

I. INTRODUCTION

The incidence of sudden infant death syndrome (SIDS) in the US has declined 50% since 1992, when the American Academy of Pediatrics (AAP) first recommended that infants be placed in a nonprone position for sleep.¹ Despite the tremendous success of the Back to Sleep campaign, African-American infants remain twice as likely to die from SIDS compared with Caucasian infants.^{2, 3} This racial disparity exists across all educational and income categories, and the extent of the racial disparity has increased rather than decreased.⁴

Epidemiologic studies have demonstrated that bed sharing, i.e., infants sleeping in a bed with other children or adults, is an important risk factor for SIDS.^{5, 6} Studies have also demonstrated a protective effect of room sharing without bed sharing.^{7, 8} Based on this research, the AAP recommends that infants sleep in a parent's room, but separately in a crib or bassinet to reduce the risk of SIDS.⁹ Bed sharing is more common among African-American infants compared with infants of other ethnicities,¹⁰ potentially contributing to their higher rates of SIDS. However, very little is known about the interplay of other SIDS risk factors, including infant, maternal and sleep environment factors, with bed sharing in African-American infants.

The Chicago Infant Mortality Study (CIMS) collected extensive data on infants who died of SIDS and matched living control infants to help explain why African-Americans in Chicago were more likely to die from this disorder than Caucasian-American infants. Previous analysis of CIMS found that bed sharing was a strong risk factor for SIDS.^{11, 12} The current study, through secondary data analysis, further examined the risk of bed sharing for SIDS among African-American infants, including interaction with factors not previously analyzed. In addition, the potential protective effect of room sharing without bed sharing in this population has been analyzed. Our specific aims are:

1) To describe aspects of the sleep environment and characteristics of infants who bed share compared with infants who do not bed share (both cases and controls) to better understand what factors might influence the choice of sleeping arrangement (bed sharing) and risk associated with bed sharing.

Hypothesis 1a: The use of pillows, soft sleep surfaces, blankets and other coverings, the prone or side sleep position, and pacifiers differ between bed sharing and non-bed sharing infants.

Hypothesis 1b: Rates of maternal smoking, breastfeeding, and recent illness differ by bed sharing status.

2) To describe the interaction between bed sharing and other risk factors for SIDS.

Hypothesis 2a: Bed sharing remains a risk factor for SIDS, independent of pillow use, soft sleep surface, blankets, sleeping position, maternal smoking, breastfeeding, or pacifier use.

Hypothesis 2b: Bed sharing is a stronger risk factor for SIDS among younger infants than for older infants.

3) To describe the effect of maternal weight on the risk for SIDS among bed sharing infants.

Hypothesis 3a: Infants who bed share with higher weight mothers are at greater risk for SIDS compared with infants who bed share with lower weight mothers.

4) To describe the effect of room sharing with parents without bed sharing compared with either sleeping in a separate room or bed sharing.

Hypothesis 4a: Room sharing without bed sharing decreases the risk for SIDS.

II. REVIEW OF THE LITERATURE

Infant Mortality and Racial-Ethnic Disparities

SIDS is the leading cause of death in the US among infants in the postneonatal period (one month to one year of age) and the third leading cause of death among infants from birth to one year.¹³ It accounts for 22% of all postneonatal deaths and 48% of sudden unexpected deaths in that period.¹⁴

Racial/ethnic disparities in these deaths are evident: the rate for non-Hispanic Whites is 1.9/1,000 live births, for Hispanic Whites 1.8, for non-Hispanic Blacks 4.6, for American Indians 4.0,

and for Asian or Pacific Islanders 1.4.¹³ Thus, African-Americans have the highest postneonatal mortality, with the Black-White ratio being 2.4.

The Back to Sleep Campaign was developed by the National Institute of Child Health and Human Development (NICHD) in partnership with other governmental and non-governmental agencies to reduce prone sleeping and other risk factors known to be associated with SIDS.¹⁵ Despite success in reducing the incidence of SIDS among all racial/ethnic groups since the promotion of back sleeping, infants born to African-American mothers continue to succumb to SIDS at a rate of 1.11 per 1000 live births, more than four times higher than the infants of Asian and Pacific Islander mothers, who have the lowest SIDS rate (0.24 per 1000 live births), and more than two times the rate in White, non-Hispanic infants (0.54 per 1000 live births).⁴ It is unclear exactly why this racial disparity exists; however, it is observed at all educational and income levels, and the extent of this racial disparity has increased rather than decreased over the past decade.^{16, 17} With respect to infant mortality overall, rates are higher in families with lower socioeconomic status (SES) or educational attainment; this variability by SES is particularly marked in Whites, African-Americans, and American Indians. However, infant mortality rates are higher in college educated African-Americans than they are in non-college educated Whites.¹⁸ Further, the rate of SIDS among all US infants has leveled off at 0.6/1,000 live births, which is higher than rates in many other developed countries, suggesting that new or expanded interventions are needed.^{19, 20}

Currently, approximately half of all sudden and unexpected infant deaths in the US occur when the infant is sharing a sleep surface with someone else.²¹⁻²⁴ The Chicago Infant Mortality Study (CIMS) found that 58% of African-American infants in this case-control study of SIDS bed shared, compared with 29.2% in non-African-American infants.²⁵ Unger and colleagues, in a retrospective population-based cohort of sudden unexpected infant deaths, found bed sharing deaths to be nearly twice as common in African-American infants compared with White infants.²⁴ In addition, they found that African-American infants who died were greater than 50% more likely to have been placed on a non-standard sleep surface (e.g., adult bed, sofa, or waterbed) than White infants.²⁴ The National Infant Sleep Position study has reported that African-Americans are 4 times more likely to routinely bed share as White infants.¹⁰ It is difficult to assess risk factors associated with bed sharing deaths in African-Americans, as large, case-control studies in this group are limited. There are two studies in largely African-American groups,^{23, 26} one of which focused on bed sharing,²⁶ but both are descriptive, non-controlled studies. The latter study showed Black race, young maternal age, more than two children, and maternal smoking to be associated with bed sharing deaths. Case-control studies of bed sharing deaths demonstrate increased risk with couch sharing,^{8, 12, 27} young infant age (<11 weeks),⁸ low birth weight,²⁸ maternal smoking,²⁸⁻³⁰ and excessive bedding and clothing.²⁸ However, almost all of these case-control studies are in European populations. Furthermore, there are factors, such as parental weight, that have unclear risk in bed-sharing situations. One cohort study demonstrated that the maternal weight was higher for infants who died while bed sharing compared with those who died while not bed sharing, and that bed sharing infants with larger mothers died at a younger age.²² The New Zealand Cot Death Study, however, reported no association between maternal weight and SIDS for bed sharing infants.³¹ No other studies assessing the risk of parental weight and bed sharing have been published.

The Chicago Infant Mortality Study was designed explicitly to examine the risk factors for SIDS in a largely African-American population in Chicago, where three-quarters of all SIDS deaths in the city were among African-American infants at the time the study was conducted. Since then, the disparity in SIDS in that city is even greater, with almost all the SIDS deaths now occurring among Blacks. The study found that bed sharing was common in both the infants who died of SIDS and their matched control subjects. Bed sharing was more common among the SIDS infants, and greater risk was found particularly when other children bed shared with the infant.^{11, 12} The proposed study will include new analyses from CIMS to further elucidate the interplay of other risk factors and bed sharing among this high-risk group.

Reductions in the incidence of SIDS, particularly among African-Americans, are essential to achieving national targets established by Healthy People 2010 (objectives 16-1c, 16-1e, 161-h).³² Such reductions would contribute greatly to reaching the target infant mortality rate of 4.5/1,000 live births and to closing the racial gap in postneonatal death.³² Furthermore, understanding factors associated with bed sharing that increase the risk of SIDS in African-Americans will lead to better targeted educational interventions, and ultimately, a decrease in the SIDS rate in African-Americans. This study thus addresses: 1) MCHB's goals and strategic research priorities, which have highlighted the elimination of health barriers and disparities, 2) research priorities in the NICHD, as outlined in both its 2000 general strategic plan (*From Cells to Selves*) and its 2000 Strategic Plan for SIDS research (*Targeting Sudden Infant Death Syndrome: A Strategic Plan*), both of which highlight the need to understand factors leading to racial, ethnic, and social disparities as a research priority, and 3) Healthy People 2010's goal of eliminating health disparities in six key areas, including infant mortality. It is critical that risk factors that interplay with bed sharing, leading to SIDS, be identified so that interventions can provide the most comprehensive preventive messages possible.

Theoretical Model for the Pathogenesis of SIDS and Established Risk Factors

The triple risk model³³ provides a framework for organizing current knowledge about SIDS. The model posits three factors essential in the causal mechanism of SIDS: a critical developmental period, a vulnerable infant and the presence of exogenous stressor(s) or an environmental challenge. The model suggests that if one of the interacting factors is removed, SIDS does not occur. Because the presence or absence of exogenous stressors is the only aspect of the triple risk model that is potentially modifiable, it is the focus of the current study. We are most interested in the increased risk of SIDS associated with bed sharing and whether this risk is modified by other aspects of the sleep environment or by maternal practices and habits. As mentioned above, bed sharing has been identified in epidemiologic studies as being hazardous in certain situations.^{8, 12, 27-30, 34-36} It is still unknown whether bed sharing itself is unsafe or whether the accompanying conditions are responsible for the increased risk of SIDS associated with bed sharing. For example, placement in the prone sleep position, use of soft sleep surfaces, pillows, blankets and other coverings may be more common for bed sharing infants and may increase the risk of SIDS by causing overheating³⁷ or rebreathing carbon dioxide.³⁸ Exposure to environmental tobacco smoke, which is known to decrease infant arousal³⁹⁻⁴¹, may be greater in bed sharing infants who sleep with a smoker. We will determine whether these risk factors are more or less common among bed sharing infants by addressing specific aim 1a. With specific aim 2a, we will be examining whether bed sharing is a proxy for these other risk factors or whether it is an independent risk factor for SIDS. If bed sharing is an independent risk factor, we will determine whether there is an interaction between bed sharing and the other factors on risk of SIDS. We will also look at the potential protective effects of infant pacifier use and breastfeeding on bed sharing. Several studies have found that pacifier use decreases risk of SIDS,^{12, 29, 36, 42-45} possibly by increasing arousal. The effects of breastfeeding are less clear with some studies demonstrating a protective effect,⁴⁶⁻⁴⁸ but a recent study from the Netherlands finding that the risk caused by bed sharing is not significantly modified by the presence or absence of breastfeeding.⁶ With specific aim 3, we will examine the effect of maternal weight on the risk for SIDS among bed sharing infants. Currently, there is little information on this topic. One study from New Zealand found no effect of maternal weight on infant risk for SIDS³¹, while a US study found maternal weight was higher for infants who died while bed sharing compared with those who died while not bed sharing.²² It is possible that bed sharing with a larger, heavier adult increases the risk of overheating or rebreathing.

III. STUDY DESIGN AND METHODS

Subjects and Data Collected

This study involved secondary data analysis from the Chicago Infant Mortality Study (CIMS). The CIMS methodology has been described in detail previously (Hauck 2003, Hauck 2002). Briefly, CIMS was a population-based, case-control study that enrolled all Chicago resident infants from birth to 1 year of age who died of SIDS (cases) as determined by the Office of the Medical Examiner of Cook County, Illinois from November 1993 through April 1996. SIDS was defined as “the sudden death of an infant under 1 year of age, which remains unexplained after a thorough case investigation, including performance of a complete autopsy, examination of the death scene, and review of the clinical history.” Standardized protocols were developed for data collection and entry, including death scene investigation, autopsy, and review/abstraction of the infant’s medical record and mother’s labor and delivery record. Two weeks after the death, a standardized follow-up home interview with the infant’s primary caregiver was conducted to address issues that were not included in the death scene investigation such as usual sleep related infant care practices and access to healthcare services.

During the study period, 260 infants died from SIDS. One living control infant was matched to each case infant on (in order of priority) maternal race/ethnicity, age at death/interview, and birth weight (<2500g, 2500g-<4000g and ≥4000g; ±250g if in the middle category). Potential control infants who met the matching criteria were identified through ongoing review of birth certificates at the Chicago Department of Public Health. Potential controls were invited to participate via mailed correspondence. Controls were accepted for interview on a “first come” basis. Mothers of control infants participated in a home interview consisting of nearly 500 questions taken from the death scene investigation and follow-up case interview, which were reworded to apply to a living infant. A reference sleep period was identified for the control infants to coincide with the time of day when the respective case infant was found unresponsive; all questions about “last sleep” referred to this reference sleep.

The control response rate was 4.7% (260 enrolled + 231 interested but not enrolled of 10,464 contacted). As compared with those who were contacted but did not respond, enrolled responders were more highly educated ($P=.001$), lower parity ($P=.027$), and more likely to have received adequate prenatal care as determined by a Kessner Index score ($P=.001$).

The study protocol was approved by the institutional review boards of Children’s National Medical Center and the University of Virginia Health System.

Statistical Analysis

Analysis was conducted using data for the 395 African American infants (195 SIDS cases and 195 matched controls) in the original study. Two outcomes were examined. The first outcome was bed sharing which was defined as an infant sleeping with one or more people on the same sleep surface, such as a mattress or sofa. The second outcome of interest was SIDS. Matching in the CIMS dataset was taken into account by using conditional logistic regression for all univariate and multivariate models created to determine unadjusted and adjusted odds ratios (ORs) and 95% confidence intervals (CIs) for associations with the 2 outcomes.

To examine the sleep environment and characteristics of infants who bed shared compared to infants who did not, we measured the association between bed sharing and the following explanatory variables: infant use of a pillow, softness of the sleep surface, number of blankets or covers over the infant (0-1 versus ≥2), the position the infant was put down to sleep in (supine versus prone or side), pacifier use, recent infant illness (symptoms of respiratory infection or gastroenteritis within the last 2 days), maternal smoking status and maternal breastfeeding. Multivariate models were adjusted for maternal age, marital status, education, index of prenatal care, infant age and SIDS.

Next, the bed sharing variable was stratified by the characteristics named above and also by infant age (<1 month, 1-3 months and >3 months old) to examine whether characteristics of the sleep environment and of the infant modified the association between bed sharing and SIDS. Multivariate models were adjusted for maternal marital status, education and index of prenatal care.

To assess the effect of maternal weight on infant risk for SIDS, maternal weight (at the time of bed sharing) for the 140 infants (84 SIDS cases and 56 controls) who shared a bed with their mothers was examined. Multivariate models were adjusted for maternal education, index of prenatal care and softness of the sleep surface.

To measure the association between sleep location and SIDS, the effect of room sharing with parents without bed sharing was compared with either: 1) sleeping in a separate room from parents and alone in a bed/crib, or 2) bed sharing with someone. Adjusted models included maternal marital status, education, and index of prenatal care.

Explanatory variables included in adjusted logistic regression models were chosen on the basis of having a relationship with either bed sharing or SIDS documented in the literature, and having a statistically significant relationship ($P < .05$) on univariate analysis with the outcome of interest in the CIMS dataset. All variables included in multivariate models were checked for correlation with each other. Because the range of Pearson Correlation Coefficients was $|0.02|$ to $|0.40|$ for all pairings, it was determined that no 2 variables were highly correlated. All analyses were conducted using SAS version 9.1 (SAS Institute, Inc, Cary, NC).

IV. DETAILED FINDINGS

First we assessed the association between bed sharing and characteristics of the sleep environment and of the infant that are known risk factors for SIDS. As seen in **Table 1**, univariate analysis revealed a higher likelihood of bed sharing associated with maternal smoking. This association was of marginal significance and was not present after adjustment for potential confounders. There was a decreased likelihood of bed sharing on multivariate analysis associated with the infant having a respiratory or gastrointestinal infection within the last 2 days. However, this association was also of marginal significance and was not present on univariate analysis, making the likelihood of a true association between bed sharing and recent illness questionable.

Next, we examined the effect of bed sharing on SIDS risk and whether this risk was modified by other characteristics of the sleep environment and of the infant (**Table 2**). After adjustment for maternal marital status, education and index of prenatal care, bed sharing was associated with a 2 times greater odds of SIDS as compared with sleeping alone (95% CI 1.2-3.4). Overall, the deleterious effect of bed sharing on the odds of SIDS seemed to be more pronounced with high versus low-risk sleep environments and infant characteristics. It should be noted that confidence intervals overlapped for each of these comparisons except for the comparison between bed sharing among infants who slept on a firm versus soft sleep surfaces, so the majority of the comparisons represent trends. Infants who bed shared on a soft sleep surface had a greater increase in odds of SIDS (adjusted OR (AOR) 8.8, 95% CI 3.5-21.7) than infants who bed shared on a firm surface (AOR 2.0, 95% CI 1.1-4.0) as compared to infants without either risk factor. Likewise, bed sharing with a pillow was associated with higher odds of SIDS (AOR 4.1, 95% CI 1.4-11.5) than bed sharing without a pillow (AOR 2.9, 95% CI 1.5-5.3). In addition, bed sharing among infants with currently smoking mothers was associated with a greater odds of SIDS (AOR 6.0 95% CI 2.7-13.4) than among infants with nonsmoking mothers (AOR 1.9, 95% CI 0.9-3.8). Bed sharing among infants with mothers who smoked during pregnancy was associated with increased odds of SIDS (AOR 8.0, 95% CI 3.4-18.5), while we did not detect an increase in odds associated with bed sharing for infants whose mothers did not smoke during pregnancy (AOR 1.7 95% CI 0.8-3.4). Bed sharing among the youngest infants (<1 month old) was associated with a higher odds of SIDS (AOR 7.1, 95% CI 1.2-42.1); whereas, no significant increase in odds of SIDS could be detected for bed sharing among older infants. The increased odds of SIDS associated with bed sharing did not differ much depending on the number of covers over the infant (AOR 2.8, 95% CI 1.5-5.2 for 0-1 covers and AOR 1.8, 95% CI 0.8-4.1) or the position the infant was laid down to sleep (AOR 4.9, 95% CI 1.6-14.7 for supine and AOR 4.1, 95% CI 1.7-9.7 for prone/side)—the difference in odds was <1 for both comparisons.

The risk of SIDS associated with bed sharing appeared to be slightly mitigated by 2 protective factors, pacifier use and current breastfeeding. Bed sharing without a pacifier was associated with marginally increased odds of SIDS (AOR 2.1, 95% CI 1.1-3.9); whereas we were unable to detect any increase in odds associated with bed sharing among infants who used a pacifier. Current bed sharing among infants who were not breastfeeding was associated with increased odds of SIDS (AOR 1.9, 95%CI 1.1-3.4), while we did not detect an association between bed sharing and SIDS among infants who were breastfeeding. It is possible that the apparent lack of SIDS risk among bed-sharing infants who used a pacifier and/or were currently breastfeeding may be due to lack of sufficient power since few of the bed-sharing infants in this study used a pacifier and/or were currently breastfeeding.

While the odds of SIDS associated with bed sharing seemed to have been magnified by high-risk sleep environments and infant characteristics, the risk of SIDS from bed sharing did not seem to be extinguished by low-risk characteristics. Bed sharing was still associated with an increased risk for SIDS among children who were not using pillows (AOR 2.9, 95% CI 1.5-5.3), slept on a firm sleep surface (AOR 2.0, 95% CI 1.1-4.0), used 0-1 covers (AOR 2.8, 95% CI 1.5-5.2), and slept in the supine position (AOR 4.9, 95% CI 1.6-14.7).

In addition to the factors above, we investigated the possible effects of maternal weight on risk of SIDS among the subset of infants who shared a bed with their mothers (**Table 3**). We did not detect a difference in odds of SIDS based on maternal weight, and in fact the maternal weights for SIDS cases and controls were roughly the same. Maternal weight was also examined as a categorical variable (results not shown) based on the Center for Disease Control and Prevention's definitions of normal weight, overweight and obese for an adult woman with the US median height of 5'5" (<145 lbs, 145 to 173 lbs and >173 lbs). These results were also not statistically significant.

Table 4 summarizes our findings regarding sleep location and risk for SIDS. On univariate analysis, bed sharing was associated with increased odds of SIDS when compared to room sharing without bed sharing (OR 2.5, 95% CI 1.4-4.4). However, this relationship did not persist once adjusted for maternal marital status, education and index of prenatal care. We did not detect any difference in SIDS risk associated with infants sleeping alone in a separate room as compared to room sharing without bed sharing using either the unadjusted or adjusted models.

There is some evidence that sleeping with an infant on a sofa is especially risky for SIDS. Therefore, we performed all of our analyses excluding the 14 infants in the study who were bed sharing on a couch since their circumstances may have been different from the rest of the group. The results were essentially the same as reported above, likely because infants bed sharing on a couch represent a very small percentage of the total number of bed sharing infants (3.5%).

V. DISCUSSION AND INTERPRETATION OF FINDINGS

We found, in our analysis of the CIMS data, that bed sharing in the African-American population, when compared with all other sleep arrangements combined, was associated with an increased risk for SIDS. The practice of bed sharing was marginally associated with current maternal smoking and recent respiratory or gastrointestinal infection. However, bed sharing itself was not associated with other risk factors for SIDS, such as quality and quantity of the bedding in the sleep environment. The effect of bed sharing on increasing SIDS risk was more pronounced with situations known to place infants at higher SIDS risk, such as soft sleep surface, use of pillow, nonuse of a pacifier, younger infant age, and maternal smoking (both current and during pregnancy). Furthermore, we did not find maternal weight to affect SIDS risk for bed-sharing infants.

We found that bed sharing was associated with an increased risk for SIDS. In the literature, the relationship between SIDS and bed sharing remains controversial. While advocates affirm that bed sharing promotes breast feeding and mother-infant bonding, critics believe that this practice places infants at higher risk for SIDS. A recent systematic review of 40 studies found an association between SIDS and bed sharing with parents who are smokers, with increased odds of SIDS associated with bed sharing ranging among studies between 2.3 to 10.⁵ However, insufficient

evidence precluded the review's authors from making a more general statement about the safety of bed sharing with non-smokers, as the odds of SIDS attributed to bed sharing in this group ranged between 0.38 to 1.73.⁵ The authors concluded that continued, rigorous studies were needed.⁵ In contrast, a review of nine case-control studies recently determined that bed sharing is consistently an independent risk factor for SIDS, both with parents who are smokers and non-smokers (overall OR: 2.0-16.5; OR with smoking parent: 4.6-17.7; OR with non-smoking parent 1.0-2.2).⁴⁹ The risk of SIDS when bed sharing with non-smokers is particularly high for young infants (less than 2-3 months of age) (OR 2.4-16.9).^{6, 8, 27-29, 36} In our present study, maternal smoking did increase the risk of SIDS associated with bed sharing.

There is also evidence in the literature that the risk of SIDS increases 21-fold when the infant is placed prone with soft bedding.¹² In our study, use of soft sleep surfaces or a pillow increased the risk of SIDS associated with bed sharing regardless of sleep position. However, prone or side sleep position alone did not increase the risk of SIDS associated with bed sharing as compared with supine sleeping.

Our study demonstrates that the risk of SIDS associated with bed sharing was increased among younger infants; whereas in general, the majority of SIDS cases occur among infants 2-4 months of age.⁵⁰⁻⁵⁴

Prior studies have found that pacifier use decreases risk of SIDS,^{12, 29, 36, 42-45} possibly by increasing infant arousal. Our study findings are in agreement in that pacifier use decreased the risk of SIDS associated with bed sharing.

Limitations

The limitations of the study are that the dataset we used for the analysis is slightly dated since enrollment occurred between 1993 and 1996 and that data collection was limited to a single city, Chicago. Regarding the issue of time passage since study enrollment occurred, there has been increasing evidence and recommendations from the American Academy of Pediatrics and other advocacy groups that infants not bed share with others. Despite national recommendations to the contrary, one study found that a trend from 1993 to 2000 of increased bed sharing from 5.5% to 12.8%¹⁰ making our analysis still very relevant. In addition, although data collection only occurred in Chicago, key indicators regarding the health of the infant population in Chicago is similar to that overall for the United States. According to the Kids Count Data Center (www.kidscount.org/datacenter), non-Hispanic blacks made up 17.0% of Chicago's total births in 2004, as compared with 14.1% of the total US population. Infant mortality rates for Chicago that year were 7.5 deaths per 1,000 live births as compared with the national average of 6.8 per 1000. Rates of known risk factors for SIDS in Chicago as compared with the national average were also similar: birth to mothers who smoked during pregnancy were 9.3% and 10.2% respectively; birth to women receiving late or no prenatal care were 2.7% and 3.6%, respectively; rates of low birth weight were 8.4% and 8.1%, respectively; infants born to teenage mothers were 40 per 1000 and 41 per 1000, respectively; and births to mothers with less than 12 years of education were 20.8% and 22.2%, respectively. Because the infant health indicators are similar for Chicago and the US as a whole, the results of the present study are likely generalizable to African-Americans across the country.

Application of findings to health care delivery and policy implications

Identification of risk factors associated with SIDS deaths that occur when African-American infants bed share, including bed sharing on a soft sleep surface, with a pillow, without a pacifier, with a younger infant or in the presence of maternal smoking, will aid in the development of educational interventions that target these potentially preventable causes of infant death. Interventions directed at improving outcomes for African-American infants in relation to SIDS can incorporate these findings into making very concrete recommendations to parents.

Suggestions for further research

Future research can be directed in two areas. The first is to determine the most effect means of communicating these findings regarding high-risk bed sharing environments for African-American infants to families via interventions that are culturally appropriate. The second is to repeat the CIMS study in a more racially/ethnically diverse infant population that included Caucasians, Hispanics and Asians to determine whether the same environmental factors that increase the risk of SIDS associated with bed sharing among African-American infants also apply to infants of other racial and ethnic backgrounds.

VI. PLANS FOR PRODUCTS

We are currently in the process of drafting 2 manuscripts that report the results from this project. In these manuscripts, we will plan to discuss more fully the results and the implications of these findings.

VII. APPENDIX: TABLES

Table 1: Association between bed sharing and various aspects of the sleep environment and infant^a

Characteristic	Bed sharing, n (%) N=185	Not bed sharing, n (%) N=204	Unadjusted OR (95% CI)	Adjusted OR^b (95% CI)
Pillow use				
No	155 (83.8)	159 (77.9)	Reference	Reference
Yes	30 (16.2)	45 (22.1)	1.0 (0.5-2.2)	0.7 (0.3-1.8)
Sleep surface				
Firm	107 (57.8)	138 (67.6)	Reference	Reference
Soft	78 (42.2)	66 (32.4)	1.8 (1.0-3.8)	1.1(0.5-2.5)
Number of covers				
0-1	140 (76.1)	177 (86.8)	Reference	Reference
≥2	44 (23.9)	27 (13.2)	1.8 (0.8-3.7)	2.0 (0.7-5.4)
Sleep position				
Supine	39 (21.1)	58 (8.7)	Reference	Reference
Prone or side	146 (78.9)	144 (71.3)	1.8 (0.9-3.5)	1.5 (0.6-3.7)
Pacifier use				
No	150 (81.1)	141 (69.1)	Reference	Reference
Yes	35 (18.9)	63 (30.9)	0.5 (0.2-1.0)	0.8 (0.3-1.9)
Maternal smoking (current)				
No	106 (58.2)	142 (70.7)	Reference	Reference
Yes	76 (41.8)	59 (29.4)	2.0 (1.1-3.8)	1.2 (0.5-2.7)
Breastfeeding (current)				
No	164 (88.6)	185 (90.7)	Reference	Reference
Yes	21 (11.4)	19 (9.3)	0.5 (0.2-1.3)	0.7 (0.2-2.5)
Respiratory or gastrointestinal infection in last 2 days				
No	80 (43.2)	91 (44.6)	Reference	Reference
Yes	105 (56.8)	113 (55.4)	0.9 (0.5-1.5)	0.4 (0.2-0.9)

Abbreviations: OR, odds ratio; CI, confidence interval

^a Numbers in columns may not sum to total numbers due to missing data.

^b Adjusted for maternal age, marital status, education, index of prenatal care, infant age and infant SIDS.

Table 2. Effect of bed sharing on SIDS risk and as modified by sleep environment and infant characteristics^a

Characteristic	SIDS Cases, n (%) N=195	Controls, n (%) N=195	Unadjusted OR (95% CI)	Adjusted OR ^b (95% CI)
Bed sharing				
No	82 (42.1)	122 (62.9)	Reference	Reference
Yes	113 (57.9)	72 (37.1)	2.3 (1.6-3.5)	2.0 (1.2-3.4)
Pillow use				
No				
Not bed sharing	52 (26.7)	107 (55.1)	Reference	Reference
Bed sharing	93 (47.7)	62 (32.0)	3.3 (1.9-5.5)	2.9 (1.5-5.3)
Yes				
Not bed sharing	30 (15.4)	15 (7.7)	4.4 (2.0-9.6)	6.7 (2.5-18.1)
Bed sharing	20 (10.2)	10 (5.2)	4.5 (1.8-11.4)	4.1 (1.4-11.5)
Sleep surface				
Firm				
Not bed sharing	42 (21.5)	96 (49.5)	Reference	Reference
Bed sharing	52 (26.7)	55 (28.3)	2.3 (1.3-4.2)	2.0 (1.1-4.0)
Soft				
Not bed sharing	40 (20.5)	26 (13.4)	4.3 (2.1-8.8)	5.0 (2.2-11.7)
Bed sharing	61 (31.3)	17 (8.8)	12.3 (5.4-28.2)	8.8 (3.5-21.7)
Number of covers				
0-1				
Not bed sharing	67 (34.4)	110 (57.0)	Reference	Reference
Bed sharing	89 (45.6)	51 (26.4)	3.3 (1.9-5.5)	2.8 (1.5-5.2)
≥2				
Not bed sharing	15 (7.7)	12 (6.2)	2.2 (0.9-5.0)	3.3 (1.2-8.8)
Bed sharing	24 (12.3)	20 (10.4)	2.1 (1.1-4.3)	1.8 (0.8-4.1)
Sleep position				
Supine				
Not bed sharing	15 (7.7)	43 (22.3)	Reference	Reference
Bed sharing	24 (12.4)	15 (7.8)	6.1 (2.3-16.1)	4.9 (1.6-14.7)
Prone or side				
Not bed sharing	66 (34.0)	78 (40.4)	2.5 (1.2-5.1)	2.7 (1.2-6.2)
Bed sharing	89 (45.9)	57 (29.5)	5.1 (2.4-10.7)	4.1 (1.7-9.7)
Pacifier use				
No				
Not bed sharing	64 (32.8)	77 (39.591)	Reference	Reference
Bed sharing	99 (50.8)	51 (26.2887)	2.7 (1.6-4.5)	2.1 (1.1-3.9)
Yes				
Not bed sharing	18 (9.2)	45 (23.196)	0.4 (0.2-0.8)	0.4 (0.2-0.9)
Bed sharing	14 (7.2)	21 (10.825)	0.6 (0.3-1.5)	0.5 (0.2-1.3)
Maternal smoking (current)				
No				
Not bed sharing	42 (22.2)	100 (51.6)	Reference	Reference
Bed sharing	54 (28.6)	52 (26.8)	2.8 (1.5-5.1)	1.9 (0.9-3.8)
Yes				
Not bed sharing	37 (19.6)	22 (11.3)	4.0 (2.0-8.0)	3.2 (1.4-7.0)
Bed sharing	56 (29.6)	20 (10.3)	7.1 (3.5-14.2)	6.0 (2.7-13.4)
Maternal smoking (pregnancy)				
No				

Not bed sharing	41 (21.0)	95 (49.0)	Reference	Reference
Bed sharing	49 (25.2)	56 (28.9)	2.5 (1.4-4.6)	1.7 (0.8-3.4)
Yes				
Not bed sharing	41 (21.0)	27 (13.9)	4.3 (2.2-8.8)	3.2 (1.4-7.0)
Bed sharing	64 (32.8)	16 (8.2)	11.0 (5.1-23.6)	8.0 (3.4-18.5)
Breastfeeding (current)				
No				
Not bed sharing	80 (41.0)	105 (54.1)	Reference	Reference
Bed sharing	105 (53.9)	59 (30.4)	2.4 (1.5-3.8)	1.9 (1.1-3.4)
Yes				
Not bed sharing	2 (1.0)	17 (8.8)	0.2 (0-0.8)	0.4 (0.1-2.1)
Bed sharing	8 (4.1)	13 (6.7)	0.9 (0.3-2.7)	1.1 (0.3-3.4)
Infant age (months)				
<1				
Not bed sharing	4 (2.1)	12 (6.2)	Reference	Reference
Bed sharing	15 (7.7)	6 (3.1)	6.6 (1.4-31.1)	7.1 (1.2-42.1)
1-3				
Not bed sharing	46 (23.6)	68 (35.1)	1.4 (0.3-6.0)	1.6 (0.4-7.7)
Bed sharing	66 (33.8)	46 (23.7)	3.3 (0.8-13.0)	2.8 (0.7-12.1)
≥4				
Not bed sharing	32 (16.4)	42 (21.6)	3.1 (0.3-29.6)	3.1 (0.3-37.3)
Bed sharing	32 (16.4)	20 (10.3)	7.3 (0.7-73.1)	5.9 (0.5-71.9)

Abbreviations: OR, odds ratio; CI, confidence interval

^a Numbers in columns may not sum to total numbers due to missing data.

^b Adjusted for maternal marital status, education and index of prenatal care.

Table 3. Effect of maternal weight on risk for SIDS among bed sharing infants

	SIDS Cases, mean±SD N=84	Controls, mean±SD N=56	Unadjusted OR^a (95% CI)	Adjusted OR^{a, b} (95% CI)
Maternal weight (lbs)	148 ± 38	150 ± 33	1.0 (1.0-1.0)	1.1 (1.0-1.1)

Abbreviations: SD, standard deviation; OR, odds ratio; CI, confidence interval

^a Odds ratio reported for every 1 lb increase in weight

^b Adjusted for maternal marital status, education and softness of the bedding

Table 4. Effect of room sharing with parents without bed sharing on risk for SIDS compared with: 1) sleeping in a separate room from parents and alone in a bed/crib, or 2) bed sharing with anyone

	Controls, n (%) N=194	SIDS cases, n (%) N=195	Unadjusted OR (95% CI)	Adjusted OR^a (95% CI)
Room sharing without bed sharing	41 (21.1)	27 (13.8)	Reference	Reference
Sleeping alone in a separate room	81 (41.8)	55 (28.2)	0.9 (0.5-1.7)	0.9 (0.5-1.9)
Bed sharing	72 (37.1)	113 (58.0)	2.5 (1.4-4.4)	1.9 (0.9-3.8)

Abbreviations: OR, odds ratio; CI, confidence interval

^a Adjusted for maternal marital status, education and index of prenatal care.

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