Trends and Factors Associated With Infant Bed Sharing, 1993-2010

The National Infant Sleep Position Study

Eve R. Colson, MD; Marian Willinger, PhD; Denis Rybin, MS; Timothy Heeren, PhD; Lauren A. Smith, MD, MPH; George Lister, MD; Michael J. Corwin, MD

**IMPORTANCE** A strong association between infant bed sharing and sudden infant death syndrome or unintentional sleep-related death in infants has been established. Occurrences of unintentional sleep-related deaths among infants appear to be increasing.

**OBJECTIVES** To determine the trends and factors associated with infant bed sharing from 1993 through 2010, including the association of physician advice on bed sharing.

**DESIGN** National Infant Sleep Position study conducted with annual telephone surveys.

**SETTING** The 48 contiguous states.

**PARTICIPANTS** Nighttime caregivers of infants born within 7 months of each survey administration. Approximately 1000 interviews were completed annually.

**MAIN OUTCOMES AND MEASURES** Infant bed sharing as a usual practice.

**RESULTS** Of 18,986 participants, 11.2% reported an infant sharing a bed as a usual practice. Bed sharing increased from 1993 (6.5%) to 2010 (13.5%). Although bed sharing increased significantly among white respondents from 1993 to 2000 ($P < .001$), the increase from 2001 to 2010 was not significant ($P = .48$). Black and Hispanic respondents reported an increase in bed sharing throughout the study period, with no difference between the earlier and later periods ($P = .63$ and $P = .77$, respectively). After accounting for the study year, factors associated with increase in infant bed sharing as a usual practice included maternal educational level of less than high school compared with college or greater (adjusted odds ratio, 1.42 [95% CI, 1.12-1.79]); black (3.47 [2.97-4.05]), Hispanic (1.33 [1.10-1.61]), and other (2.46 [2.03-2.97]) maternal race or ethnicity compared with white race; household income of less than $20,000 (1.69 [1.44-1.99]) and $20,000 to $50,000 (1.29 [1.14-1.45]) compared with greater than $50,000; living in the West (1.61 [1.38-1.88]) or the South (1.47 [1.30-1.66]) compared with the Midwest; infants younger than 8 weeks (1.45 [1.21-1.73]) or ages 8 to 15 weeks (1.31 [1.17-1.45]) compared with 16 weeks or older; and being born prematurely compared with full-term (1.41 [1.22-1.62]). Almost 46% of the participants reported talking to a physician about bed sharing. Compared with those who did not receive advice from a physician, those who reported their physicians had a negative attitude were less likely to have the infant share a bed (adjusted odds ratio, 0.66 [95% CI, 0.53-0.82]), whereas a neutral attitude was associated with increased bed sharing (1.38 [1.05-1.80]).

**CONCLUSIONS AND RELEVANCE** Our finding of a continual increase in bed sharing throughout the study period among black and Hispanic infants suggests that the current American Academy of Pediatrics recommendation about bed sharing is not universally followed. The factors associated with infant bed sharing may be useful in evaluating the impact of a broad intervention to change behavior.
Infant bed sharing is a common practice in many countries, including the United States. In a previous analysis of the National Infant Sleep Position Study (NISIP), almost 45% of parents reported sharing a bed with their infants at least some of the time. Strong associations between bed sharing and sudden infant death syndrome or unintentional sleep-related death in infants have been established. Occurrences of unintentional sleep-related deaths appear to be increasing.

The American Academy of Pediatrics recommends that infants share a room with parents without sharing a bed when sleeping. The previous report from the NISIP found that, from 1993 to 2000, factors associated with bed sharing by an infant as a usual practice included young maternal age, race, geographic region, low annual household income, younger infant age, prematurity, bedding, and infant sleeping position. The objectives of the present study were to examine trends in infant bed sharing from 1993 to 2010 with a special focus on how these trends might differ by race or ethnicity; to analyze how the trends have changed over time by comparing trends from 1993 through 2000 with those from 2001 through 2010; to describe factors associated with bed sharing as a usual choice from 1993 through 2010; and to describe bed-sharing practices according to advice received from a physician.

This study was reviewed and approved by the institutional review boards of Boston University School of Medicine and Yale University School of Medicine. Written consent was waived. Beginning in 2006, per a change in institutional review board requirements, specific language was added to the telephone interview script to ensure that all elements of verbal consent were consistently provided to participants prior to the interview.

Methods

The NISP Sample

The NISP is an annual, cross-sectional study designed to track infant care practices. DataStat, Inc, conducted the telephone interviews to home and cellular telephones by sampling targeted households with infants 7 months or younger at random. A representative list taken from the 48 contiguous states was purchased from Metromail. The list was based on public information from sources such as birth records, infant photography companies, and infant formula companies. Telephone numbers were provided by individuals and, for that reason, we do not know whether the numbers provided were land line or cellular telephone numbers. Interviews were completed if the respondent (the nighttime caregiver) answered yes to the question: “Is there an infant in the house born in the last 7 months, that is, on or after [date]?” More than 80% of the respondents were the infants’ mothers. The goal was to complete approximately 1000 calls each year. The number of calls completed annually ranged from 1012 to 1188 during the study period.

Response rates were calculated using the American Association for Public Opinion Research standard definitions and formulas. An exact response rate cannot be calculated because eligibility cannot be determined for those who refused to be interviewed. We estimated the response rate based on the assumption that the eligible proportion of households who refused is the same as the eligible proportion of those for whom we could determine eligibility. The response rate ranged from 78.0% in 1993 to 46.2% in 2010. In 2005, the NISP sample differed from the National Center for Health Statistics National Vital Statistics Report in the following maternal characteristics: black race (6.0% vs 15.3%), Hispanic ethnicity (6.8% vs 23.8%), age younger than 20 years (3.4% vs 10.2%), and educational level of less than 12 years (5.1% vs 23.5%).

Measures

The interview was developed for the NISP study, with an approximate completion time of 10 minutes. We asked questions about characteristics of the infants and infant sleep environment, including sleeping position, location for sleep, type of bedding, and sociodemographic characteristics. Participants were asked: “Which of the following best describes the mother’s race or ethnic background?” They were then read a list but also given the option to name an option that was not listed. Once eligibility was confirmed, a mean of 3.5% of the participants did not complete the interview from 1993 to 2010. Noncompletion rates ranged from a low of 2.2% in 2006 to 29.1% in 2010.

To elicit information about where infants slept, interviewers read the following scripted questions: “I am going to read a list of places where infants often sleep. After I finish reading the list, please tell me where the infant usually slept at night during the past 2 weeks.” Participants could choose among a crib, a bassinet, a cradle, a carry-cot or traveling bed, an adult bed or mattress, a sofa, a playpen, a car or infant seat, or someplace else that the participants then specified.

Regarding bed sharing, all respondents were asked: “Does the baby usually sleep alone or share [the usual sleep place] with another person or child?” If caregivers replied that they share, they were then asked to specify with whom (parent or guardian, another adult, or another child). Infant bed sharing was considered to be the usual practice if respondents answered that they usually share with another person. We also examined the time that the infant spent on an adult bed (bed sharing) from the responses usually, half of the time, less than half of the time, and never. To determine quilt and comforter use, caregivers were asked if they had usually used a quilt and/or a comforter to cover the infant during the past 2 weeks.

Finally, in 2006, based on the new recommendations from the American Academy of Pediatrics regarding safe sleep and the link between physician advice and adherence to safe sleep recommendations, we added the following question: “Has a doctor ever talked with you about your baby sleeping in a bed with another person?” For those responding yes, we then asked if the physician’s attitude was negative, positive, or neutral toward bed sharing.

Statistical Analysis

The main outcome variable was the participant response that the infant usually shares a bed (or other sleep space) with any other person. We calculated descriptive statistics, including frequencies and percentages. Trends over time for usually shar-
ing a bed by race or ethnicity were plotted using 3-year moving averages and tested through the odds ratio (OR) for year in logistic regression models. We used piecewise logistic regression models with a term modeling a change in the OR for time to test and estimated different trends in bedsharing from 1993 to 2000 and from 2001 to 2010.

The survey year, maternal and infant characteristics, characteristics of the sleep environment, and position in which the infant was placed to sleep were used in univariate logistic regression modeling to determine individual influence of variables on usually sharing a bed and in a multivariate logistic regression model to determine independent contributions. We considered $P < 0.05$ statistically significant. All analyses were conducted with commercially available software (SAS, version 9.2; SAS Institute).

### Results

#### Sample Characteristics

From 1993 through 2010, 18,986 participants completed the questionnaire, with the goal of approximately 1000 participants each year (ranging from 1012 in 1996 to 1188 in 2002). The median infant age was 131 days; the 10th percentile, 61 days; and the 90th percentile, 192 days. These percentiles were similar for each study year. More than 84% of respondents were the mothers of the infants. Almost half of the respondents were 30 years or older, had at least a college education, and had a yearly income of at least $50,000. More than 80% of the participants were white (Table).

### Table. Adjusted Odds Ratios for Infant Bed Sharing as a Usual Practice by Demographic Variables for 1993-2010

<table>
<thead>
<tr>
<th>Variable</th>
<th>No. (%) of Participants</th>
<th>Usual Bed Sharing, OR (95% CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Total</td>
<td>Usually Share</td>
</tr>
<tr>
<td>Mother’s age, y</td>
<td></td>
<td></td>
</tr>
<tr>
<td>&lt;20</td>
<td>910</td>
<td>179 (19.7)</td>
</tr>
<tr>
<td>20-29</td>
<td>9067</td>
<td>1049 (11.6)</td>
</tr>
<tr>
<td>≥30</td>
<td>8925</td>
<td>891 (10.0)</td>
</tr>
<tr>
<td>Mother’s educational level</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Less than HS</td>
<td>1051</td>
<td>198 (18.8)</td>
</tr>
<tr>
<td>Completed HS/some college</td>
<td>9299</td>
<td>1136 (12.2)</td>
</tr>
<tr>
<td>Completed college or more</td>
<td>8588</td>
<td>789 (9.2)</td>
</tr>
<tr>
<td>Mother’s race</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Other</td>
<td>895</td>
<td>183 (20.4)</td>
</tr>
<tr>
<td>Hispanic</td>
<td>1160</td>
<td>178 (15.3)</td>
</tr>
<tr>
<td>Black</td>
<td>1174</td>
<td>355 (30.2)</td>
</tr>
<tr>
<td>White</td>
<td>15757</td>
<td>1412 (9.0)</td>
</tr>
<tr>
<td>First child</td>
<td></td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>9678</td>
<td>1095 (11.3)</td>
</tr>
<tr>
<td>Yes</td>
<td>8962</td>
<td>963 (10.7)</td>
</tr>
<tr>
<td>US region</td>
<td></td>
<td></td>
</tr>
<tr>
<td>West</td>
<td>2811</td>
<td>396 (14.1)</td>
</tr>
<tr>
<td>New England</td>
<td>1033</td>
<td>91 (8.8)</td>
</tr>
<tr>
<td>Mid-Atlantic</td>
<td>2582</td>
<td>184 (7.1)</td>
</tr>
<tr>
<td>South</td>
<td>6651</td>
<td>943 (14.2)</td>
</tr>
<tr>
<td>Midwest</td>
<td>5909</td>
<td>514 (8.7)</td>
</tr>
<tr>
<td>Annual household income, $</td>
<td></td>
<td></td>
</tr>
<tr>
<td>&lt;20 000</td>
<td>2628</td>
<td>471 (17.9)</td>
</tr>
<tr>
<td>20 000-50 000</td>
<td>6699</td>
<td>770 (11.5)</td>
</tr>
<tr>
<td>≥50 000</td>
<td>8619</td>
<td>785 (9.1)</td>
</tr>
<tr>
<td>Infant’s age, wk</td>
<td></td>
<td></td>
</tr>
<tr>
<td>&lt;8</td>
<td>1443</td>
<td>197 (13.7)</td>
</tr>
<tr>
<td>8-15</td>
<td>5469</td>
<td>673 (12.3)</td>
</tr>
<tr>
<td>≥16</td>
<td>11506</td>
<td>1182 (10.3)</td>
</tr>
<tr>
<td>Prematurity (&lt;37 wk)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>2175</td>
<td>329 (15.1)</td>
</tr>
<tr>
<td>No</td>
<td>16757</td>
<td>1791 (10.7)</td>
</tr>
</tbody>
</table>

* Percentages have been rounded and might not total 100.
* The 95% CI does not include 1 (the reference value).
Trends in Infant Bed Sharing as a Usual Practice
From 1993 to 2010, 2128 of 18945 participants (11.2%) reported that the infants usually shared a bed (or other sleep space). Information about usually sharing a bed was missing for only 41 participants (0.2%). Figure 1 shows the trend over time in usually sharing a bed by race or ethnicity. Each racial or ethnic group showed a significant trend of increasing reports of usually sharing a bed over time from 1993 through 2010. In 1993, 6.5% of all infants usually shared a bed compared with 13.5% in 2010.

We also performed piecewise analyses to determine if the trend differed in the 1993-2000 period (the period that was the subject of a previous report) compared with the 2001-2010 period. Using the 3-year moving average for the calculation, we found that among white infants, usually sharing a bed increased from 4.9% in 1993 to 9.1% in 2010 (unadjusted OR, 1.04 per year [95% CI, 1.03-1.05; P < .001]), but we found a significant difference in trend over time between the 2 periods (P < .001). During the 1993-2000 period, the odds of infant bed sharing increased 1.13 times per year (95% CI, 1.09-1.16), whereas during the 2001-2010 period, the rate did not change over time (OR, 0.99 [0.97-1.01; P = .48]).

This pattern was in contrast to that for the black and Hispanic infants, for whom bed sharing as a usual practice progressively increased over time without a difference between the 2 periods (P = .63 and P = .77, respectively). Again using the 3-year moving average for the calculation, we found that for black infants, the percentage of those usually sharing a bed increased from 21.2% in 1993 to 38.7% in 2010 (OR, 1.04 per year [95% CI, 1.02-1.07; P < .001]); for Hispanic infants, from 12.5% in 1993 to 20.5% in 2010 (1.05 per year [1.02-1.09; P = .003]). Thus, as shown in Figure 1 and from the piecewise regression analysis, we found a widening in the racial gap in usually sharing a bed between the 1993-2000 and 2001-2010 periods.

We found a significant increase in the amount of time spent bed sharing in an overall comparison of the 1993-2000 and 2001-2010 periods (P < .001). The percentage of caregivers responding that the infant usually shared a bed increased from 8.9% to 10.8%; the percentage responding that the infant spent half of the time sharing a bed increased from 6.1% to 6.5%. At the same time, the percentage of caregivers responding that the infant never shared a bed decreased from 56.0% to 54.3%, and the percentage responding that the infant spent less than half of the time sharing a bed decreased from 29.0% to 28.3%.

Factors Associated With Infant Bed Sharing as a Usual Practice
After accounting for the change in bed sharing over time, the factors associated with the infant usually sharing a bed from 1993 through 2010 are given in the Table and include maternal race or ethnicity (adjusted OR [AOR], 3.47 for black, 2.46 for other, and 1.33 for Hispanic mothers compared with white mothers), maternal educational level (1.42 for less than high school compared with college graduates), annual household income (1.69 for <$20,000 and 1.29 for $20,000-$50,000 compared with >$50,000), geographic region (1.61 for the West, 1.47 for the South, and 0.77 for the mid-Atlantic compared with the Midwest), infant age (1.45 for <8 weeks and 1.31 for 8-15 weeks compared with ≥16 weeks), and gestational age at birth (1.41 for preterm births compared with full-term infants). We also compared factors associated with infants usually sharing a bed separately for the 1993-2000 and 2001-2010 periods. All of the factors identified in the overall study period were also significantly associated with bed sharing for the later period. For the earlier period, maternal educational level and gestational age at birth did not achieve statistical significance.

In the surveys from 2006 and 2010, we added questions as to whether the physician talked about bed sharing and, if so, whether the respondent perceived the physician's attitude as positive (supportive of bed sharing), negative (against bed sharing), or neutral (Figure 2). More than half of the participants reported that they did not get any advice from a physician regarding bed sharing (2839 of 5252 [54.1%]). Of the 2413 who received advice, 1751 (72.6%) reported negative advice; 514 (21.3%), neutral advice; and 148 (6.1%), positive advice. Participants who reported that they received negative advice from a physician were significantly less likely to share a bed with the infant (158 of 1751 [9.0%]; AOR, 0.66 [95% CI, 0.53-0.82]) than those who received no advice (405 of 2839 [14.3%]). Receiving positive advice affected only 2.8% of the 5252 participants; and although 37 of these 148 participants (25.0%) reported usually sharing a bed, these findings were not
Discussion

We found that black infants, who are at highest risk of sudden infant death syndrome and accidental suffocation and strangulation in bed, share a bed most often. Compared with white infants, black infants are 3.5 times more likely to share a bed and are more likely than any other race or ethnicity examined in this study to do so. Although this trend has not increased in the most recent years (2001-2010) for white infants, bed sharing continues to increase for black infants.

Laehr et al\textsuperscript{11} published a population-based study using the Oregon Pregnancy Risk Assessment Monitoring System and found that 35.2\% of mothers reported frequent bed sharing. In 2008, Fu and colleagues\textsuperscript{2} examined bed-sharing practices of more than 700 mothers at Women, Infants, and Children centers across the country that served a predominantly black population. They found that 32.5\% reported bed sharing the previous night, which is consistent with our data showing that, in 2010, 39.6\% of black mothers reported their infants usually shared a bed.\textsuperscript{2} In a qualitative study of black mothers, Joyner and colleagues\textsuperscript{14} found that the choice to share a bed was related to convenience, easier vigilance over the infant, and in some cases as a way to protect their infants from outside dangers.

As in the first NISP study,\textsuperscript{7} we found that quilt and comforter use continues to be associated with bed sharing. Although fewer caregivers reported quilt or comforter use from 2001 to 2010 compared with 1993 to 2001, the association between quilt or comforter use and bed sharing, 2 behaviors that put infants at risk for sleep-related death, remains strong.\textsuperscript{11,15}

Public health interventions have been successful in targeting infant sleeping position by motivating more parents to place their infants on their back to sleep. However, studies have shown that black infants are less likely to be placed on their back to sleep compared with white and Hispanic infants.\textsuperscript{25,16} Changing behaviors can be challenging, and previous work has shown that multiple factors affect parent report of infant care practices, such as receiving information from and trusting health care providers.\textsuperscript{11} Previous studies\textsuperscript{11,12} have shown an association between receiving advice from a physician about infant care practices and following this advice. However, in the present study, we found that many caregivers did not receive any advice from physicians about bed sharing. If they received advice that they should not share a bed with their infants, they were significantly less likely to practice bed sharing. We also observed that advice that was perceived as neutral from the physician was associated with more bed sharing than was no advice at all. Given the association between physician advice and bed sharing and the fact that advice was not reported as uniform and often not reported as given at all, consistent physician advice in line with recommendations might reduce bed sharing.

In addition, during the years of the NISP survey, a number of articles were published regarding the risks and benefits of bed sharing. For example, some studies have shown that bed sharing is associated with successful breastfeeding, thus supporting bed sharing.\textsuperscript{17} Other studies have shown that bed sharing increases the risk of sudden infant death syndrome, suffocation, and strangulation.\textsuperscript{5} During our study period, families and health care providers may have received mixed messages about the risks of bed sharing. At this point, however, the weight of the evidence has tipped to the point where the American Academy of Pediatrics now strongly recommends room sharing without bed sharing.\textsuperscript{6}
Although our study provides unique data about the trends and factors associated with bed sharing in the United States, some limitations should be acknowledged. These data come from the report of the caregiver about what they choose to do about bed sharing and may not reflect actual practice. In addition, we included the responses of nighttime caregivers, which could be different from those of daytime caregivers. However, we are reassured that our findings are similar to those of other studies using different samples and methods of data collection.\(^1\)\(^,\)\(^2\) In addition, the response rate was quite high in the early years of the study; however, consistent with telephone surveys in general, the rate declined substantially in the latter years of the survey. This changing response rate over time, and particularly the relatively low response rate in the latter years, affects the generalizability of our findings. However, the consistency of our findings over time suggests that the changing response rate did not have a major effect on our findings. Finally, the sample is not a nationally representative sample when compared with nationally collected vital statistics,\(^3\) likely and at least in part owing to the known difficulties reaching underrepresented and economically disadvantaged individuals via the telephone for surveys.\(^4\)\(^,\)\(^5\) We have attempted to correct for these differences by controlling variables in the multiple logistic regression analysis and by showing the prevalence of bed sharing over time stratified by race or ethnicity.

Despite these limitations, these data are helpful in understanding trends in and factors associated with bed sharing. The data may be useful in evaluating the impact of any broad intervention to change behavior.

**ARTICLE INFORMATION**

**Accepted for Publication:** March 27, 2013.

**Published Online:** September 30, 2013. doi:10.1001/jamapediatrics.2013.2560.

**Author Affiliations:** Department of Pediatrics, Yale University School of Medicine, New Haven, Connecticut (Colson, Lister); Pregnancy and Perinatology Branch, Eunice Kennedy Shriver National Institute of Child Health and Human Development (Willinger); Data Coordinating Center, Boston University School of Public Health, Boston, Massachusetts (Rybin); Department of Biostatistics, Boston University School of Public Health, Boston, Massachusetts (Heeren); Massachusetts Department of Public Health, Boston, Massachusetts (Smith); now with Department of Pediatrics, Boston University School of Medicine, Boston, Massachusetts (Smith); Department of Pediatrics, Boston University School of Medicine, and Slone Epidemiology Center, Boston University, Massachusetts (Corwin).

**Author Contributions:** Drs Colson and Corwin had full access to all data in the study and take responsibility for the integrity of the data and the accuracy of the data analysis.

**Study concept and design:** Colson, Willinger, Smith, Lister, Corwin.

**Acquisition of data:** Corwin.

**Analysis and interpretation of data:** Colson, Willinger, Rybin, Heeren, Lister, Corwin.

**Drafting of the manuscript:** Colson, Willinger, Lister. Critical revision of the manuscript for important intellectual content: All authors.

**Statistical analysis:** Rybin, Heeren.

**Obtaining funding:** Lister, Corwin.

**Administrative, technical, and material support:** Willinger.

**Study supervision:** Colson, Corwin.

**Conflict of Interest Disclosures:** None reported.

**Funding/Support:** This study was supported in part by grant U01 HD029067-09A1C from the Eunice Kennedy Shriver National Institute of Child Health and Human Development.

**Role of the Sponsor:** Dr Willinger was the program scientist from the Eunice Kennedy Shriver National Institute of Child Health and Human Development. She participated in the study design, analysis, and interpretation and in the drafting and review of the manuscript. The Eunice Kennedy Shriver National Institute of Child Health and Human Development approved the manuscript for submission for publication.

**Disclaimer:** The views expressed in this article are those of the authors and do not necessarily reflect the views of the National Institutes of Health or the Eunice Kennedy Shriver National Institute of Child Health and Development.

**REFERENCES**


