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Bilgin, Ayten and Wolke, Dieter (2021) *Bed-Sharing in the First 6 Months: Associations with Infant-Mother Attachment, Infant Attention, Maternal Bonding, and Sensitivity at 18 Months*. Journal of Developmental & Behavioral Pediatrics . ISSN 0196-206X.

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Abstract

Objective: To investigate whether bed-sharing during the first 6 months of life is associated with infant's attachment and behavioral outcomes and mother's bonding and sensitive parenting at 18 months of age.

Methods: The sample with complete longitudinal data comprised 178 infants and their caretakers. Bed-sharing was assessed with maternal report at term, 3, 6 and 18 months. Infant attachment was measured at 18 months using the strange situation procedure. Infant behavioral outcomes (i.e., poor attention/hyperactivity and task persistence) were assessed with two observational measures at 18 months. Maternal sensitivity was observed at 3 and 18 months and mothers reported on bonding to their infant at term, 3 and 18 months.

Results: Bed-sharing was common at term (41.2%), which decreased at 3 months (22.6%) followed by a slight increase at 6 (27.5%) and 18 months of age (31.3%). No associations between bed-sharing during the first 6 months and infant-mother attachment and infant behavioral outcomes at 18 months were found. Similarly, there were no associations between bed-sharing during the first 6 months and maternal bonding and sensitivity at consequent assessment points (i.e., 3 and 18 months).

Conclusions: Bed-sharing during the first 6 months is not associated with positive or negative outcomes about infant-mother attachment, infant behavior, maternal bonding or sensitive parenting.

Introduction

Whether parents should share a bed with their infants is a topic hotly debated by researchers and parents[1]. Some have argued strongly against bed sharing due to the potential harmful outcomes for the infant, while others have endorsed bed-sharing based on the potential benefits for the infant and the mother [2,3].

Opponents of bed-sharing have voiced concern regarding its safety. There is consistent evidence that the risk of Sudden Infant Death Syndrome (SIDS) is increased when parents sleep in the same bed with their infant even in the absence of hazardous situations [4]. The risk of bed-sharing for SIDS is further increased when parents consume alcohol, take drugs, smoke or sleep on a soft surface (i.e., soft mattress, sofa)[4-6]. One report estimates that up to 90% of SIDS could have been avoided if parents had not shared a bed with their infants when their infant was less than three months of age[4]. Given this research evidence, the American Academy of Pediatrics advises against bed-sharing before 6 months of age and recommends that infants should sleep in their own crib in the same room with their parents for at least the first 6 months but preferably a year [3].

Despite the warnings, bed-sharing has been endorsed in some parenting books and websites suggesting that it was the norm traditionally and it is beneficial for both the mother and the infant as long as practiced safely.[2,7,8] Particularly, it has been endorsed by supporters of *'Attachment Parenting'*, which is a popular Western parenting philosophy promoting close contact between the mother and infant with an aim to improve infant attachment and behavioral development[9,10]. Consequently, it has been reported that an increasing number of parents either choose to share a bed or take their infant into bed once awoken.[11-13] Mothers report several reasons to bed-share such as convenience, facilitation of breastfeeding (i.e., longer durations of breastfeeding),[14,15] better infant-mother attachment, maternal bonding (i.e., mother's attachment feelings towards her infant), and sensitive caregiving[2,7,16]. Thus,

some mothers choose bed-sharing for its potential benefits[17]. However, many parents may share a bed with their infants not because they planned to but as a reaction to the sleeping difficulties of their infants such as frequent night waking and long settling durations[18,19]. Different from intentional bed-sharers, these mothers report increased marital conflict and fatigue[20,21]. Thus, it is important to consider the role of infant sleeping difficulties in understanding the outcomes of bed-sharing.

The strong and opposing opinions by parents and experts as well as the reactive use of bed-sharing make it impossible to conduct a randomized controlled trial on the effects of bed sharing. However, there is even a dearth of longitudinal observation studies that have investigated whether bed-sharing has any associations with infant subsequent relational (i.e., attachment) or behavioral development (i.e., poor attention/hyperactivity and task persistence) as well as maternal bonding and sensitive parenting [21]. To this point, only one previous study investigated the link between bed-sharing and infant-mother attachment [11]. This Dutch study investigated bed-sharing at 2 months and infant-mother attachment was assessed at 14 months in 550 mother-infant dyads. Those who never shared a bed with their parents were more likely to form an insecure attachment, in particular resistant attachment, in comparison to those who had any bed-sharing with their parents (OR= 1.74, 95% CI: 1.10-2.76).

Similarly, little apart from anecdotal evidence is available about the outcomes of bed-sharing on maternal parenting behavior and bonding. The link between bed-sharing and maternal bonding was investigated by only one cross-sectional study when the infants were 11 weeks old[22]. Interestingly, this study revealed that bed-sharing was associated with impaired maternal bonding, where mothers reported being annoyed or irritated by their baby more often in comparison to those who did not share a bed with their infant. The link between bed-sharing and parenting quality was also assessed by a further study[23] that found

that mother's supportiveness at 1 year of age was not associated with bed-sharing from 1 to 3 years of age. The infant-related behavioral outcomes of bed-sharing such as poor attention/hyperactivity and low task persistence have only been investigated again by a single study that found no significant associations between bed-sharing from 1-3 years of age and hyperactivity at 5 years of age.[23] In summary, there is a lack of longitudinal investigations that have assessed the effects of bed-sharing on infant-mother attachment, behavioral development and on mother's parenting and bonding within the same study.

The current study has two aims. First, to investigate whether parental bed-sharing during the first 6 months of life is related to infant attachment and behavior development such as poor attention/hyperactivity and task persistence at 18 months. Second, to investigate if parental bed-sharing during the first 6 months of life is associated with maternal bonding and observed maternal sensitivity at subsequent assessment points (i.e., 3 and 18 months).

Methods

Participants

Caretakers of 112 very preterm/very low birth weight (VP/VLBW; <1500g or <32 weeks of gestation) in three Neonatal Intensive Care Units (NICU) in southeast England were approached during an 18-month period[24,25]. Seventy-six caretakers of 90 VP/VLBW infants participated at the first assessment point at term and 73 participated throughout the whole study period. Recruitment of full-term infants (FT; 37-42 weeks gestation) were conducted in the postnatal wards of the same hospitals within 48 hours of birth. One hundred fifteen FT infants, matched for annual income, sex and multiple birth, and their caretakers (N= 98) participated at the first assessment point at term and 105 took part throughout the study (See Supplemental File 1 for a full description of the recruitment process). Both VP/VLBW and FT infants were included to allow investigation for whether there are differences in parenting (e.g. sharing a bed) and subsequent behaviour or attachment between the two groups[26-28].

Ethical approval was received from the Ethics committee of the Psychology Department at the ~~university~~ University of Hertfordshire and from the ethics committee at all hospitals. Informed consent was obtained from all mothers. VP/VLBW and FT samples were combined to allow for sufficient statistical power while controlling for any effect of preterm birth in all analyses. The infants and their mothers were assessed longitudinally at term (i.e., at birth for the FT group and at the corrected age of term for the VP/VLBW group), 3, 6, and 18 months.

Measures

Bed-sharing: Mothers were asked to report on the frequency of bed-sharing with the following question at term, 3, 6 and 18 months: 'How often does your baby sleep in your bed at night?' The answers were as follows: Never, once a month or less, 1-4 times a month, 2-3 times per week and 4 times a week or more. In line with previous studies[11,23], we created a dichotomous variable to measure bed-sharing at term, 3 and 6 months and 18 months: 0= solitary sleeping (never bed-sharing); 1= bed-sharing (once a month or less to 4 times a week or more).

Mother-Infant Attachment: Attachment type was assessed at 18 months with the strange situation procedure (SSP), a widely used and well-validated laboratory procedure to measure the quality of attachment [29]. The experimenters were trained by Dr. Elizabeth Carlson and all tapes were sent and coded at the Institute of Child Development, University of Minnesota. The coders were blind to child and family characteristics and infant history. A third (32%) of the tapes were randomly selected for inter-rater reliability assessment, which was found to be acceptable (κ= 0.76). A categorical variable was created to measure attachment insecurity: 0=secure versus 1=insecure (insecure-avoidant and insecure-resistant). Attachment disorganization scores were coded according to Main and Solomon's (1990) continuous scale and a categorical variable was created: 0= organized versus (<5) 1= disorganized (≥ 6).

Infant Behavioral Outcomes: Infant behavior was assessed with two different observational measures. The first assessment was the Play Observation Scheme and Emotion Rating (POSER) at 18 Months[30] . POSER is an observational measure to rate maternal and infant behaviors, which includes play with a toy and free play, each lasting 2.5 minutes. Scales in both sessions were rated by two independent researchers who were blind to child characteristics. Each episode was viewed by the researchers a minimum of three times, focusing firstly on maternal behaviors, followed by infant behaviors and mother-infant joint behaviors. Overall, the coding procedure took approximately half an hour per infant-mother dyad. Infant behaviors were rated using 9-point Likert scales (1= very low, 9 = very high). Activity, intensity and persistence/attentiveness were combined to a scale of poor attention/hyperactivity[25]. Internal consistency was found to be moderate ($\alpha = 0.71$) and the inter-rater reliability was found to be $\kappa = 0.90$.

The second assessment is the Tester's Rating of Infant Behaviour (TRIB) completed by a trained examiner during the Bayley Scales assessment [31,32] at 18 months. Observations lasted on average 45 minutes and 20% of the assessments were videotaped and rated by independent examiners for reliability assessment. Behaviors were rated on a nine-point Likert scale ranging from 1=very low to 9=very high. The six rating scales attentiveness, competence, cooperativeness, robustness/endurance, low demandingness and difficultness were combined to an overall scale of task persistence[25] with high internal consistency ($\alpha = 0.95$) and $\kappa = 0.93$ inter-rater reliability.

Maternal Bonding: Mothers were asked to report on their feelings about their infant with the following question at term, 3 and 18 months: 'How close/attached do you feel to your baby at the moment?' The answers were as follows: Not at all attached, a little attached, moderately attached, attached and very closely attached.

Maternal Sensitivity: At 3 months of age, maternal sensitivity was measured with the Mother-Infant Structured Play Assessment (MISPA)[33,34] during 2 minutes of play with a toy and 2 minutes of free play. Maternal sensitivity was coded using a 5-point scale of maternal positive emotion expression, sensitivity, and stimulation adapted from 3 interaction coding schemes: the Play Observation Scheme and Emotion Ratings: POSER[30]; the Emotional Availability Scales: EAS[35]; and the Infant and Caregiver Engagement Phases: ICEP[36]. The inter-rater reliability scores for each item were high ($\kappa_{\text{positive emotion}}$= 0.76, $\kappa_{\text{sensitivity}}$= 0.76, $\kappa_{\text{stimulation level}}$= 0.78) and the overall internal consistency of the maternal sensitivity factor was moderate ($\alpha_{\text{maternal sensitivity}}$= 0.73).

At 18 months, maternal sensitivity was observed with the POSER[34], the same mother-child interaction observation we used to rate infant behavior (see above). The maternal sensitivity factor consisted of maternal positive emotion expression, sensitivity, and appropriateness of play each rated on a 9-point Likert scale (1= low; 9= high). The inter-rater reliability of each of the maternal behavior items ($\kappa_{\text{positive emotion}}$= 0.93, $\kappa_{\text{sensitivity}}$= 0.90, $\kappa_{\text{appropriateness of play}}$= 0.91) was high. The ratings on the three items during the unstructured and structured play situation were totalled for an overall maternal sensitivity score, which had high internal consistency (α= 0.90).

Maternal Depressive Symptoms. At 6 months, mothers completed the Edinburgh Depression Scale [37], which is a widely used 10-item screening tool to assess postnatal depression on 4-point scales and has high sensitivity to detect depression in the postnatal period[38]. An example item is as follows: '*In the past 7 days, I have been anxious or worried for no good reason*' (0= No, not at all, 1= Hardly ever, 2= Yes, sometimes, 3= Yes, very often). Individual scores were summed up to create a continuous depression score, which can range from 0 to 30.

Infant Night Waking and Settling Duration. Parents were asked to report on the frequency of night waking per night and how long it takes to settle their infant to sleep at term, 3, 6 and 18 months.

Breastfeeding. Mothers were asked about how they fed their infant at term, 3 and 6 months. They were divided into 2 categories: 0=not breastfed and 1=breastfed.

Statistical Analysis

Analyses were performed using SPSS version 23 in three stages. First, differences in sample characteristics across the two groups of bed-sharing (0= solitary sleeping, 1=bed-sharing) were analyzed using X^2 tests and independent sample t-tests. Covariates were identified based on these comparisons.

Second, logistic regression analyses were used to analyze the association between night waking and settling duration (i.e., term, 3, 6 and 18 months) and bed-sharing at term, 3, 6 and 18 months while considering the role of breastfeeding (i.e., term, 3 and 6 months) and controlling for preterm birth (0= FT, 1= VP/VLBW), infant sex, maternal age, and parental annual income. Based on the results of this analysis, earlier or concurrent night waking and settling duration were used as covariates in the main analyses to account for the role of reactive bed-sharing.

Third, logistic regression and multiple linear regression analyses were conducted to investigate the association between bed-sharing at term, 3 and 6 months and subsequent mother-infant attachment (insecure or disorganized) at 18 months; infant poor attention/hyperactivity and task persistence at 18 months; and maternal bonding (at 3 months and 18 months) and maternal sensitivity at 3 and 18 months while controlling for covariates. Sensitivity analysis was performed where all analyses were repeated excluding VP/VLBW born participants and using the following combination of bed-sharing (0= never and once a

month or less; 1= 1-4 times a month to 4 times a week or more). We applied Bonferroni correction to account for multiple comparisons.

Results

There were 101 (56.7%) male and 77 (43.3%) female infants. The mean gestational age was 35.03 (*SD* = 4.91) weeks and the mean birth weight was 2408.98 (*SD* = 1061.81) grams. Forty-one percent of infant participants had no siblings, 39% had one sibling and the remaining 20% participants had more than one sibling. There were 29.8% multiple births. Furthermore, 40% had low to moderate income (yearly income of <£25k). Mean maternal age was 30.6 years (*SD* = 5.82) and 34.5% of the infants' mothers had education of more than 10 years (Supplemental Table 1).

Characteristics of bed-sharing mothers and infants

Figure 1 shows the frequency of bed-sharing during the first 18 months, as well as breast-feeding, night-waking frequency and settling duration in those who were solitary sleepers or bed-sharers. The rate of bed-sharing was highest at term (N= 68, 41.2%), which decreased sharply at 3 months (N= 40, 22.6%) and then slightly increased at 6 (N= 46, 27.5%) and 18 months (N=55, 31.3%).

At term, mothers of male infants reported bed-sharing more often than those of females. Those who were bed-sharing had higher frequency of night-wakings at term, 3, 6 and 18 months, had higher rates of breast-feeding at 3 and 6 months and had longer settling duration at 6 months of age in comparison to solitary sleepers (Table 1). Mothers who were bed-sharing at 6 and 18 months were older and mothers who were bed-sharing at 6 months had higher income in comparison to those who were not bed-sharing. Supplemental Table 2 shows the bivariate correlations for all study variables.

Concurrent and longitudinal associations between infant night-waking, settling duration and bed-sharing

Night-waking at 3 and 6 months was associated with higher rates of bed-sharing concurrently at 3 and 6 months (OR= 2.46; 95% CI= 1.57-3.85 and OR= 1.50; 95% CI= 1.10-2.06, respectively). Similarly, settling duration at 6 and 18 months was associated with higher rates of bed-sharing concurrently at 6 and 18 months (OR= 1.03; 95% CI= 1.00-1.07 and OR= 1.03; 95% CI= 1.00-1.06, respectively). There were no prospective associations between night-waking, settling duration and bed-sharing (Table 2).

Longitudinal associations between bed-sharing and infant-related outcomes

There were no significant associations between bed-sharing during the first 6 months of age and mother-infant insecure or disorganized attachment at 18 months of age (Table 3). Bed-sharing at 6 months of age was negatively associated with task persistence at 18 months of age (β= -0.20, p= 0.01). However, this finding was rendered non-significant when the p-value was adjusted for multiple comparisons using Bonferroni correction (0.05/8= 0.006). Sensitivity analyses revealed the same findings (Supplemental Tables 3 and 4).

Associations between bed-sharing and mother-related outcomes

There were no significant associations between bed-sharing at term and 3 months and maternal bonding at subsequent assessment points (i.e., 3 and 18 months respectively) (Table 3). Similarly, there were no significant associations between bed-sharing at term and 3 months and maternal sensitivity at subsequent assessment points (i.e., 3 and 18 months respectively). When we repeated the analyses excluding VP/VLBW infants, findings remained the same (Supplemental Table 3).

Discussion

This prospective longitudinal study revealed no significant associations between bed-sharing in the first 6 months in infancy and infant-mother insecure or disorganized

attachment at 18 months. Moreover, there were no significant associations between bed-sharing in the first 6 months and poor attention/hyperactivity rating at 18 months, as well as no significant links with maternal bonding and maternal sensitivity. There was a significant association between bed-sharing at 6 months and low task persistence at 18 months. However, this association became non-significant once corrected for multiple comparisons.

Thus, this longitudinal study reveals no positive or negative outcomes of bed-sharing on infant relational and behavioral development, as well as on maternal bonding and sensitive parenting. Our findings regarding infant attachment and maternal bonding are in contrast to the findings of the two previous studies conducted in this area. The first study showed a significant positive link between bed-sharing at 2 months and secure infant-mother attachment at 14 months[11] and the second study showed a negative association between bed-sharing and maternal bonding[22]. However, these studies had limitations. In the first study[11], bed-sharing was assessed only once at 2 months and the role of sleeping difficulties was not considered. The second study[22] was cross-sectional and did not control for any covariates. On the other hand, our finding that bed-sharing was not associated with poor attention/hyperactivity and maternal sensitive parenting is in line with the findings of a previous study[23]. Moreover, the only significant finding on task persistence at 18 months disappeared after correction for multiple comparisons. Thus, there is not yet enough evidence to support or refute the primary message of the supporters of bed-sharing, which suggests that bed-sharing is an evolutionarily meaningful and natural practice with several benefits to the infant and mother.

Findings from this UK sample showed that the highest rate of bed-sharing occurred at term (41.2%), which decreased by half at 3 months (22.6%) showing that most mothers seem to follow the guidance against bed-sharing before 4 months of age even though they might be bed-sharing right after birth[16]. Afterwards, the rate of bed-sharing increased by approximately

10% until 18 months of age. Similar to the findings of previous studies, mothers who were bed-sharing were older, breastfeeding and had higher income [14] and were more likely to have boys than those who were not bed-sharing. This could be due to boys having more sleeping problems than girls.[39] There was no longitudinal associations between infant sleeping and bed-sharing, however cross-sectional associations between bed-sharing and infant sleeping were found. To illustrate, infants who were bed-sharing had higher frequency of night-waking consistently over the first 18 months, and longer settling durations from 3 to 18 months than solitary sleepers, which was also shown in previous studies[19]. Our findings suggest that bed-sharing early on at 3 months of age is related to night-waking frequency at the same assessment point. Similarly, at 6 months of age night-waking and settling duration was associated to bed-sharing at the same age, and bed-sharing later on at 18 months of age was associated with settling duration at the same age. Thus, these findings suggest that concurrent infant sleeping difficulties are associated with bed-sharing rather than the influence of pre-existing difficulties in sleeping.

This prospective longitudinal study has several strengths, including adjustment for several important covariates, using repeated assessment of bed-sharing during infancy, observer assessed infant-mother attachment and the assessment of infant attention using researcher observations. There are also limitations. First, the correlational design of the current study does not allow to determine if there is a causal relationship between bed-sharing and the assessed outcomes. However, randomization in controlled trials is unlikely to be possible due to strongly held views by parents. Second, the current study included a large group of infants who were born VP/VLBW (41%). However, all analyses were controlled for the role of VP/VLBW birth. Furthermore, sensitivity analysis excluding VP/VLBW born participants did not alter the main findings except the significant link between bed-sharing and poor attention/hyperactivity in the FT group, revealing wider confidence intervals. Third,

maternal bonding was assessed using a one-item measure rather than a scale affecting reliability. Fourth, bed-sharing was reported by mothers. Video observations of bed-sharing during night time would have provided more objective results, however, conducting video observations was not feasible given the sample size and repeated measurement in this study.

In conclusion, there are neither positive or negative consequences of bed-sharing during the first 6 months on infant-mother attachment and infant behavioral development, or on mother's sensitive parenting and bonding to her infant according to the current observation study based on a UK sample. However, further studies are required to confirm the findings of the current study given the lack of research evidence on the link between bed-sharing and infant's attachment and behavioral development and mother's sensitive parenting and bonding.

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Figure Legend

Figure 1. Percentages of breastfeeding, night-waking and settling duration in solitary sleepers vs bed-sharers at term, 3, 6 and 18 months