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Evaluation of Bedtime Basics for Babies: A National Crib Distribution Program to Reduce the Risk of Sleep-Related Sudden Infant Deaths

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Abstract

Rates of sleep-related infant deaths have remained stagnant in recent years. Although most parents are aware of safe sleep recommendations, barriers to adherence, including lack of access to a safe crib, remain. The objective of this study was to describe parental knowledge and practices regarding infant sleep position, bedsharing, pacifier use, and feeding practices before and after receipt of a free crib and safe sleep education. Bedtime Basics for Babies (BBB) enrolled high-risk families in Washington, Indiana, and Washington, DC and provided them with cribs and safe sleep education. Parents completed surveys before ("prenatal" and "postnatal") and 1–3 months after crib receipt ("follow-up"). Descriptive and bivariate analyses were completed. 3,303 prenatal, 1,483 postnatal, and 1,729 follow-up surveys were collected. Parental knowledge of recommended infant sleep position improved from 76 % (prenatal) and 77 % (postnatal) to 94 % after crib receipt ($p < 0.001$). Intended use of supine positioning increased from 84 % (prenatal) and 80 % (postnatal) to 87 % after the intervention ($p < 0.001$). Although only 8 % of parents intended to bedshare when asked prenatally, 38 % of parents receiving the crib after the infant's birth reported that they had bedshared the night before. This decreased to 16 % after the intervention. Ninety percent reported that the baby slept in a crib after the intervention, compared with 51 % postnatally ($p < 0.01$). BBB was successful in changing knowledge and practices in the majority of

high-risk participants with regards to placing the infant supine in a crib for sleep. Crib distribution and safe sleep education positively influence knowledge and practices about safe sleep.

Keywords

Safe sleep; Bedsharing; Breastfeeding; Sleep position

Introduction

Since the launch of the *Back to Sleep* campaign in 1994, the rates of sudden infant death syndrome (SIDS) have declined by more than 50 %. Despite this tremendous progress, the United States continues to rank 49th among nations in overall infant mortality rates [34], and SIDS (ICD 10 R95) remains the leading cause of death for infants 1 month to 1 year of age [20]. Further, the rates of other causes of sudden and unexpected infant death in sleep environments (i.e., sleep-related deaths), such as accidental suffocation or strangulation in bed (ICD 10 W75) and ill-defined deaths (ICD 10 R99), are increasing. Currently, ~4,000 deaths annually in the US are attributed to SIDS and other sleep-related infant deaths [29].

Studies show that most parents are aware of safe sleep recommendations [23], and that this does not vary by race-ethnicity. However, there are still many barriers to influencing parental behavior and to creating safe sleep environments for infants, which would further decrease infant mortality. Adherence to supine sleep recommendations has plateaued since 2001, at a level well below targets [24]. Further, US public health efforts have been less successful in influencing behaviors with regards to soft bedding and bed-sharing in high-risk groups [26]. Currently, approximately half of SIDS and other sleep-related infant deaths in the US occur while the infant is sharing a sleep surface [1, 6, 17, 36], and most occur in the presence of multiple unsafe sleep practices (such as prone/side positioning, use of soft bedding, bedsharing, and pacifier nonuse) [25, 30, 31]. In addition, there are racial disparities in all of these sleep-related deaths. Black infants are twice as likely to die from SIDS, accidental suffocation and strangulation in bed, and ill-defined deaths, compared to White and Hispanic infants [20]. While the increased mortality rate in Blacks is disturbing, it is also concerning that rates of unsafe sleep practices may be increasing in other racial/ethnic groups as well [9]. Rates of prone positioning, parent-infant bedsharing, and use of soft bedding are higher among Blacks [7, 10–12, 14, 19, 26, 28, 33, 37, 38] infants of younger parents [10, 33, 38] and those of lower educational and socioeconomic status [7, 10, 28, 38]. Breastfeeding, a strongly protective factor against SIDS [15], is also less common among these same groups [13].

There is growing evidence that roomsharing without bedsharing is associated with a reduced risk of SIDS [2, 5, 32]. Several countries, including the US, currently recommend that infants sleep in a crib or bassinet next to the parents' bed. The American Academy of Pediatrics (AAP) recommends a separate but proximate sleep environment (i.e., the infant should be in a crib/bassinet in the parent's room), or roomsharing without bedsharing [21]. However, although most parents are aware that bedsharing is not recommended, many

parents continue to do so for a number of reasons, including lack of access to a safe crib and the belief that babies are safer sleeping with them [16].

It has been shown that safe sleep education, particularly when it addresses misconceptions, is effective in changing beliefs and practices [22]. To address the lack of cribs that some families cite as a reason for bedsharing, a number of free crib distribution programs have been implemented throughout the US. However, with the exception of one study that surveyed 105 families who received cribs [4], no large-scale evaluation of the impact of crib distribution programs has been conducted.

In 2007, First Candle, a national non-profit organization whose mission is to promote infant health and survival during pregnancy through the first years of life, received funding from the Gates Foundation to establish and implement a multi-state crib distribution program called the Bedtime Basics for Babies (BBB) project. BBB was developed to distribute cribs to high-risk families and to provide education about safe sleep and how to reduce the risk for SIDS and other sleep-related infant deaths. In addition to the education and crib, high-risk families were given a Safe Sleep Kit, containing pacifiers and a wearable blanket, both of which have been recommended to reduce the risk of SIDS [21]. A total of 17,243 cribs and Safe Sleep Kits were distributed in Washington State, Indiana, and Washington, DC to low-income families whose infants were at high risk for SIDS. During the first 2 years of the project, data were collected, both before and after the cribs were distributed, about parental beliefs, attitudes and practice with regards to infant health and safety, and the impact of receiving a free crib for the infant. This paper describes analysis of these data to identify the usefulness of crib donation programs and inform future practices.

The specific aims of the study were:

1. To describe parental knowledge of the recommended infant sleep position and self-reported practices regarding infant sleep position and differences by race-ethnicity.
2. To compare bedsharing rates among parents before and after receipt of the crib, and to describe differences by race-ethnicity.
3. To describe use of pacifiers and feeding methods of mothers before and after receipt of the Safe Sleep Kit and education materials.

Methods

Study Design and Setting

BBB was a prospective cohort study. Data were collected in 2010–2011 in Washington State, Indiana, and Washington, DC. These regions were selected by the Gates Foundation for participation in BBB. Nonetheless, when one compares the demographics that place infants at high risk for SIDS, the collective demographics of the study states were similar in that time period to those of the US [18, 35], as noted in Table 1.

Participant Eligibility and Identification

BBB focused on serving families with financial need whose infants were at highest risk for SIDS and sleep-related deaths. Criteria included: (1) no crib in the home; (2) low-income status (Medicaid or SCHIP eligibility, WIC program eligibility; or family income < 150 % of federal poverty level), and (3) at least one risk factor for SIDS and sleep-related death (African American, American Indian or Alaska Native, maternal smoking, pre-term or low birth weight, or sibling of a SIDS infant). Families were identified in the prenatal, perinatal, or postpartum periods by different sources including, but not limited to, WIC programs, obstetricians, pediatricians, family physicians, healthcare clinics, and social workers. Upon identification, families were referred to the crib distribution agency for eligibility determination.

While all families meeting the above criteria were eligible to receive a crib, only families in which at least one parent was 18 years of age or an emancipated minor were eligible for this study. Trained staff at the distribution sites identified eligible families and asked them to participate in this study. Each family was asked to sign written informed consent to participate. Each qualifying family received a crib (Travel Tender Playard™), a Safe Sleep Kit (crib sheet, wearable blanket and pacifier), and educational materials about reducing the risk of SIDS and sleep-related infant death and encouraging breastfeeding. Educational materials were evaluated for cultural competence and were appropriate for low-literate families. Materials were available in both English and Spanish. A pre-survey was administered to one parent in each family by a staff member of the crib distribution site prior to provision of the crib, Safe Sleep Kit, and educational materials. Two surveys were developed, one for families receiving a crib before the birth of the infant (“prenatal”) and one for families receiving a crib after the infant’s birth (“postnatal”). All survey questions had been previously validated and asked about demographic information, knowledge of safe infant sleep practices, and intended or actual practices with regards to infant care. Families also received education about correct crib set-up before leaving the crib distribution agency. Families who did not wish to participate in this study were still eligible to receive a crib.

Families also participated in a follow-up survey 1–3 months after receiving the crib. This survey was administered by either a project staff member or a visiting nurse. If a visiting nurse was planning to see the family because of clinical care or case management reasons, the nurse administered the survey during that visit. If no visiting nurse visit was planned, a project staff member administered the survey by phone. This survey inquired about knowledge and behavior with regards to safe infant sleep practices and about the family’s satisfaction with the crib distribution process.

Only de-identified data were collected in the surveys and provided to the research team. Contact information for crib recipients was kept in a separate database for use by the crib distribution sites only for purposes of follow-up if consented for this purpose. Institutional review board approval was obtained by every participating site: Children’s National Medical Center (Washington, DC), District of Columbia Department of Health, St. Joseph Hospital (Indianapolis), Portland Area Indian Health Service, Seattle Children’s Hospital, and the University of Virginia.

Data Analysis Plan

The overall purpose of this investigation was to evaluate the effectiveness of the BBB crib distribution programs in (1) providing cribs and Safe Sleep Kits to families, and (2) providing education with regards to reducing the risk of SIDS and sleep-related infant deaths.

The data sources for the project included a survey completed at the time of the crib distribution, either before (prenatal) or after (postnatal) the infant's birth, and a follow-up survey (completed either by the distribution site or the visiting nurse).

Analysis included descriptive statistics consisting of measures of central tendency and variability, mean, standard deviation (SD) and standard error of the mean (SEM), range, minimum and maximum observations, median, and inter-quartile range. Comparing groups for categorical data by stratified comparative analyses involving Chi squares and/or Fisher's exact test and comparing groups for continuous data by analysis of variance or *t* tests and/or Kruskal–Wallis test was used to assess and understand simple relationships, including defining first order effect modification.

Bivariate analyses, using the Chi square or Fisher's exact test, assessed whether or not the outcomes were associated with the predictor variables being studied. For all tests of significance, an alpha of 0.05 was used as the significance level.

Power and Sample Size Calculations

The data were collected at delivery of the crib, and a subsequent smaller follow-up study was conducted on a portion of the parents. In total 4,786 parents completed the initial survey at the time of crib receipt. Of these 3,303 cribs were delivered prenatally and 1,483 were delivered postnatally. A total of 1,729 parents also completed the follow-up survey and 92 received a follow-up home visit.

Approximately 32 % of parents in the program received the crib after the child's birth. Since we have data after the child's birth, and both before and after crib receipt, this subgroup was used to directly assess change in behavior.

Based on national data, baseline all night bed sharing was estimated to be 44 % [38]. We expected the crib distribution program to reduce this rate by half. The estimated sample size needed to detect an actual rate of 22 % in the follow-up survey with 90 % power at a 5 % significance level was 47. Since the total follow-up included 1,729 parents, the sample size was more than adequate. All parents in the follow-up survey were included in the initial survey. Because pre-crib receipt and follow-up responses could not be linked, comparisons between pre-receipt and follow-up surveys were treated as comparisons between independent samples.

Results

A total of 3,303 prenatal surveys, 1,483 postnatal surveys and 1,729 follow-up surveys were collected in this study. Since there were only 92 home visits, these survey responses were

not included in the following analyses. There were some differences in demographics between the prenatal population and the postnatal population. There were slightly more African American mothers (42 %) and fathers (49 %) in the prenatal survey group compared with 37 and 44 %, respectively, in the postnatal group ($p < 0.05$ for both comparisons). There were also more smokers in the postnatal survey (30 %) compared to the prenatal survey (25 %, $p < 0.01$; Table 2).

The first aim was to describe parental knowledge of the recommended infant sleep position and the actual sleep placement of the infant. Seventy six percent of mothers who completed the survey prenatally stated correctly that the recommended sleep position for healthy babies was on their back. Similarly, 77 % of mothers who completed the survey postnatally chose the correct response. After the intervention, this increased significantly to 94 % of mothers stating that the recommended sleep position was on the baby's back ($p < 0.001$, Table 3). The mothers were also asked in what position they were going to place their baby for sleep (prenatal survey) or in what position they placed the baby for sleep last night. There was a statistically significant difference between the prenatal survey responses and the postnatal survey responses, with 84 and 80 % responding with "back only", respectively ($p < 0.001$). In the follow-up survey, the response for "back only" increased to 87 % ($p < 0.001$, Table 3). The prenatal and postnatal survey data were then analyzed by maternal race, and the results were significant in both surveys ($p < 0.001$); prenatally, 90 % of White, non-Hispanic mothers, compared with 81 % of Black and White Hispanic mothers, and 86 % of American Indian mothers, planned to place their infants on the back for sleep. Post-natally, 85, 77, 86, and 85 % of White, non-Hispanic, Black Hispanic, White Hispanic, and American Indian mothers, respectively, placed their infants supine. There were no race data available for the follow-up survey.

There were also significant differences in the bedsharing rates between the prenatal and postnatal surveys and between the postnatal and follow-up surveys. Bedsharing was defined as sharing a bed, sofa or armchair with anyone. Only 8 % of parents intended to bedshare when asked prenatally, while 38 % had bedshared the prior night when asked postnatally. After the intervention, bedsharing rates decreased to 16 % ($p < 0.001$, Table 3). The difference in rates of bedsharing by maternal race was also statistically significant in both the prenatal and postnatal surveys ($p < 0.001$); prenatally, 5 % of White non-Hispanic mothers planned to bedshare, while 8 % of Black mothers, 9 % of White Hispanic mothers and 15 % of other mothers planned to bedshare. Postnatally, 25, 41, 57 and 50 % of White non-Hispanic, Black, White Hispanic and other mothers, respectively, bedshared. There were no race data available for the follow-up survey. In addition, there was a significant difference between smoking mothers who planned to bedshare (prenatal 9 %) and smoking mothers who reported bedsharing (postnatal 33 %, $p < 0.001$). The proportion of smoking mothers who bedshared decreased to 22 % in the follow-up survey ($p < 0.01$).

Prenatally, 81 % of mothers planned to use a pacifier, while only 71 % used a pacifier postnatally. This did not change significantly in the follow-up survey (74 %). There was a large intent to exclusively or partially breastfeed in the prenatal survey (81 %) while postnatally, this decreased to 47 %. This did not change in the follow-up survey (47 %).

Sleep location also varied across the three surveys. Ninety-one percent in the prenatal survey said that the baby would sleep in a crib or bassinet, while only 51 % of mothers in the postnatal survey responded that their baby slept in a crib or bassinet ($p < 0.01$). In the follow-up survey and after crib receipt, 90 % of mothers responded that their baby slept in a crib or bassinet ($p < 0.01$).

Mothers were asked where their baby would sleep if they had not received the BBB crib. The top five responses were as follows: (1) in another crib (38 %); (2) in parents' bed (32 %); (3) other (7 %); (4) in a bed with someone other than parents or sibling (6 %); and (5) car seat or infant seat (4 %).

Discussion

BBB is the most comprehensive and largest existing dataset that includes pre- and post-crib distribution family survey data allowing for critical program evaluation. Many crib donation programs are active throughout the US, but to date and to our knowledge, there has been only one publication evaluating the effectiveness of one program [4]. Considering the large outlay of resources involved in crib donation programs, this evaluation is timely and overdue. In addition, since the BBB targeted high-risk families (low income, ethnic minorities that are highest risk, including African Americans and American Indians), the results of the analysis have the potential to bring attention and additional funding to similar crib donation and safe sleep education programs.

The primary objective of the BBB program was to provide a safe crib to mothers who otherwise did not have access to one to reduce the prevalence of bedsharing, a potentially unsafe sleep environment for a newborn infant. The results of the analysis show that this objective was achieved. While intent to use a crib or bassinet was high, only half of the mothers reported using one postnatally (before receiving the BBB crib). After receipt of the crib, 90 % of mothers responded that their baby slept in a crib. Bedsharing rates decreased to 16 % post-intervention compared with 38 % postnatally. Among smoking mothers, a group at higher risk of SIDS when bedsharing, the intervention also reduced bedsharing rates, although not as dramatically (22 %). When asked where their infant would have slept had they not received the BBB crib, 32 % responded that they would have slept in their parents' bed or in bed with another person (other than parents or siblings).

The intervention had a positive effect also on maternal knowledge of recommended infant sleep position; while about three-quarters of mothers identified the correct response in the prenatal and postnatal surveys, this proportion increased to 90 % after the intervention. One might have expected a higher proportion in the postnatal survey, since mothers should have presumably received some safe sleep education in the birth hospital. However, this method of education appears to have been less effective than the BBB intervention. There was also a small but significant increase in babies who were placed supine for sleep post-intervention. This is consistent with studies showing that 81 % of African American mothers know and 63 % use the recommended sleep position for infants [9, 27]. We found small racial-ethnic differences in choice of sleep position, with Black infants less likely to have been placed supine. This is consistent with other national data [8].

The intervention had minimal effects on pacifier use and breastfeeding rates. A large proportion of mothers had already planned to use a pacifier, and the intervention did not appear to influence that. Actual breastfeeding rates were lower than the rates of mothers who planned to breastfeed and were not influenced by the intervention. The timing of the intervention is particularly important for breastfeeding, as the decisions to initiate and continue breastfeeding generally occur in the prenatal and immediate postpartum period [3]. By the time mothers received the crib and educational messages, it was likely too late to influence the choice of feeding.

Weaknesses

The major weakness of the study was the inability to link participants' responses between the pre-intervention and post-intervention surveys. This also prevented analyses of results in the post-intervention survey by race-ethnicity, since that information was collected only in the prenatal and postnatal pre-intervention questionnaires. Nonetheless, we were still able to conduct our main analyses, unlinked, comparing pre- and post-intervention results. In addition, since this program included provision of a free crib and safe sleep education, we cannot determine if one aspect of the program was more important in modifying parental practice. Furthermore, since all free crib programs are not identical in their content, these results may not be generalizable.

Conclusion

This large free crib and education program was successful in changing knowledge and practices in a large proportion of participants with regard to safe infant sleep, i.e., placing babies to sleep in a crib on their back. It is reassuring that receiving a crib and safe sleep education is effective, as many free crib programs exist around the country. Such programs should be evaluated on a periodic basis to assure that they positively influence practices and knowledge about safe sleep. If the data continue to demonstrate the benefit of these programs, they should be expanded to ensure that every family that needs a crib for their newborn baby has access to one.

Abbreviations

SIDS	Sudden infant death syndrome
BBB	Bedtime Basics for Babies

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Table 1

Comparison of demographics between Bedtime Basics for Babies participation states and the US as a whole (2010 data)

Characteristic	BBB states (N)	United States (N)
% population < 5 years of age	6.0 % (903,927)	6.5 % (20,137,884)
% living below poverty level	15.0 % ^a	14.9 % ^a
% births to mothers with 12 years education	19.0 % (32,434)	20.0 % (597,375)
Median household income	\$57,338	\$53,046
% Black	8.2 % (1,130,209)	12.6 % (38,929,319)
% American Indian/Alaska Native	0.8 % (110,800)	0.9 % (2,529,100)
% births to mothers who smoked during pregnancy	10.0 % (22,568)	9.0 % (236,250)
% births that were low birth weight	8.0 % (13,125)	8.1 % (325,563)

^aTotal N unavailable

Table 2

Demographic characteristics

	Prenatal survey	Postnatal survey	<i>p</i> value
Relation to baby			
Mother	3,167 (96 %)	1,311 (91 %)	< 0.001
Other	123 (4 %)	133 (9 %)	
Maternal race			
Caucasian	1,395 (47 %)	621 (47 %)	< 0.001
African American	1,228 (42 %)	496 (37 %)	
American Indian/Alaska native	75 (3 %)	53 (4 %)	
Asian	42 (1 %)	33 (2 %)	
Mixed/Other	218 (7 %)	128 (10 %)	
Maternal ethnicity			
Non-Hispanic	2,518 (78 %)	1,169 (82 %)	< 0.01
Hispanic	706 (22 %)	259 (18 %)	
Maternal age (median)	25	25	0.52
Maternal education			
Did not finish high school	744 (23 %)	400 (28 %)	0.001
High school diploma/GED	1,206 (37 %)	498 (35 %)	
Some college, technical or vocational school	970 (30 %)	410 (28 %)	
Technical school graduate	257 (8 %)	51 (4 %)	
4-year college graduate	46 (2 %)	47 (3 %)	
Post-graduate or professional training	0 (0 %)	30 (2 %)	
Maternal smoker			
No	2,425 (75 %)	1,007 (70 %)	< 0.01
Yes	828 (25 %)	421 (30 %)	
Maternal depression			
No	2,421 (75 %)	993 (69 %)	< 0.001
Yes	780 (24 %)	388 (27 %)	
Don't know	38 (1 %)	56 (4 %)	
Paternal race			
Caucasian	1,195 (42 %)	556 (43 %)	< 0.001
African American	1,401 (49 %)	572 (44 %)	
American Indian/Alaska native	66 (2 %)	42 (3 %)	
Asian	39 (1 %)	20 (2 %)	
Mixed/Other	166 (6 %)	101 (8 %)	
Paternal ethnicity			
Non-Hispanic	2,438 (76 %)	1,101 (79 %)	< 0.05
Hispanic	764 (24 %)	286 (21 %)	
Paternal education			
Did not finish high school	849 (28 %)	408 (30 %)	< 0.001
High school diploma/GED	1,364 (44 %)	585 (43 %)	

	Prenatal survey	Postnatal survey	<i>p</i> value
Some college, technical or vocational school	603 (20 %)	252 (19 %)	
Technical school graduate	229 (7 %)	40 (3 %)	
4-year college graduate	36 (1 %)	55 (4 %)	
Post-graduate or professional training	0 (0 %)	14 (1 %)	

Demographic data were not collected for the follow-up and home visit surveys

Table 3

Comparison between surveys: 2-sample test for equality of proportions

Planning/reported	Prenatal survey (N)	Postnatal survey (N)	Follow-up survey (N)	Prenatal— postnatal χ^2	Postnatal— follow-up χ^2
Sleep position—back only	0.84 (3,241)	0.80 (1,375)	0.87 (1,715)	$p < 0.001$	$p < 0.001$
Recommended sleep position—back only	0.76 (3,247)	0.77 (1,440)	0.94 (1,718)	$p = 0.37$	$p < 0.001$
Bedsharing	0.08 (3,176)	0.38 (1,390)	0.16 (1,594)	$p < 0.001$	$p < 0.001$
Pacifier use	0.81 (2,251)	0.71 (1,410)	0.74 (1,717)	$p < 0.001$	$p = 0.17$
Breastfeed or combination (breastfeed and formula)	0.81 (3,104)	0.47 (1,408)	0.47 (1,711)	$p < 0.001$	$p = 0.98$
Maternal smoking and bedsharing	0.09 (814)	0.33 (403)	0.22 (355)	$p < 0.001$	$p < 0.01$