range for bed sharing cited by other studies.^{9,11,20} They had a nonsignificant increment in the proportion of cases with bedding risks, and their most common bedding risk was different. However, in terms of risk-reducing behaviors, breastfed infants used prone sleep position less than the lateral or supine, whereas for nonbreastfed infants it was the most common position. Breastfed infants were also less likely to have had mothers who smoked.

Relationship of Findings to Previous Studies

Using US cohorts, researchers have studied bed sharing in terms of living infants,^{1,21} case-control studies,^{10,12} or cases. Studies of cases have been specific to SIDS^{18,22} or have included related deaths.^{23,24} Our results are similar to other studies of SIDS cases in that we found associations between bed sharing and risk factors for some of the risks jointly examined and comparably defined. For example, our results were consistent with those of Carroll-Pankhurst and Mortimer²² who found in their study comparing a smaller cohort of 54 non-bed-sharing and 30 bed-sharing SIDS cases from an earlier era (1994–1997) that a higher proportion of the latter were black and had single parents and that both groups were comparable with respect to gestational age. Both studies also found that the bed-sharing groups were younger at time of death. The differences did not reach statistical significance in our study; however, for the subset of bed-sharing infants who breastfed, age of death was lowest.

With respect to sleep position and bed sharing, our data were comparable to the population-based study of Knight et al²³ concerning sudden unexpected infant deaths in Kentucky from 1991 to 2000 in that the majority of infants were found prone, with no difference between bed-sharing and non-bed-sharing groups in the proportion of infants so found. Finally, our study was similar to Knight et al,²³ Ling et al,¹⁸ and Carroll-Pankhurst and Mortimer²² in the percentage of infants who bed shared (38.9%, 36.2%, 33.4%, and 35.7%, respectively).

This study of cases adds to the literature by providing

data on what distinguishes a bed-sharing and non-bed-sharing environment on additional variables and in a larger and more recent population of SIDS deaths by generating a multivariable model of demographic and lifestyle characteristics associated with bed sharing in SIDS and by providing a sleep-position, age, and bedding profile for bed-sharing cases that is specific to breastfeeding status.

Educational Outreach

In the United States, SIDS rates have declined to 0.57 deaths per 1000 live births in 2002²⁵ from 1.2 deaths per 1000 live births in 1992.²⁶ A similar decline occurred in New Jersey, from 0.8 deaths per 1000 live births in 1992 to 0.3 deaths in 2003.²⁷ The decline in SIDS parallels a drop in nonsupine infant sleep and maternal prenatal smoking, 2 major risk factors.^{16,28} In the National Infant Sleep Position Study, supine sleep rose from 13% in 1992 to 35% in 1996.²⁸ On the basis of 2002 data from the New Jersey Pregnancy Risk Assessment Monitoring System, 54% of New Jersey infants were placed supine, with an additional 7% placed supine some of the time.²⁹ In contrast, only 28% of the SIDS cases had been placed supine. To disseminate risk-reduction information that promotes acceptance and action, researchers have had to identify barriers, expand the targeted audiences, and improve the methods by which information is conveyed and explained. Thus, for example, Moon et al³⁰ identified the need for risk-reduction education for nighttime child care providers, Colson and Joslin³¹ identified effective methodologies for the newborn nursery, and Ostfeld et al³² developed a school-based intervention to reach urban populations earlier regarding information about infant health and safety. Rasinski et al²¹ found some improvements in sleep practices after an ethnically sensitive, comprehensive risk-reduction program. With respect to the risk factor of bed sharing, the message, the audiences, and the methodology for conveying information must be revisited. For populations most likely to bed share, we need a better understanding of what factors contribute to the decision and to the conditions of the bed-sharing setting and what barriers might prevent change even with the presentation of more detailed risk-reduction information.

Interpreting Race as a Risk Factor

In the United States, infants identified as black have an increased probability of bed sharing^{1,6} and may do so under conditions that elevate or fail to mediate risk. Thus, bed-sharing black infants are not more likely to be breastfed,^{2,6} but they are likely to be placed prone in soft bedding.⁷ It has been proposed that infant sleep practices may be cultural, reflecting a pattern of child rearing shared and found meaningful by a cohesive group.^{1,21} However, racial differences in bed sharing may also reflect differences in access to accurate risk-reduction in-

formation. For example, Hauck et al³³ reported that prone sleep was recommended to a higher proportion of black parents compared with nonblack parents in an urban community. Providing advice about bed sharing may be even more complex. Bed sharing has also been associated with low income¹ and, therefore, may reflect limitations in resources. In our study, we did not have direct estimates of economic status and its association with race. However, through the Small Area Income and Poverty Estimates of the US Census Bureau,³⁴ we identified the 4 of New Jersey's 21 counties with the highest portion of children below the age of 18 living in poverty (1997–2000). These counties also had the highest proportion of uninsured children <18 years based on 2000 data from the US Census Bureau Small Area Health Insurance Estimates.³⁵ Using the New Jersey State Health Assessment Data system,²⁷ we determined that these were listed as counties of residence for 56% of black infants who died as a result of SIDS compared with 21% of white infants who died as a result of SIDS from 1996 to 2000. Although it may be hypothesized that poverty plays a role in some bed-sharing decisions or bed-sharing conditions, it is important to note that some studies have found black infant mortality rates for non-improverished infants to be similar,³⁶ an indicator of the complexity of race as a variable and a reminder that risk-reduction education must reach all families. Finally, black women have been reported to be at higher risk for postpartum depression.³⁷ In a study of predominantly black and single low-income women, depressive symptoms were associated with a lower likelihood of using the back-to-sleep position, suggesting another variable for exploring disparities in bed sharing.³⁸ If risk-reduction education is to be effective, these and other mediators of choices must be identified and addressed.

Breastfeeding and Bed Sharing

In its policy statement on breastfeeding, the American Academy of Pediatrics (AAP) section on breastfeeding recommended exclusive breastfeeding in the first 6 months of life.³⁹ Bed sharing in breastfeeding has been described as facilitative.⁴ Baddock et al⁵ called for a determination of how to make bed sharing safer and McCoy et al,⁶ in an article published before the 2005 AAP policy statement on SIDS, noted that the risks and benefits of bed sharing should be weighed, with breastfeeding to be afforded particular attention. However, the AAP policy statement indicates that it can be hazardous under certain conditions.¹⁴ Accordingly, it recommended that although infants may be taken into the parental bed to support breastfeeding, they should be placed on a proximal sleep surface, such as a crib, for sleep. And, in a reply to published comments regarding the guidelines, Kattwinkel et al^{40,41} reiterated the challenge of defining a safe bed-sharing environment.

Bed sharing is described as being of greater risk for

very young infants, variously defined as younger than 11 through 16 weeks,^{9,11,20} and Tappin et al⁹ noted an association between bed sharing and SIDS for infants in this young age group even in infants that breastfed. Yet, for parents who bed share in association with breastfeeding, bed sharing is more likely to occur at younger ages.⁶ In our SIDS cases, the age at death for breastfed infants reflected this association as well, underscoring the need for parent education to commence early. Our data also describe, albeit in a small cohort, that the sleep-environment risk profile is complex and different for bed-sharing infants that were breastfed compared with those who were not. The former included a lower risk of maternal smoking and prone sleep. However, despite these benefits, bedding risks were more prominent. In the absence of case-control studies on the populations defined here and on the risk patterns described, it is not possible to specify the degree to which risk is elevated in cases. Case-control studies using more detailed descriptions of the shared bedding environment with and without breastfeeding are needed and could serve as a basis for guidance on safe bed sharing should there be a change in the AAP guidelines.

Limitations

Our study had several limitations. Although between 183 and 239 cases had complete data for each of the univariate analyses, only 70% of the cases had complete data on all the variables used in the multivariate analyses. Although this subset was comparable to the larger group in terms of the pattern and degree of risks present, it remains possible that the missing data might have altered findings. In addition, data were obtained by many interviewers. Therefore, it is possible that there was a variance in how questions were clarified for families. No independent sources such as hospital birth records were used to corroborate data, which were based primarily on parental reporting. With respect to the types of bedding risks described here, there were too few cases within each category to determine if the sociodemographic profile varied by type of bedding risk. The detail was not sufficient to speculate on mechanisms such as rebreathing or hyperthermia by which a bed condition could elevate risk in a vulnerable infant.^{13,42} We also did not have information available on encumbrances to parental arousal during last sleep. With the exception of sleep position, for which New Jersey Pregnancy Risk Assessment Monitoring System data were available for 2002, this study did not have comparison data in living controls. The associations of bed sharing and breastfeeding with respect to sleep position and other risk factors need to be replicated with larger cohorts. Finally, caution should be used in generalizing these findings to communities and states demographically dissimilar to New Jersey.

CONCLUSIONS

In a population-based study of SIDS cases in New Jersey (1996–2000), bed-sharing cases were distinguished from non-bed-sharing cases by a greater proportion of risk in the bedding environment, defined as the use of a couch; the presence of another child; proximity to blankets, pillows, and other soft bedding; a greater proportion of placement in a less-stable lateral sleep position; and, on multivariable analysis of sociodemographic risk factors, a greater proportion of race self-identified as black, higher gravida, adolescent mothers, and mothers self-identified as smokers. Breastfeeding was not more common in bed-sharing cases. However, in bed-sharing cases where it did occur, the risk profile associated with it, both in terms of risk-elevating and risk-reducing factors, was distinct from that of nonbreastfeeding cases, and their age at death was younger. Providers of SIDS risk-reduction education can use the risk profile and bedding and positional characteristics to identify families in greater need of earlier anticipatory guidance and follow-up consultations to help families understand risk and prepare clear and detailed educational content to promote safe sleep. Additional research is needed into possible barriers to change within the subgroups at higher risk and into best-practice models for effectively communicating this information. These findings can be used to support the risk-reduction educational initiatives of the AAP guidelines, and they may also be a resource for studies to determine conditions under which bed sharing in the context of breastfeeding could be made safer, should the guidelines undergo revision.

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Sleep Environment, Positional, Lifestyle, and Demographic Characteristics Associated With Bed Sharing in Sudden Infant Death Syndrome Cases: A Population-Based Study

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