Risk Factors Associated With Sudden Unexplained Infant Death: A Prospective Study of Infant Care Practices in Kentucky

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ABSTRACT. Objective. To ascertain the prevalence of infant care practices in a metropolitan community in the United States with attention to feeding routines and modifiable risk factors associated with sudden unexplained infant death (specifically, prone sleeping position, bed sharing, and maternal smoking).

Methods. We conducted an initial face-to-face meeting followed by a telephone survey of 189 women who gave birth at a level I hospital in Kentucky between October 14 and November 10, 2002, and whose infants were placed in the well-infant nursery. The survey, composed of questions pertaining to infant care practices, was addressed to the women at 1 and 6 months postpartum.

Results. A total of 185 (93.9%) women participated in the survey at 1 month, and 147 (75.1%) mothers contributed at 6 months. The racial/ethnic composition of the study was 56.1% white, 30.2% black, and 16.4% biracial, Asian, or Hispanic. More than half of the infants (50.8%) shared the same bed with their mother at 1 month, which dramatically decreased to 17.7% at 6 months. Bed sharing was significantly more common among black families compared with white families at both 1 month (adjusted odds ratio [OR]: 5.94; 95% confidence interval [CI]: 2.71–13.02) and 6 months (adjusted OR: 5.43; 95% CI: 2.05–14.35). Compared with other races, white parents were more likely to place their infants on their back before sleep at both 1 and 6 months. Black parents were significantly less likely to place their infants on their back at 6 months compared with white parents (adjusted OR: 0.14; 95% CI: 0.06–0.33). One infant succumbed to sudden infant death syndrome at 3 months of age, and another infant died suddenly and unexpectedly at 9 months of age. Both were bed sharing specifically with 1 adult in the former and with 2 children in the latter.

Conclusions. Bed sharing and prone placement were more common among black infants. Breastfeeding was infrequent in all races. This prospective study additionally offers a unique perspective into the risk factors associated with sudden infant death syndrome and sudden unexplained infant death associated with bed sharing by examining the survey responses of 2 mothers before the death of their infants combined with a complete postmortem examination, scene analysis, and historical investigation. Pediatrics 2005;116:e13–e20. URL: www.pediatrics.org/cgi/doi/10.1542/peds.2004-2333; sudden infant death syndrome, infant care practices, bed sharing, feeding, smoking.

ABBREVIATIONS. SIDS, sudden infant death syndrome; OR, odds ratio; CI, confidence interval; SUID, sudden unexplained infant death.

Sudden infant death syndrome (SIDS) is the primary cause of postneonatal mortality in the United States and the third leading cause of infant death, following congenital anomalies and disorders related to prematurity and low birth weight.1,2 Initially defined in 1969 and with subsequent revisions in 1989, SIDS was defined as “the sudden death of an infant under one 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.”3,4 One of the authors of the present study coauthored the most recent working-group definition of SIDS in 2004: “SIDS is defined as the sudden unexpected death of an infant <1 year of age, with onset of the fatal episode apparently occurring during sleep, that remains unexplained after a thorough investigation, including performance of a complete autopsy and review of the circumstances of death and the clinical history.”5 Although various epidemiologic and pathologic features have been associated with SIDS, the diagnosis remains one of exclusion. SIDS is rarely encountered during the first month of life, peaks by the second or third month, and subsequently subsides.6 This age peak has been less pronounced in the last few years, as the overall SIDS rate has fallen.5

Numerous risk factors have been suggested as increasing the risk of SIDS, including low birth weight, male gender, black race, young maternal age, and multiparity.6–9 Several modifiable behaviors have also been associated with a higher risk of SIDS: the prone sleeping position, bed sharing, lack of breastfeeding, and maternal cigarette smoking.6–9 The term “cosleeping” is defined by some to encompass a variety of sleeping environments, ranging from intimate bed sharing to the presence of the infant’s crib or bassinet in the mother’s bedroom.10 In our study we used the term “bed sharing” to denote an infant’s...
sleeping in the same bed as the caregiver and, furthermore, have specified when an infant slept in the caregiver’s room in a crib or bassinet. Although the causes of SIDS remain to be elucidated, many toxic, infective, metabolic, nutritional, endocrine, cardiac, respiratory, and neurologic disorders have been proposed. The “‘triple-risk model’ of SIDS has been suggested, incorporating external stressors that impact a vulnerable infant during a critical stage in development. Apoptotic neurodegeneration may disturb nervous coordination and alter cardiorespiratory function, leading to SIDS.

Although a myriad of risk factors have been associated with SIDS, relatively little attention has focused on the prevalence of the behaviors related to these risk factors in society. Our study aims to highlight the pervasiveness of infant care practices in a moderately sized metropolitan community in the United States. We address various aspects of daily infant care, including sleeping environment, positioning before and on waking from sleep, feeding, and exposure to maternal cigarette smoke.

METHODS

Study Population

The study population consisted of women who had given birth to infants placed in the well-infant nursery at a level 1 metropolitan hospital in Kentucky between October 14 and November 10, 2002. All women provided written informed consent within 1 day of parturition. The participants were contacted by telephone when their infants were 1 month of age, with subsequent follow-up 6 months postpartum. A host of questions pertaining to infant care practices was addressed to the women. The women who were unable to be contacted by telephone were sent a written survey and asked to return their responses. The participants were not financially compensated for their involvement in this study. The study was approved by the University of Louisville Institutional Review Board before its initiation.

A thorough investigation was conducted into the deaths of 2 of the infants whose mothers had participated in this study. An extensive scene analysis and sudden unexplained infant death (SUID) investigation report form were completed by the Jefferson County coroner’s office in cooperation with the homicide unit of the Louisville Metro Police Department. Developed at the Interagency Panel on SIDS “Workshop on Guidelines for Scene Investigation of Sudden Unexplained Infant Deaths” in 1993 and updated in 1996, this Centers for Disease Control and Prevention form documents circumstances surrounding the infant’s death, the infant’s medical/birthing history, pertinent maternal history during pregnancy, subjective observations by the investigator of the surroundings at the death scene, interviews with family members of the deceased, and illustrations of the infant’s body.

Statistical Analysis

Statistical analysis was performed by using SPSS 11.0 for Windows (SPSS Inc, Chicago, IL). Associations between independent and outcome variables (bed sharing, positioning of infant on back, and breastfeeding) were assessed by using the χ2 or Fisher’s exact test. Logistic regression was used to calculate odds ratios (ORs) and 95% confidence intervals (CIs) for the 3 outcome variables associated with relevant factors at both 1 and 6 months. Potential risk factors for infant care practices were incorporated into the model, including race, maternal age, birth order, maternal employment, and cigarette smoking. Factors significantly associated with the outcome at P ≤ .05 in univariate analyses were introduced into logistic-regression models. Variables were removed from the multivariate model if they did not reach statistical significance.

RESULTS

Study Population

A total of 185 (93.9%) mothers participated in the survey 1 month postpartum, and 148 women were contacted 6 months postpartum. One infant whose mother contributed to the study at 1 month died at 3 months of age; therefore, 147 (75.1%) women were included in the 6-month survey. Four women were involved in the 6-month survey even though they had not participated in the 1-month survey. The sociodemographic features of the 189 participants in this study are highlighted in Table 1. The ages of the mothers ranged between 16 and 41 years, with an average age of 26.2 years. There was a total of 3169 live births at the hospital in 2002 with 304 (9.5%) admissions to the neonatal intensive care unit. A wide range of incomes was noted for the 3043 mothers who gave birth, with 24.1% below $15,000 per year and 6.6% above $100,000 per year.

Approximately one third of the households welcomed the infant as the first born (31.7%), second born (33.3%), or later born (34.9%). Three of the households had ≥4 children other than the newborn: 1 mother who cared for her 6 children between the 1 and 9 years old, 1 mother who had 5 children between 3 and 14 years old, and 1 woman who had 4 children between 6 and 11 years old.

A total of 100 (68.0%) women had resumed employment when contacted at the 6-month follow-up. Of these 100 mothers, 13 (8.8%) had returned to work <6 weeks postpartum, 73 (49.6%) between 6 and 12 weeks postpartum, and 14 (9.5%) between 13 and 24 weeks postpartum. A total of 92 (62.5%) women worked ≤40 hours per week, and 8 (5.4%) worked >40 hours per week. Of the 100 employed women, 24 (24.0%) had placed their infants in day care.

Sleep Practices

The infants’ sleep practices pertaining to sleeping position, bedding, and room environment with pos-

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>No. of Subjects (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Infant gender*</td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>92 (47.9)</td>
</tr>
<tr>
<td>Female</td>
<td>100 (52.1)</td>
</tr>
<tr>
<td>Infant race</td>
<td></td>
</tr>
<tr>
<td>White</td>
<td>106 (56.1)</td>
</tr>
<tr>
<td>Black</td>
<td>57 (30.2)</td>
</tr>
<tr>
<td>Biracial</td>
<td>19 (12.7)</td>
</tr>
<tr>
<td>Asian</td>
<td>5 (2.6)</td>
</tr>
<tr>
<td>Hispanic</td>
<td>2 (1.1)</td>
</tr>
<tr>
<td>Maternal age</td>
<td></td>
</tr>
<tr>
<td>19 y</td>
<td>20 (10.6)</td>
</tr>
<tr>
<td>20–29 y</td>
<td>112 (59.2)</td>
</tr>
<tr>
<td>≥30 y</td>
<td>57 (30.2)</td>
</tr>
<tr>
<td>Birth order</td>
<td></td>
</tr>
<tr>
<td>First born</td>
<td>60 (31.7)</td>
</tr>
<tr>
<td>Second born</td>
<td>63 (33.3)</td>
</tr>
<tr>
<td>Later born</td>
<td>66 (34.9)</td>
</tr>
<tr>
<td>Maternal employment (at 6 mo)</td>
<td></td>
</tr>
<tr>
<td>Employed</td>
<td>100 (68.0)</td>
</tr>
<tr>
<td>Unemployed</td>
<td>47 (32.0)</td>
</tr>
</tbody>
</table>

* Includes 2 sets of male-female twins and 1 set of male-male twins.

TABLE 1. Sociodemographic Characteristics of Mothers and Their Infants
possible bed sharing are presented in Table 2. More than half of the infants (50.8%) shared a bed with their mother at 1 month of age, which drastically decreased to only 17.7% at 6 months of age. Compared with white infants, black infants were significantly more likely to bed share at both 1 month (adjusted OR: 5.94; 95% CI: 2.71–13.02) and 6 months (adjusted OR: 5.43; 95% CI: 2.05–14.35) (Table 3). Biracial, Asian, and Hispanic infants were also more likely to bed share at 6 months compared with white infants (adjusted OR: 4.55; 95% CI: 1.28–16.17). A total of 24 infants always bed shared at 1 month, reflecting 25.5% of those who bed shared and 13.0% of all infants. Furthermore, 21 infants shared a bed at every sleeping period with their parents at 6 months, accounting for 80.8% of the bed-sharers and 14.3% of the total number of infants.

The majority of infants were placed on their back at both 1 and 6 months (67.0% vs 68.0%) (Table 2). It is particularly notable that at 6 months, only 42.2% of the infants remained on their backs when they were woken by their caregiver, whereas 21.1% had turned to the supine position and 29.2% were discovered in varied positions on waking. In univariate analysis, white parents, compared with other races, were more likely to place their infants on their backs at 1 month (P = .02) and 6 months (P < .0001). Placement of the infant on the back was significantly less common by black parents compared with white parents at 6 months (adjusted OR: 0.14; 95% CI: 0.06–0.33) (Table 3). Mothers who had given birth to ≤3 children were significantly less likely to place their newborn on his or her back at 1 month of age compared with women who had given birth to their first child (adjusted OR: 0.38; 95% CI: 0.17–0.85). Furthermore, women ≥30 years were more likely to position their infants on their back at 6 months compared with mothers <30 years old (P < .002), a finding marginally significant on multivariate analysis when compared with women ≤19 years (adjusted OR: 3.86; 95% CI: 0.99–15.14). Infants who shared a bed with their parents at 1 month were significantly less likely to be placed on their back before sleeping compared with those who slept in a bassinet or crib (adjusted OR: 0.43; 95% CI: 0.21–0.89).

A total of 87 (47.0%) infants slept only in a crib and/or bassinet at 1 month, which drastically increased to 119 (80.9%) at 6 months (Table 2). Ten percent of infants bed shared with their mothers at every sleeping period. At 1 month, 3 infants slept on a couch with their mother. The majority (71.3%) of infants slept in their mother’s room at 1 month of age, whereas a higher percentage slept in their own room compared with their mother’s at 6 months (53.7% vs 46.3%).

### Smoking Habits

Of the 185 women contacted at the 1-month survey, 49 (26.5%) admitted that they smoked cigarettes. Of these 49 mothers, 47 (95.9%) smoked ≤1 pack per day, and 2 (4.1%) smoked >1 pack per day. A total of 42 (85.7%) women smoked only outside, whereas 7 (14.3%) smoked inside. Furthermore, 35 (23.8%) of the 147 women contacted at 6 months postpartum smoked cigarettes. Of these 35 women, 33 (94.3%) smoked ≤1 pack per day, and 2 (5.7%) smoked >1 pack per day. A total of 30 (85.7%) mothers stated that they smoked only outside, whereas 5 (14.3%) smoked inside.

In univariate analysis, compared with mothers who smoked, women who abstained from smoking cigarettes were more likely to breastfeed their infants at 1 month (P < .0001) and were more likely to share a bed with their infants at 6 months (P < .015). These findings were not significant in the multivariate analysis (Table 3).

### Feeding Practices

A total of 135 (73.0%) infants were only fed formula at 1 month of age (Table 4). Only 25 (13.5%) infants consumed breast milk as their sole sustenance: 20 (19.0%) of the 105 white infants, 4 (7.3%) of the 55 black infants, and 1 (5.3%) of the 19 biracial infants. One hundred and twenty-nine (87.8%) infants were fed both formula and semisolids at 6 months of age. No infants were exclusively breastfed at 6 months. Feeding practices in relation to race were not statistically significant at either 1 or 6 months (data not shown). A total of 106 (56.3%) infants were fed both formula and semisolids at 6 months of age. No infants were exclusively breastfed at 6 months. Feeding practices in relation to race were not statistically significant at either 1 or 6 months (data not shown). A total of 106 (56.3%) infants were fed both formula and semisolids at 6 months of age. Compared with women ≤19 and ≥30 years, women between 20 and 29 years old were significantly less likely to breastfeed their infants at 1 month (adjusted OR: 0.16; 95% CI: 0.06–0.45) (Table 3).

### Deceased Infants

The preliminary 2002 state vital statistics records reported that the infant mortality rate for the county

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**TABLE 2. Sleeping Practices at 1 and 6 Months of Age**

<table>
<thead>
<tr>
<th>Infant bed shared for naps/night</th>
<th>Age 1 mo (n = 185)</th>
<th>Age 6 mo (n = 147)</th>
</tr>
</thead>
<tbody>
<tr>
<td>No</td>
<td>91 (49.2)</td>
<td>121 (82.3)</td>
</tr>
<tr>
<td>Yes</td>
<td>94 (50.8)</td>
<td>26 (17.7)</td>
</tr>
<tr>
<td>Infant placed in bed</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Back</td>
<td>124 (67.0)</td>
<td>100 (68.0)</td>
</tr>
<tr>
<td>Side</td>
<td>26 (14.0)</td>
<td>13 (8.8)</td>
</tr>
<tr>
<td>Stomach</td>
<td>0</td>
<td>17 (11.6)</td>
</tr>
<tr>
<td>Combinations</td>
<td>35 (18.9)</td>
<td>17 (11.6)</td>
</tr>
<tr>
<td>Infant wakes in bed (at 6 mo)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Back</td>
<td>NA</td>
<td>62 (42.2)</td>
</tr>
<tr>
<td>Stomach</td>
<td>NA</td>
<td>31 (21.1)</td>
</tr>
<tr>
<td>Side</td>
<td>NA</td>
<td>11 (7.5)</td>
</tr>
<tr>
<td>Combinations</td>
<td>NA</td>
<td>43 (29.2)</td>
</tr>
<tr>
<td>Bedding</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Crib/bassinet only</td>
<td>87 (47.0)</td>
<td>119 (80.9)</td>
</tr>
<tr>
<td>Parent’s bed only</td>
<td>19 (10.3)</td>
<td>15 (10.2)</td>
</tr>
<tr>
<td>Combinations</td>
<td>72 (38.9)</td>
<td>12 (8.2)</td>
</tr>
<tr>
<td>Other</td>
<td>7 (3.8)</td>
<td>1 (0.68)</td>
</tr>
<tr>
<td>Room in which infant sleeps</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Parent’s room</td>
<td>132 (71.3)</td>
<td>68 (46.3)</td>
</tr>
<tr>
<td>Infant’s room</td>
<td>29 (15.7)</td>
<td>79 (53.7)</td>
</tr>
<tr>
<td>Living room with parents</td>
<td>4 (2.2)</td>
<td>0</td>
</tr>
<tr>
<td>Unknown</td>
<td>20 (10.8)</td>
<td>0</td>
</tr>
</tbody>
</table>

NA indicates not applicable.
was delivered vaginally at 37 weeks’ gestation. The white female newborn weighed 6 pounds, 4 oz (2840 g) with a length of 18 inches. Her 26-year-old mother had previously sustained 3 miscarriages and had given birth to 2 infants. She suffered from premature labor and depression during her pregnancy and was placed on the nonscheduled antidepressant fluoxetine (Prozac). The infant was evaluated at the local emergency department 6 days before her death for “viral” congestion and experienced increased fussiness and decreased appetite within the last 24 hours of her life. The mother recalled that she placed her infant in the supine position next to her on a queen-sized bed (Fig 1). Apart from a “whimper” within 1 hour of falling asleep, the mother denied any unusual circumstances and awoke to observe her daughter unresponsive and lifeless lying on her right side. A complete postmortem examination with tox-
Ecological and genetic studies revealed no cause of death. Rare thymic and pleural petechiae and pulmonary edema were noted at autopsy. The findings of this 3-month-old infant were consistent with SIDS, with bed sharing as a recognized confounding factor.

The mother of the first deceased infant shared her infant care practices during the 1 month survey. The infant’s mother lived with the father of the infant and her 2 other children aged 3 and 5 years. She admitted to smoking a half-pack of cigarettes per day outside. Because of reflux concerns, the mother alternated placing her daughter on her back and side before sleep. The infant slept with her mother 2 nights per week and slept in a bassinet the remainder of the week. The infant never breastfed and consumed 4 to 5 oz of formula every 3 to 5 hours at 1 month of age.

The second infant, a white infant boy, was delivered vaginally at 37 weeks’ gestation with an initial weight of 5 pounds, 13 oz (2650 g) and length of 17 inches. At 9 months of age, the infant was discovered in cardiopulmonary arrest by his 10-year-old sister lying in an adult full-sized bed between his 12-year-old sister and a 13-year-old cousin (Fig 2). Historical information indicated that overlying was not occurring when the infant was discovered. The family denied any medical illnesses or other symptoms before death. The infant had been evaluated by his pediatrician for a well-infant check-up reported as normal and was immunized 3 weeks before his death. His pediatrician indicated that the infant had fallen behind on his well-infant visits and immunizations and failed to appear at 6 appointments. Physical findings included facial petechiae. Intrathoracic petechial hemorrhages, specifically involving the thymus gland, epicardial heart, and lungs, were not present. No anatomic or toxicological cause of death was determined after a complete postmortem examination. The authors consider this SUID undetermined as to both cause and manner. The possibility of asphyxiation via overlay in this bed-sharing scenario has not been totally excluded.

The mother of the second infant discussed her infant care practices at both 1 and 6 months. The infant lived with his parents and 4 siblings between the ages of 3 and 12 years. The mother disclosed that she smoked half a pack of cigarettes per day outside and in her bathroom at both survey periods. She placed her son on his side for sleeping at 1 month and alternated placement on the back and side at 6 months. At 1 month, the infant slept with his mother 2 nights per week and in the crib for the remainder of the week which was located in his mother’s room. He slept every night in the crib, which was still present in the mother’s room at 6 months. The infant was never breastfed and consumed 4 to 5 oz of formula every 3 to 4 hours at 1 month and 8 oz of formula every 2 hours, 1 jar of semisolids per day, and mashed potatoes at 6 months.

Fig 1. Queen-sized bed that a 3-month-old infant bed shared with her mother. Note the extensive disarray of the bedroom.

Fig 2. Double bed with soft bedding in which a 9-month-old infant was discovered lying between his 12-year-old sister and 13-year-old cousin.
Although the etiology of SUID remains unknown, a host of modifiable risk factors has been suggested as increasing the risk of SUID, including prone sleeping, bed sharing, and maternal smoking.\textsuperscript{5,14–17} The Back to Sleep campaign initiated in 1994 by the US Public Health Service, American Academy of Pediatrics, the SIDS Alliance, and the Association of SIDS and Infant Mortality Programs urged caregivers to place their infants on their back before sleeping, which in turn decreased the frequency of prone sleeping from 70% in 1992 to 24% in 1996 and decreased the SIDS rate by \textgreater 36%.\textsuperscript{14,18,19} Willinger et al\textsuperscript{19–21} initiated the National Infant Sleep Position Study in 1992, highlighting infant sleeping position and the practice of bed sharing. Between 1994 and 1998, they reported that placement in the supine position increased from 27% to 38% for white infants and from 17% to 31% for black infants.\textsuperscript{20} Willinger et al also documented that by 1998, 17% of infants continued to be placed prone and 56% in the supine position.\textsuperscript{20} Prone placement was significantly more common among black women, mothers aged 20 to 29 years with a previous child, women living in the mid-Atlantic or southern region of the country, and for infants <8 weeks old.

In our study, black mothers and women who had given birth to \geq2 children were also significantly more likely to place their infants prone. The majority of infants were placed in the supine position at both 1 and 6 months (67% and 68%, respectively). None of the infants at 1 month was placed solely on his or her stomach at every sleeping period, whereas 11.6% of infants at 6 months were always placed prone.

Infants placed in a specific position before sleep may be found in a different position on waking. The developmental milestone of rolling over is attained by 75% of infants by 4 months of age.\textsuperscript{22} In this respect, as they grow and develop, infants roll with increasing frequency, thus increasing the likelihood that they will assume different positioning during sleep. Willinger et al\textsuperscript{19} reported that the percentage of infants placed prone was similar to that discovered prone (28% vs 24% in 1996), whereas more infants were found supine than were placed in that position (50% vs 35% in 1996). At 6 months of age in our study, 68% of the infants were placed on their back, and only 42.2% were discovered on their back. More infants were found in the supine position than were placed supine (21.1% vs 11.6%).

The supine sleeping position of an infant has been recommended internationally, with various ensuing alterations in sleeping practices. The nonprone sleeping position was recommended in Sweden in April 1992 by the Swedish Board of Health and Welfare for infants \textgreater1 month of age.\textsuperscript{23} In a 1994–1995 survey conducted by Lindgren et al\textsuperscript{23} of Swedish parents of 1028 infants, 15.3% of infants were placed in the prone position compared with 72% in 1991. Mothers who placed their infants in the prone position were more likely to participate in other behaviors associated with an increased risk of SIDS such as formula feeding their infant and smoking. The percentage of infants placed prone was significantly lower in a 1997 survey in Canterbury, New Zealand, compared with that recorded in the 1987–1990 New Zealand Cot Death Study (2.9% vs 39.7%, respectively), suggesting that the “nonprone sleeping” mission in Canterbury was effective.\textsuperscript{24}

The benefits and risks of bed sharing have been debated extensively without a resolution. The American Academy of Pediatrics in 1997 strongly discouraged bed sharing on soft sleep surfaces and in situations with a caregiver who smoked or used alcohol or drugs.\textsuperscript{25} Advocates of bed sharing embrace the maternal-infant bond that is nurtured through the close proximity of mother and infant during sleep. The mother is able to respond promptly to the needs of her infant while providing protection and emotional security.\textsuperscript{26} In addition to the physiologic and psychological benefits of bed sharing, McKenna et al\textsuperscript{27} suggest that bed sharing encourages breastfeeding. Infants who routinely bed shared were twice as likely to breastfeed and for a 39% longer duration of time during the night compared with infants who slept alone. Our study shows that only 13.5% of women solely breastfed, and an additional 13.5% combined breastfeeding and formula use at 1 month postpartum. Furthermore, only 4.1% of infants consumed breast milk in combination with formula at 6 months of age.

The Willinger et al National Infant Sleep Position Study\textsuperscript{21} reported that 45% of infants had spent a portion of time on an adult bed in the preceding 2 weeks and that \textgreater90% of infants who usually slept on an adult bed shared it with their parents. The percentage of infants who shared an adult bed increased from 5.5% to 12.8% between 1993 and 2000. Bed sharing was significantly more common with mothers \textless18 years old, in black families, and with those living in the South. In a study of low-income, inner-city mothers by Brenner et al,\textsuperscript{28} 48% of infants usually slept in a bed with a parent or other adult from 3 to 7 months of age, which only decreased by 1 percentage point from 7 to 12 months. A total of 75% of infants who bed shared from 3 to 7 months old continued this practice from 7 to 12 months. The results of our study showed that more than half of the infants shared a bed with their mother at 1 month of age, which decreased to only 17.7% at 6 months. In addition, black mothers were significantly more likely to share a bed with their infant at 1 month, and black, biracial, Asian, and Hispanic women were significantly more likely to bed share at 6 months.

Ten percent of infants in our study always shared a bed with their mother at both 1 and 6 months of age. Certain women who advocated bed sharing with every sleeping period admitted that the fear of “crib death” and the possibility of “the infant’s leg getting caught in the crib” deterred them from placing their infant in a crib. Numerous individuals sharing a single bed was encountered in 3 households. In 1 household, a mother, father, 2-year-old child, and the new infant shared a bed at 1 month. At 6 months, a mother, a 6-year-old child, a 3-year-old child, and the infant shared a bed. In another case at 6 months,
a mother, a 4-year-old child, a 2-year-old child, and the infant shared a bed.

The sleeping environment of the infant may contain hazards that may prove fatal. These risks include overlaying of the infant by another individual, entrapment or wedging between the mattress and another object such as a wall, head entrapment in the bed railings, and suffocation. Infants often fail to extricate themselves from perilous sleeping situations because of their poorly developed motor skills and muscle strength.

Infants were 8.1 times more likely to die in an adult bed and 17.2 times more likely to die on a sofa or chair in the 1990s compared with the 1980s. Furthermore, the risk of suffocation was 40 times greater for infants in adult beds opposed to those in cribs. In a study of 119 infant deaths by Kemp et al., SIDS was the diagnosis in 88 cases, accidental suffocation in 16, and undetermined in 15. Infants were discovered in the prone position in 61.1% of cases, on a sleep surface not designed for infants in 75.9%, and sharing a sleeping surface with another individual in 47.1% of cases. In a study of 697 cases of unexpected infant death between 1991 and 2000 in Kentucky by Knight et al., 65% of the deaths were attributed to SIDS, 16% to unintentional asphyxia and overlay, and 19% to undetermined causes. A total of 36.2% of all infants had been bed sharing with children or adults at the time of death. In an attempt to decrease the risk of infant mortality resulting from bed sharing, researchers have suggested that the infant sleep in his or her crib and/or bassinet placed next to the parental bed.

Our study showed that only half of the infants slept in a crib and/or bassinet at 1 month, which drastically increased with age. Approximately three fourths of infants slept in their parents' room, either bed sharing or in a crib and/or bassinet at 1 month, compared with less than half at 6 months.

Maternal cigarette smoking during pregnancy and smoking in the home of the infant after birth have been recognized as major risk factors for SIDS. In a case-control study by Klonoff-Cohen et al., passive smoke from the mother, father, and other live-in adults in the vicinity of an infant increased the risk of SIDS. A dose-response effect was observed with a greater risk of SIDS with increasing amounts of smoke exposure. Furthermore, bed sharing by infants with smoking mothers poses a stronger risk compared with those with mothers who abstain from smoking. In our study, 26.5% of mothers smoked cigarettes at 1 month postpartum, which minimally decreased at the 6-month period. Non-smoking mothers were significantly more likely to breastfeed their infants at 1 month and bed share at 6 months.

Breastfeeding has been associated with a decreased risk of SIDS. This practice has increased in popularity throughout the 1990s. A Lindgren et al. survey reported that a total of 724 (70.4%) infants breastfed, whereas 176 (17.1%) were solely formula fed. Breastfeeding was seldom encountered in our study. A total of 135 (73.0%) infants were fed only formula at 1 month of age, whereas 25 (13.5%) were only breastfed. Women between 20 and 29 years old were significantly less likely to breastfeed at 1 month. A common explanation given by responders for the lack of breastfeeding was overwhelming breast discomfort with the practice with a previous child. Maternal smoking was given as another reason for formula feeding. One woman assumed that smoking while breastfeeding was not recommended, and another woman stated that she had been informed by a nurse at the hospital after the birth of her infant that nicotine within breast milk is harmful to an infant and that a smoker, therefore, should not breastfeed. A total of 129 (87.8%) infants consumed both formula and semisolids at 6 months of age, whereas only 17 (11.6%) breastfed in conjunction with other food items. There was a large variation in the introduction of solid foods. One mother believed that Gerber semisolid food within a jar was "modern medicine" and needed to discuss its use with her pediatrician before allowing her infant to consume it. In contrast, 1 woman stated that her 6-month-old infant enjoyed chewing on chicken bones, and another mother reported that her 6-month-old infant devoured spaghetti and meatballs.

CONCLUSIONS

The deaths of 2 of the infants whose mothers had participated in our study provided us a unique opportunity to assess their various infant care practices before their demise. The death of the 3-month-old was consistent with SIDS, whereas the 9-month-old's death was attributed to SUID. Both fatalities were associated with bed sharing in a standard adult bed. The mothers of both infants smoked cigarettes, and neither infant was breastfed at any time in their lives. In the case of the infant who died at 3 months, she was alternately placed on her back and side before sleep at 1 month. The other infant was placed on his side at 1 month and alternately was placed and woke on his back and side at 6 months.

This study highlights major differences in child care practices of the black population compared with other races. Compared with white parents, black parents were significantly more likely to bed share at both 1 and 6 months and were significantly less likely to place their infants on their back before sleep at 6 months. These observations may be related to the marked differences in countywide infant mortality rates in that the infant mortality rate of black infants was more than twice that of white infants for the study year. Furthermore, McKenna's promotion of bed sharing as a tool to both encourage and lengthen the duration of breastfeeding may be ineffective in the high-risk black population, because they are significantly more likely to bed share compared with other races, although feeding practices by race were not statistically significant in this study.

The findings gleaned in this prospective study may impact infant care practices by highlighting the pervasiveness of specific behaviors associated with an increased risk of SUID. In this respect, special attention may be addressed to inform and educate at-risk groups in our society.
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