



Original Article

Sleep patterns of co-sleeping and solitary sleeping infants and mothers: a longitudinal study



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ABSTRACT

Objective: Controversies exist regarding the impact of co-sleeping on infant sleep quality. In this context, the current study examined: (a) the differences in objective and subjective sleep patterns between co-sleeping (mostly room-sharing) and solitary sleeping mother–infant dyads; (b) the predictive links between maternal sleep during pregnancy and postnatal sleeping arrangement; (c) the bi-directional prospective associations between sleeping arrangement and infant/maternal sleep quality at three and six months postpartum.

Methods: The sample included 153 families recruited during pregnancy. Data were obtained in home settings during the third trimester of pregnancy and at three and six months postpartum. Mothers were asked to monitor their own sleep and their infants' sleep for five nights using actigraphy and sleep diaries. Questionnaires were used to assess sleeping arrangements, feeding methods, socio-demographic characteristics, and maternal depressive and anxiety symptoms.

Results: Mothers of co-sleeping infants reported more infant night-wakings than mothers of solitary sleeping infants. However, none of the objective sleep measures was significantly different between co-sleeping and solitary sleeping infants, after controlling for feeding techniques. Co-sleeping mothers had significantly more objective and subjective sleep disturbances than mothers in the solitary sleeping group. Moreover, poorer maternal sleep during pregnancy and at three months postpartum predicted higher levels of co-sleeping at six months.

Conclusion: Mothers of co-sleeping infants report more infant night-wakings, and experience poorer sleep than mothers of solitary sleeping infants. The quality of maternal sleep should be taken into clinical consideration when parents consult about co-sleeping.

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1. Introduction

Parent–infant co-sleeping (parents sharing the same room or bed with the infant) is the most widely used sleeping arrangement in the majority of cultures around the world [1,2]. Even in the western society, where most parents prefer solitary sleeping arrangements (infant sleeping in a different room), co-sleeping has increased significantly during the last decades [3]. Nonetheless, major controversies exist regarding the physical (eg, Sudden Infant Death Syndrome) and psychological (eg, dependency, attachment relationship) risks and benefits of co-sleeping [2]. One source of disagreement relates to the impact of co-sleeping on infant sleep quality [4]. Studies based on subjective reports have found that co-sleeping is associated with more sleeping problems [5–12]. However, co-sleeping parents could be more aware of their infants'

night-wakings, due to physical proximity to the child at night, regardless of the infant's actual sleep quality [7]. Moreover, feeding methods may account for the reported link between co-sleeping and infant night-wakings, as breastfeeding mothers are more likely to co-sleep with their infants compared to bottle-feeding mothers [4,13,14], and breastfeeding has been found to be associated with more disturbed infant and maternal sleep [15–19]. Contrary to the findings based on subjective reports, results from studies using objective sleep measures (ie, polysomnography, video recording) yield an inconclusive picture. Whereas some findings indicate lower sleep quality in co-sleeping infants as reflected in more brief awakenings [20,21] and lighter sleep [22], other findings demonstrate lack of difference [20,21]. For instance, Mao et al. [21] found no difference in the total amount of time awake at night, and in the percent of time spent in active sleep and quiet sleep between co-sleeping and solitary sleeping infants.

It is important to note that the reported associations between co-sleeping and sleep quality may be bi-directional. Thus, co-sleeping may affect infant sleep quality, but at the same time, parents of infants with existing sleep problems may be more likely to endorse

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co-sleeping (ie, reactive co-sleeping) [7]. Hence, the phenomena may best be examined in the context of the transactional model which delineates bidirectional, ongoing dynamic influences between infant sleep development and the environment [2]. However, the lack of longitudinal studies in this field makes it difficult to infer about the direction of the links between infant sleep quality and sleeping arrangements.

One important aspect that has received little attention in the debate on co-sleeping is the role of maternal sleep quality. The few studies that have examined the links between maternal sleep and sleeping arrangement yielded inconsistent results. One study found that co-sleeping was significantly associated with less efficient maternal sleep (as assessed by one night of actigraphy) [23]. In another study [24], using laboratory polysomnography, no differences were found between co-sleeping mothers and solitary sleeping mothers in total sleep time, though the total frequency of arousals in the co-sleeping group was higher as awakenings were of shorter duration. The present study aimed at expanding the limited knowledge on this issue by examining the prospective links between maternal sleep quality and sleeping arrangements starting at pregnancy, the latter to better understand whether maternal sleep patterns, present before experiencing any influences of infant nighttime care, would predict future sleeping arrangement choices.

1.1. Study goals

The main goal of the present study was to assess comprehensively the concomitant and predictive relationships between infant/maternal sleep patterns and sleeping arrangements, using objective and subjective measures of sleep in the context of a longitudinal design. Specifically, we aimed at examining: (a) The differences in infant/mother sleep quality and quantity between co-sleeping mother–infant dyads and solitary sleeping dyads; (b) The predictive links between maternal sleep during pregnancy and sleeping arrangement at three and six months postpartum; (c) The bidirectional prospective association between infant/maternal sleep at three and six months postpartum and sleeping arrangement.

2. Method

2.1. Participants

One hundred and fifty three married couples expecting their first child were recruited during pregnancy through childbirth preparation classes and announcements on Internet forums for expectant parents. Inclusion criteria were: (1) Two-parent families expecting their first child; (2) Singleton pregnancy. Participants were excluded if they had a chronic health condition (by self-report). Of the 153 families recruited, 16 dropped-out from the study at the three months assessment point, and 12 families withdrew from the study at six months. Three families did not participate at three months but were contacted again when the infant reached the age of six months, and agreed to participate then. The characteristics of the sample are presented in Table 1.

At the age of three months, most of the infants were sleeping in their parents' room (76%), while at the age of six months, 50% of the infants were sleeping in their parents' room. Only a small number of infants ($n = 7$ at three months and $n = 8$ at six months) were sharing the same bed with their parents. As there were no significant differences on any of the sleep measures between infants sleeping in the same bed with their parents and infant sharing the same room (but not the same bed), we combined these two groups together as **co-sleeping** infants without further distinction in the analyses.

Table 1

Characteristics of study sample (N = 137 at three months, 128 at six months).

	Mean	SD	%
Maternal age*	28.97	2.9	
Maternal education	15.70	2.0	
Paternal age	30.87	3.7	
Paternal education	15.02	2.2	
Number of rooms in the house	3.25	0.92	
Infant weight at delivery	3.25	0.42	
Infant weight first assessment point	5.48	1.25	
Infant weight second assessment point	7.67	0.95	
Infant age at first assessment point	3.10	0.43	
Infant age at second assessment point	6.10	0.27	
Girls			54
Day care at three months			
Home reared			88
Baby sitter			8
Day-care			4
Day care at six months			
Home reared			46
Baby sitter			23
Day-care			31
Feeding method at three months			
Fully breastfeeding			58
Partial breastfeeding			25
Bottle feeding			17
Feeding method at six months			
Fully breastfeeding			32
Partial breastfeeding			28
Bottle feeding			40

* Parental socio-demographic measures were assessed during pregnancy.

2.2. Procedures

The study was approved by a hospital's Helsinki committee. All women signed informed consent before assessment of their own sleep and their infants' sleep. The study included three assessment points: during pregnancy, at three and six months postpartum. A research assistant visited the participants during the third trimester of pregnancy (week 34 to week 37) and instructed them about actigraphy use and questionnaires completion. Sleep was assessed for five nights (only on weekdays when a regular routine was maintained) with actigraphy and sleep diaries. Families were contacted again after delivery and an appointment was scheduled when the infant reached the age of three months. Mothers were asked to monitor their infants' and own sleep with actigraphy and diaries for five nights. In addition, they completed an infant background questionnaire that included questions regarding sleeping arrangements and questionnaires assessing depressive and anxiety symptoms. The same procedure was repeated at the age of six months. After completing the assessments, participants received a small gift (value of about \$20) and a graphic report of their actigraphic sleep.

2.3. Measures

2.3.1. Actigraphy

Actigraphy has been established as a valid and reliable method for studying and assessing sleep–wake patterns in infants, children [25], and adults [26]. The actigraph is a miniature wristwatch-like device attached to the adult's wrist or infant's ankle during the recording period. The device records movement for extended period of time with minimal disruption of ongoing sleep in the subject's natural environment. In the present study, we used the micro motion logger sleep watch (Ambulatory Monitoring Inc., Ardsley, NY) with a one-minute epoch interval according to the standard mode for sleep–wake scoring. Data were analyzed with Sadeh's validated scoring algorithm for infants [25] and adults [27]. Sleep diaries were used to identify possible actigraphy errors and artifacts. Mothers

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