

2012

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Recommended Citation

DeLeón, Cheryl (2012) "A Pilot Study on Perceptions of Sleep Deprivation and Mother-Infant Interaction," *Journal of the Indiana Academy of the Social Sciences*: Vol. 15 : Iss. 1 , Article 6.

Available at: <http://digitalcommons.butler.edu/jiass/vol15/iss1/6>

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*A Pilot Study on Perceptions of Sleep Deprivation
and Mother-Infant Interaction**

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ABSTRACT

Maternal sleep deprivation due to caring for an infant during the night has been found to be related to deficits in maternal mood and functioning during the first year of the infant's life. Perceptions of sleep deprivation are particularly important to assess when examining the relations between infant night awakening and maternal health and well-being because perceptions influence caregiving behaviors. Forty mothers of three-to-four-month-old infants enrolled in a larger study exploring maternal interaction with young infants were examined. The objective of this pilot study was to explore how perceptions of sleep deprivation in a particular group of mothers categorized as highly sleep deprived resulting from infant night awakening were associated with ratings of the infant and interaction within the dyad. As hypothesized, there were strong positive relationships between perceptions of sleep deprivation and ratings of the infants and interactions in the highly sleep deprived group of mothers *only*. These associations have implications for future research, which needs to examine how these perceptions of highly sleep deprived mothers influence actual behavioral interactions with infants.

KEY WORDS Mother-Infant Interaction; Maternal Sleep Deprivation; Perceptions

Maternal sleep deprivation due to caring for an infant during the night has been found to be related to deficits in maternal mood and functioning during the first year of the infant's life. Perceptions are particularly important to assess when examining the

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The author would like to acknowledge Dr. Jane Brooks, Dr. Carla Pfeffer, and Dr. Christabel Rogalin for their review of and guidance about earlier versions of this piece. The author would also like to acknowledge the West Virginia University Department of Psychology's Alumni Fund for providing the necessary funding to complete the project.

relations between infant night awakening and maternal health and well-being because perceptions influence maternal caregiving behaviors (Mantymaa et al. 2006).

It has been well demonstrated that mothers who are experiencing deficits in mood perceive their infants more negatively than mothers who are not experiencing these deficits (Field 1995; Foreman and Henshaw 2002). One population that experiences deficits in mood and has been extensively studied is women diagnosed with postpartum depression (PPD). Women who experience PPD have consistently exhibited negative perceptions of their infants (Luoma et al. 2004). Field (1995) reported that when PPD mothers and observers coded infant behaviors during interactions, the depressed mothers coded their infants' behaviors as more negative than did the observers. Similarly, Foreman and Henshaw (2002) found that they could distinguish between PPD mothers and non-PPD mothers by asking them 20 questions about their perceptions of their six-month-old infants. Specifically, PPD mothers had less positive views about their infants than did non-PPD mothers.

Maternal negative perceptions of the infants have also been found to be related to night awakening behaviors. Nover et al. (1984) found that mothers' negative perceptions of their infants' behaviors during play interactions were also associated with night awakening in their nine-month-old infants. Evidence of the relation between maternal perceptions and sleep deprivation has also been found with three-month-olds. Highly sleep deprived mothers, a result of infant night awakening, rated their infants as less manageable than mothers who were not sleep deprived (Karraker and Cottrell 2000). This collection of findings indicates that mothers' negative perceptions of their infants are related to their moods and their experiences of sleep deprivation.

Little is known however, about how sleep-deprived mothers perceive their own interactions with their infants. If sleep-deprived mothers are negatively perceiving their own infants, they could be negatively perceiving their own interactions with their infants as well. Over the past two decades, there has been increasing focus on the relations between parental cognitions and their influence on behaviors (Bugental and Johnston 2000; Miller 1988; Tikotsky and Sadeh 2009). It is important to ascertain this relationship because parental perceptions and expectations can influence their behaviors toward their children in interactions (Belsky 1984; Hernandez-Martinez, Sans, and Fernandez-Ballart 2011; McGillicuddy-De Lisi and Sigel 1995; Miller 1988, Scher and Tirosh 1997; Tikotsky and Sadeh 2009). The concern is that negative perceptions of the child can negatively affect the parent's behavior toward the child and that, over time, negative parental behaviors could be harmful to the child's development (Hernandez-Martinez et al. 2011).

The majority of the research examining the relationship between parental perceptions and negative parental behaviors focuses on maternal PPD and illustrates the importance of early interactional patterns and their effects on later child development (Page, Combs-Orme, and Cain 2007). In a review of the research over the past decade, Field (2010) states that significant negative long-term behavioral, emotional, and health problems are associated with infants who have poor mother-infant interactions as a result

of maternal PPD. Mothers who are depressed tend to be more intrusive, controlling, and negative, as well as less engaging than nondepressed mothers during interactions with their infants (Field 2010; Lovejoy et al. 2000; Murray et al. 1996). Also, depressed mothers tend to vocalize less and provide fewer stimulating activities such as singing songs, playing peek-a-boo, and telling stories with their infants than do nondepressed mothers. Given these findings, it is unsurprising that infants of depressed mothers are more likely to show delays in expressive language and to score lower on cognitive assessments than infants of nondepressed mothers (Field 2010).

A few contemporary studies have focused on parents' perceptions in nonclinical samples. Mantymaa et al. (2006) found that parents' reports of a child's difficult temperament were related to a more negative interactional style with the child. Specifically, mothers showed more intrusiveness toward their infants during the interactions. Page et al.'s study of a sample of mothers who had recently given birth found that parenting attitudes had a "significant, direct effect on mother-infant interaction" (2007:164). Parental perceptions do appear to have an important impact on actual parental behavior (Page et al. 2007).

Based on what is known about maternal depression and negative perceptions of and interactions with the infants, the present study sought to apply this knowledge to the study of maternal sleep deprivation, especially given that many sleep-deprived mothers also experience deficits in mood (Bayer et al. 2007; DeLeón 2011; Dennis and Ross 2005; Dorheim et al. 2009a, 2009b; Goodlin-Jones, Eiben, and Anders 1997; Hiscock and Wake 2001; Karraker and Cottrell 2000; Karraker and Young 2007; Nover et al. 1984). The purpose of this pilot study was to explore how perceptions of sleep deprivation in a group of mothers categorized as highly sleep deprived resulting from infant night awakening were related to perceptions of the infant and to interactions within the dyad. It was expected that mothers in the highly sleep deprived group would rate their infants more negatively. It was also expected that mothers in the highly sleep deprived group would perceive themselves as being more sleep deprived and would rate that they would interact better with their infants if they were receiving more sleep. The study was unique in that the relationship between *perceptions* of sleep deprivation and ratings of maternal interaction with the infants in a group of highly sleep deprived mothers has gone relatively unexplored in the literature thus far.

METHOD

Participants

Participants were enrolled in a larger study examining maternal interaction with young infants (Wiedman and Karraker 2003). A total of 40 mothers (39 non-Hispanic white, 1 Native American; mean age = 30.58 years, range 24 to 39 years) and their three-to-four-month-old infants (25 girls and 15 boys) participated. Participants lived in a university town and were employed full time (37.5%) or part time (12.5%) or were homemakers (50%), with four years of college being the average education level. To

control for issues associated with special cases such as prematurity (less than 37 gestational weeks) and other medical problems (i.e., any malady that required hospitalization for at least one week), only women who delivered healthy full-term infants, without complications, were included in the study.

Participants were recruited by accessing county birth records to obtain the names of community members who had recently borne children. Addresses and phone numbers were obtained via the local telephone book, and mothers were initially contacted using an introductory letter describing the study. When the infants were three months of age, mothers were telephoned and categorized as highly sleep deprived or not according to their responses to a screening questionnaire. In the absence of a clear definition of sleep deprivation in previous literature, mothers in the present study were categorized as highly sleep deprived if the difference between the average amount of sleep they reported and the amount of sleep they reportedly needed to function well was two or more hours and their infant was reportedly awakening at least two times per night on average. Mothers were categorized as not sleep deprived when the difference between the average nightly sleep they reported and the amount of sleep they reportedly needed to function well was zero and they reported their infants were awakening less than once per night (i.e., the infant was sleeping through the night at least once per week and did not typically wake up multiple times during the night).

After the screening was completed, only mothers who fit the criteria for the highly sleep-deprived or not sleep-deprived groups were invited to participate. A total of 182 mothers were screened. One hundred of those mothers were not invited to participate because they did not meet the criteria or because their infants were born prematurely or had medical complications after birth. Of those mothers who did meet the criteria, 28 declined because of time constraints and 14 agreed to participate but later withdrew (also because of time constraints). Of the 14 mothers who withdrew from the study, 6 were classified as highly sleep deprived and 8 were classified as not sleep deprived. Participant dropout did not appear to be systemic, because a relatively equal number of women in each group declined participation; therefore, the sample included 20 mothers in the highly sleep-deprived group and 20 mothers in the not sleep-deprived group.

Procedure

Mothers who agreed to participate were asked to make a visit to the laboratory. One week prior to the visit, they received an introductory packet explaining the study, as well as several questionnaires that assessed their current sleep patterns and infant characteristics.

The laboratory visit consisted of a face-to-face interaction in which the mother interacted with her infant. The scheduled visit occurred approximately two weeks after the mother initially agreed to participate with her infant. Visits were scheduled during the afternoon or early evening hours, given that it was the time when the effects of sleep deprivation were expected to be at their peak (Karraker and Cottrell 2000). Mothers and

infants engaged in typical face-to-face interactions. During the interaction, the mother was instructed to sit at a table with her infant situated in an infant seat directly in front of her. A mirror reflected the mothers' facial expressions, and vocalizations were heard with the aid of a baby monitor. The dyad was videotaped for three minutes through a one-way mirror during the interaction. The mother was instructed to play with the infant and to keep him or her entertained as she would at home without the use of toys. Following the interaction, each mother was asked to complete several more questionnaires to obtain information pertaining to her demographic characteristics, mood, previous night's sleep, and rating of the interaction with her infant. Upon completion of the study, each mother was reimbursed for her time commitment with \$20 as well as a booklet about infant development, and the infant received a t-shirt and certificate of participation.

Measures

The Infant Care Diary (ICD; Karraker and Cottrell 2000) was used as a self-report measure to assess maternal and infant sleep patterns one week prior to the home visit. Mothers who utilized day care or babysitters to provide care for their infants were asked to have the child care workers complete the ICD during the time that the infant was away from the mother. From this measure, the mothers' total reported sleep time per night, total reported wake time per night, total reported wake frequency per night, and total reported nap time per day were calculated. Measures of the infants' total reported sleep and wake times as well as total reported wake frequencies per night were also calculated.

The Verran/Snyder-Halpern Sleep Scale (Snyder-Halpern and Verran 1987) is a 15-item self-report measure that obtained information about the mother's previous night's sleep and was completed at the laboratory visit. The items were combined into three scales assessing disturbance, effectiveness, and supplementation. The disturbance scale provides information about the participant's perception of the degree of disturbed sleep she experienced due to fragmentation and difficulty falling asleep. The effectiveness scale assesses the participant's perception of how effective she considered her sleep to be given the quality and length of the sleep. Finally, the supplementation scale assesses the participant's perception of how her sleep was improved with additional sleep times. Snyder-Halpern and Verran (1987) reported theta coefficients illustrating consistency for each scale to be .86 for disturbance, .75 for effectiveness, and .45 for supplementation.

To ascertain the extent to which mothers were experiencing depressive symptoms, the Beck Depression Inventory-II (BDI-II; Beck, Steer, and Brown 1996) was administered. This measure is a frequently used depression assessment that requires participants to rate their feelings on a 4-point Likert scale ranging from 0 to 3 on 21 questions. Responses to the questions are then totaled to yield an overall depression score, with higher scores indicating more depressive symptoms. Individuals with scores of 20 or above are considered to be suffering from moderate levels of depression. Individuals with scores of 9 or lower are considered to be nondepressed (Beck, Steer, and Garbin 1988). The internal consistency, using coefficient alpha, for the present study was .91.

The Early Infant Temperament Questionnaire (Medoff-Cooper, Carey, and McDevitt 1993) was used to assess the mother's perceptions of her infant. This questionnaire is used to assess the infant's temperament between one and four months of age. The mother was asked to complete the 86-item questionnaire by rating her infant on a six-point Likert scale yielding ratings. At the end of the questionnaire, the mother was also asked to rate several general impressions of her infant's temperament. For the purpose of the present study, only the manageability scale is reported as a measure of maternal perceptions of infant difficulty. Mothers were asked to rate how manageable their infants were in comparison to other infants who were the same age, with a 1 being "very easy" and 6 being "very" difficult.

RESULTS

There were significant differences between the groups using the various measures of sleep obtained from the demographic questionnaire. Across all measures of sleep, unsurprisingly, the highly sleep-deprived mothers significantly differed in the amount of reported sleep, their self-reported ratings of sleep deprivation, the number of times they were being awakened per week, the number of hours they needed to function well, and how sleep deprivation was negatively affecting their functioning from the not-deprived mothers (see Table 1). As predicted, the highly sleep-deprived mothers rated themselves on a five-point scale with 5 being "very sleep deprived" to be more sleep deprived ($M = 3.35$, $SD = 0.88$) than did the not-deprived mothers ($M = 1.95$, $SD = 0.89$). In addition, the highly sleep-deprived mothers reported on a five-point scale with 5 being "a great deal" that their everyday functioning was being negatively affected by sleep deprivation ($M = 3.15$, $SD = 0.81$) more than did the not deprived mothers ($M = 1.79$, $SD = 0.89$).

A review of the Infant Care Diary results confirmed the findings from the demographic questionnaire. In the week prior to the laboratory visit, the highly sleep-deprived mothers reportedly were receiving less sleep and were being awakened more by their infants per night than the not-deprived mothers (see Table 1). In addition, the subscale scores of the Verran/Snyder-Halpern Sleep Scale revealed that the sleep of the highly sleep-deprived mothers was perceived as being more disturbed and less effective than that of the not-deprived mothers (see Table 1).

In terms of the goals of this pilot study, only the perceptions of the 20 highly sleep-deprived mothers were of interest. As was hypothesized, there were strong relationships between mothers' perceptions of sleep deprivation and negative ratings of their infants and interactions with their infants in the highly sleep-deprived group. There was a strong positive correlation between maternal ratings of sleep deprivation and infant manageability. Mothers in the highly sleep-deprived group who rated themselves as more sleep deprived rated their infants as more difficult ($r = .65$, $p < .01$).

Table 1. Difference in Self-Reported Maternal and Infant Sleep Behaviors between Mothers Who Were Highly Sleep Deprived and Mothers Who Were Not Sleep Deprived

Measure	<u>Highly Sleep Deprived</u>		<u>Not Sleep Deprived</u>		t (38)
	M	SD	M	SD	
Average Amount of Sleep	5.90	0.98	6.85	0.67	-3.57**
Rating of Sleep Deprivation	3.35	0.88	1.95	0.89	5.03**
Rating of Sleep Deprivation Negatively Affecting Function	3.15	0.81	1.79	0.89	4.63**
Number of Times Sleep Interrupted per Week	6.32	1.94	3.52	2.50	3.95**
Hours of Sleep Needed to Function Well	7.50	0.74	6.70	1.25	2.46**
					t (30)
Total Amount Maternal Sleep per Night	6.33	0.78	6.98	0.80	-2.29*
Infant Awakenings per Night	2.52	0.87	1.03	0.74	5.18**
					t (37)
Sleep Disturbance	318.32	133.38	185.26	136.42	3.08*
Sleep Effectiveness	235.31	83.41	295.61	79.70	2.31*

* $p < .05$, ** $p < .001$

There was also a strong positive correlation between maternal ratings of sleep deprivation affecting functioning and sleep deprivation interfering with the mother's ability to interact with her infant. Mothers categorized as highly sleep deprived who more strongly agreed that sleep deprivation was affecting their functioning were more likely to strongly agree that the sleep deprivation was interfering with their ability to interact with their infants ($r = .68$, $p < .01$).

A strong positive relationship between perceptions of sleep deprivation and ratings of the interaction on the day of the laboratory visit was also found. Mothers categorized as highly sleep deprived who more strongly agreed that sleep deprivation was affecting their functioning were more likely to strongly agree that they would have interacted better with their infant during the observed interaction if they had gotten more sleep the night prior to the lab visit ($r = .59$, $p < .01$).

Perceptions of sleep deprivation were also found to be related to depressive symptoms in this sample of mothers categorized as highly sleep deprived. Exploratory analyses revealed that the mothers who more strongly agreed that sleep deprivation was

affecting their functioning were more likely to score higher on the Beck Depression Inventory ($r = .59, p < .01$).

The same pattern of correlations was found to be nonsignificant for the not sleep-deprived group of mothers. Perceptions of sleep deprivation in the not sleep-deprived group were not related to perceptions of their infants, their ratings of interactions with their infants, or their moods.

DISCUSSION

This pilot study was one of the first to examine the relationships between perceptions of sleep deprivation in a group of mothers categorized as highly sleep deprived and negative perceptions of the infant and ratings of the interaction within the dyad. Study results show that, as predicted, mothers categorized as highly sleep deprived perceived themselves to be sleep deprived and perceived their infants as being difficult. Mothers in the highly sleep-deprived group also perceived that sleep deprivation was affecting their functioning and agreed that it was interfering with their ability to interact with their infants. Mothers categorized as highly sleep deprived perceived that sleep deprivation was affecting their functioning and that they would have interacted better with their infants on the day of the laboratory visit if they had received more sleep the night before. Finally, mothers who perceived that sleep deprivation was affecting their functioning were more likely to show more depressive symptoms. Together, these findings suggest that mothers who perceive themselves as sleep deprived may be at risk for having deficits in mood as well as negative perceptions of their infants and their interactions with their infants.

Self-perceptions have been found to influence an individual's abilities to parent (Belsky 1984; Miller 1988; Page et al. 2007; Renk 2011; Scher and Tirosh 1997). When individuals have more positive self-perceptions as parents, they are more likely to engage in positive parenting behaviors, which have been found to be related to more positive child outcomes (Page et al. 2007). There appears to be a self-fulfilling nature to this association between parental self-perceptions and behaviors. Parents with positive self-perceptions are more likely to execute positive behaviors, which have positive effects on the infants' development (Page et al. 2007). Given the findings of the present study that highly sleep deprived mothers are more likely to negatively perceive their interactions with their infants, it follows that if a highly sleep-deprived mother perceives that she is not interacting well with her infant because she perceives that sleep deprivation is interfering with her ability to function, then she may actually not be interacting well with her infant, with potential effects on the infant's development over time.

The effects of negative mother-infant interaction over the first few months of life can be significant, as is the case with infants of mothers who have PPD. Infants of mothers with PPD who experience poor mother-infant interaction are more likely to have significant negative long-term behavioral, emotional, and health problems (Field 2010). Mothers with PPD have been shown to be more hostile, negative, and irritable during

interactions with their infants (Field 2010; Lovejoy et al. 2000; Murray et al. 1996). They also tend to be less warm, sensitive, and vocal and to show less emotion during face-to-face interactions with their infants than do mothers who are not depressed (Field 2010; Luoma et al. 2004; Murray et al. 1996). These negative maternal behaviors during mother-infant interactions are significant because face-to-face interactions are an important means for the infant to learn how to communicate and socially interact during infancy (Field 2010). Mothers in this pilot study who perceived that sleep deprivation was affecting their functioning were also more likely to score higher on the BDI-II. It is possible that, as in mothers with PPD, these deficits in mood could also be affecting these women's interactions with their infants.

The finding that mothers categorized as highly sleep deprived were more likely to perceive their infants as being more difficult is also important to address. The self-fulfilling nature of this relationship can also be discussed here. If the highly sleep-deprived mother perceives her infant to be more difficult, she may behave negatively toward her infant. The infant may consequently behave negatively, which may confirm the mother's initial negative perception she has about her infant's manageability. These negative maternal perceptions of the infant's difficulty are significant because it has been previously found that infants who are perceived as more difficult to manage are at risk for later developmental problems as well as maltreatment (Casanueva et al. 2010; Hernandez-Martinez et al. 2011).

There are several limitations to this pilot study that suggest directions for future research. First, the study relied on self-report data about the interaction. Future research might further examine actual maternal behaviors executed when interacting with the infant using larger sample sizes. Two specific behaviors that could be targeted are maternal contingency and sensitivity. Previous research has shown that mothers who are depressed tend to be less sensitive and contingently responsive toward their infants, which could affect the infant who is dependent on the mother for cues about how to socially interact (Field 2010). This research could be applied to the study of sleep-deprivation effects on mother-infant interaction because the mother's mood and abilities to react sensitively and contingently toward her infant may be affected not only by her mood but also potentially by her lack of sleep. Second, the study primarily focused on negative perceptions of interaction with the *infant* as a result of lack of sleep. Future research may also wish to consider how maternal negative perceptions of sleep may be affecting interaction with other family members as well (Meltzer and Mindell 2007). It is possible that if highly sleep-deprived mothers perceive that their interactions with their infants are being affected by their lack of sleep, their other familial interactions may also be affected. Finally, this study included a small homogenous sample of highly educated Caucasian mothers. Future studies might examine relations between maternal perceptions of sleep and interactions with infants using a more diverse sample that includes fathers and siblings as well (Meltzer and Mindell, 2007).

The results of this study suggest the importance of examining the relationships between perceptions of sleep deprivation in a group of mothers categorized as highly sleep deprived and negative perceptions of the infants and ratings of the interactions

within the dyad. It is important to study these relationships because negative maternal perceptions of the infant and of mother-infant interactions could potentially affect maternal behavior toward the infant, which may in turn have an impact on the infant's development.

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