

THE PENNSYLVANIA STATE UNIVERSITY
SCHREYER HONORS COLLEGE

DEPARTMENT OF HUMAN DEVELOPMENT AND FAMILY STUDIES

SLEEP FRAGMENTATION, MATERNAL DEPRESSIVE SYMPTOMS, AND EMOTIONAL
AVAILABILITY: THE ROLE OF SLEEP ARRANGEMENTS

SARA NAVARRO
SPRING 2015

A thesis
submitted in partial fulfillment
of the requirements
for a baccalaureate degree in
Human Development and Family Studies
with honors in Human Development and Family Studies

Reviewed and approved* by the following:

Douglas M. Teti
Professor of Human Development and Family Studies, Psychology, and Pediatrics
Thesis Supervisor

Charles F. Geier
Professor of Human Development and Family Studies
Honors Adviser

* Signatures are on file in the Schreyer Honors College.

ABSTRACT

Common concerns of parents with infants include sleep loss and fatigue, as well as making the important decision of where their child will sleep. This study examined sleep arrangement, sleep fragmentation, and depressive symptoms for mothers across the first nine months of their infant's life. Maternal emotional availability was used to measure the quality of mother-infant relationship at nine months. Participants included 149 mother-infant dyads recruited by Project SIESTA II. Mothers practicing consistent cosleeping arrangements were significantly associated with higher maternal sleep fragmentation, higher maternal depressive symptoms, and lower emotional availability at bedtime, compared to the consistent solitary sleeping and early switching groups. These results suggest that cosleeping arrangements can indicate poorer maternal sleep, well being, and parenting competency.

TABLE OF CONTENTS

LIST OF TABLES	iii
ACKNOWLEDGEMENTS	iv
Chapter 1 Introduction	1
Infant Sleep Loss and Sleep Arrangement	1
Maternal Sleep Loss and Maternal Depression	3
Maternal Depression and the Mother-Infant Relationship	4
The Present Study	6
Chapter 2 Methods	7
Participants	7
Questionnaire Measures	8
Observational Measures	10
Parent- Infant Sleep Quality	13
Data Analytic Plan	14
Chapter 3 Results	15
Chapter 4 Discussion	19
Implications	22
Limitations and Future Directions	23
Conclusion	24
BIBLIOGRAPHY	25

LIST OF TABLES

Table 1. Descriptive Information for Sleep Arrangements and Mean Maternal Sleep Fragmentation.	15
Table 2. Descriptive Information for Sleep Arrangements, Maternal Depressive Symptoms, and Maternal Emotional Availability.....	17

ACKNOWLEDGEMENTS

Many thanks are due for those who helped me along the thesis writing process. I would first and foremost like to thank Dr. Douglas Teti for giving me the opportunity to get involved with Project SIESTA II, as well as for sharing his expertise and patience throughout the completion of this thesis. A special thanks to all of the help I have received from Grace Rhee, Lauren Philbrook and Jon Reader throughout my time in the Project SIESTA II lab. Lastly, a big thank you to my advisers Dr. Charles Geier and Dr. Lisa Gatzke-Kopp for their continued support from the very beginning of my honors experience. I could not have been successful in this task without your kind words and encouragement.

Chapter 1

Introduction

Infant sleep patterns differ across cultures and households, as well as across the period of infancy. Sleep problems are one of the most common concerns parents reported to pediatricians about their infants across the first year of life (Loutzenhiser, Ahlquist, & Hoffman, 2011; Teti & Crosby, 2012). These complaints to pediatricians often include an infant's difficulty falling asleep, frequent night wakings, and instances of infant sleep problems causing distress for parents (Sadeh, Tikotzky, & Scher, 2010). This is not surprising, as research has reported that around 17-34% of infants exhibit sleep problems and two thirds of one-month-old infants wake more than once per night without being able to return to sleep independently (Geramo, 2009; McDaniel & Teti, 2012). Although, children do learn how to sleep through the night, research has shown that infant night waking decreases in frequency as the child matures (Mindell, Telofski, Wiegand, & Kurtz, 2009). Infant sleep, or lack thereof, is a concern because it extends beyond fatigue for the mother and child. Infant sleep loss or disordered sleep has effects on the whole family system including parental stress, maternal depression, reduced sense of parenting competence, and overall reduced quality of life (Sadeh, Mindell, & Owens, 2011).

Infant Sleep Loss and Sleep Arrangement

Infant sleep is highly influenced by parental behaviors. The decisions parents make in regards to where the baby sleeps, feeding practices, and how they settle the child can result in

improved or diminished sleep quality for both the infant and the parents (Field, 2010). For example, infants who fall asleep with significant parental involvement have been found to be more likely to have increased numbers of night waking, compared to those who fall asleep in crib with minimal parental assistance (Sadeh et al., 2010).

Parents structure infant sleep, specifically sleep arrangements, and their choices are shaped by various cultural, medical, and personal influences. In general, parental decisions of where the baby is sleeping is seen as a controversial topic in the field of human development, as cosleeping is not normative in United State's culture. However, it is normative in 65% of the world's other cultures(Teti, Kim, Mayer, & Counterline, 2010). The debate on the safety and effectiveness of cosleeping is continually debated, and as with any debate there are two sides. Supporters of cosleeping believe it is a natural sleeping arrangement, which allows for parents to respond to the child's needs promptly, it facilitates breastfeeding, and provides close and intimate contact with caregiver supporting the child's socio-emotional development, and some believe it to be a protective factor against Sudden Infant Death Syndrome (SIDS) (McKenna, Ball, & Gettler, 2007; Sadeh et al., 2010). In contrast, those opposed to cosleeping state it as having many risks to the child's health and development, claiming the child may be more prone to accidents or death, cosleeping may interfere with development of independence and autonomy and that it is related to more problematic sleep behavior such as increased night wakings (Sadeh et al., 2010).

The success of cosleeping, or bedsharing as it is commonly referred to, is often contingent upon it being an active choice made by the parents planned ahead of time. This practice is known as proactive bedsharing. Reactive bedsharing, however, is another type in which the bedsharing is a result of the child being unsuccessful at solitary sleep, which was not

an active choice by the parents but simply a measure used to get the child to fall asleep (Loutzenhiser et al., 2011). Parents who participated in proactive bedsharing perceived their child's sleeping patterns to be undistruptive and not an inconvenience, while parents practicing reactive bedsharing interpreted their child's sleep behaviors negatively and label it as troublesome (Dyer, Youngclarke, & Jane, 2007).

Maternal Sleep Loss and Maternal Depression

In the infant sleep arrangements literature, most research focuses on infant sleep loss, but little research has looked at maternal sleep loss. The infant is not the only losing sleep; when children have sleep problems it clearly affects parent sleep and their subsequent functioning in daytime (Meltzer & Montgomery-Downs, 2011). Subjective poor maternal sleep negatively impacts well being and daily functioning, which could be detrimental to the parent-child relationship (Tikotzky, Chambers, Gaylor, & Manber, 2010), as even just one night of sleep loss impairs integrative executive functioning (Karlsson, Nilsson, & So, 2005).

When maternal sleep loss occurs it can affect the quality of interaction with the infant and may be predictive of poorer mother-child interactions during daytime. Research shows that women in the immediate postpartum period had short sleep duration associated with significant performance deficits, general health problems, and overall psychological stress (J. Mindell, Sadeh, Kwon, & Goh, 2013). Maternal sleep loss may lead to irritability in mothers, fatigue, lower functioning, and therefore missed cues from the child. Many parenting practices related to cosleeping have been linked to maternal depressive symptoms, and these symptoms have been

speculated to put children at risk for long-term negative effects on social, emotional, cognitive, and physical development (Field, 2010).

There are consequences to maternal sleep loss and choices affecting sleep arrangements that often effect maternal well being. When sleep disruption is cumulative, infant sleep problems may alter parent mood, distress or lead to depressive symptoms (McDaniel & Teti, 2012). Infant sleep quality has been frequently linked with maternal depression and has an alarming prevalence and strong reciprocal impact. Research shows that 13% of mothers develop a major depressive episode within the first three months after birth (Dennis & Ross, 2005). Mothers in cosleeping arrangements specifically were found, by six months, to have significantly elevated depressive symptoms relative to mothers whose infants slept in separate room (Kim & Teti, 2014).

Maternal Depression and the Mother-Infant Relationship

Now that maternal sleep loss has been established as a risk factor for maternal depressive symptoms it is time to inquire what the risks for the mother and child are. Mothers who are depressed are associated with maladaptive cognitions, affect and behaviors, and are at risk for compromised and negative parenting. These inadequate parenting skills may negatively affect the child's social and cognitive development (Goodman, 2007). Depressed mothers provide appropriate structure and guidance to their children less frequently than non-depressed mothers (Goodman & Brumley, 1990). By nature, many depressive symptoms are opposite to the qualities considered to be necessary for good parenting; depressed mothers can suffer from

diminished energy, pessimism, dysphoria, and insensitivity, disengagement, and display of disapproving and hostile attitudes toward her children (Gelfand & Teti, 1990).

Mothers with depressive symptoms also are predicted to have lower maternal emotional availability (Kim & Teti, 2014). Maternal emotional availability was determined based on mothers responding promptly and accurately to their infant's emotional cues, not introducing distracting interactions, and refraining from impatience, sarcasm or anger toward their child, as well as using quiet soothing routines at bedtime (Kim & Teti, 2014). Depressed mothers may be interacting with their infants inappropriately, which is why it is important to study emotional availability at bedtime. Depressed mothers may for example exhibit anger towards their children at bedtime if they are unable to fall asleep, depressed mothers may not be using soothing voices or may present their infants with distracting toys at bedtime, which not surprisingly may lead to the child taking longer to fall asleep. It can be understood why it is of concern that mothers with depressive symptoms and low emotional availability can be considered to have a decreased level of parenting efficacy and put them at risk for poor mother-infant attachment (Kim & Teti, 2014).

This can jeopardize the mother-infant relationships, as the depressed mother may be an inadequate social partner for the child, and may be unable to meet the child's emotional and social needs. Infants who spend most of their waking hours close to their mothers are especially sensitive to their mother's mood, and therefore are susceptible to her mood disturbances (Gelfand & Teti, 1990). Infants show concerning responses to their depressed mother's behavior such as increased fussiness, lowered physical activity, withdrawal, and less positive affect (Cohn, Matias, Tronick, Connell, & Karlen, 1986; Field et al., 1985). These distorted behaviors that accompany maternal depression have effects on the child that reach farther than compromised care. Additional risks for children of depressed mothers are early depression in the child,

negative affect, heightened emotionality, as well as poorly regulated aggression (Goodman, 2007).

The Present Study

This research will investigate to what extent sleep arrangements is correlated with objective measures of maternal sleep, as measured by actigraphy. It will observe mother depressive symptoms for those mothers experiencing sleep loss, as well as observe quality of mother infant interactions, determined by videos that coded for maternal emotional availability at bedtime.

Specific Aim 1: To examine the association between infant sleep arrangements and quality of maternal sleep across the first 9 months.

Hypothesis 1. Consistent cosleeping arrangements will be associated with greater sleep fragmentation in mothers than in consistent solitary sleeping or early switching arrangements.

Specific Aim 2: To examine the association between average maternal sleep fragmentation and average maternal depressive symptoms across the first 9 months.

Hypothesis 2. Elevated maternal sleep fragmentation will be associated with elevated maternal depressive symptoms.

Specific Aim 3: To examine the association between average maternal depressive symptoms across the first 9 months and quality of mother-infant interaction during bedtime at 9 months.

Hypothesis 3. Elevated maternal depressive symptoms will be associated with lower maternal emotional availability levels during mother-infant bedtime interactions.

Chapter 2

Methods

Participants

The study's one hundred and sixty-seven participants were families with 1-month old infants recruited to participate in the Project SIESTA (Study of Infants' Emergent Sleep Trajectories). Project SIESTA is a longitudinal study funded by NICH that investigates parenting practices, infant sleep patterns, and early development across the first two years of the infant's life. The present study however includes data collected across the infants' first year, collected at 1,3,6, and 9-month time points, during home visits. All participants were presented with a flyer within the first two days after delivery in two central Pennsylvania hospitals. The flyer gave a description of the study along with contact information, and directions for interested mothers to contact two or three weeks after they left the hospital. Initial home visits were scheduled for 4-6 weeks after delivery.

167 families were initially recruited, but 18 withdrew from the study within the first year of the data collection, leaving 149 families participating at the end of the study. Using a one way analysis of variance (ANOVA), chi-square analysis, and Fisher Exact Probability tests the 18 families who dropped out of the study were compared against those remaining in the study on all socio-demographic variables, as well as all other study variables collected at 1 month. One difference was found between those who dropped out and those who completed the study; dropouts were more likely to be non-White [35% vs. 14%, $\chi^2 (1) = 4.96, p = .026$] than those

who completed the study. No differences were found between those who dropped out and those who completed the study in sleep arrangements, marital adjustment, positive and negative co-parenting, parental adjustment to infant nighttime sleep, and bedtime parenting quality at 1 month.

Of the families who completed the study through 12 months, the infant participants included 80 females and 69 males. 95% of parents were living with a partner or married. 37% of mothers were first time moms. The sample included 86% of mothers, 85% of fathers who were White, with the remaining parents an even split of African American, Asian American, Latino or “other”. At the beginning of the study 88% of mothers were breastfeeding their infants in some capacity, and at 12 months it dropped to 33%. The majority of mothers in this study were working, 65% employed full time or part time at 1 month, and 62% by 12 months. 95% of fathers were employed full time or part time at 1 month, 98% employed by 12 months. Median family income was \$60,000. The parents in this study were fairly well educated with 99% of mothers having completed high school, 60% with a bachelor’s degree or higher, 85% and 61% for fathers, respectively.

Questionnaire Measures

Sociodemographics. Upon recruitment all parents completed a socio-demographic questionnaire including questions regarding educational attainment, family income, age, partner status (live in vs. no live-in partner) and family size. Mothers also completed Keller and Goldberg’s (2004) Sleep Practices Questionnaire (SPQ), which provided their thoughts on if they had adequate sleeping space for all members of their household. The specific item on the SPQ

was worded as, “We have limited sleeping space”, and mothers responded by rating how descriptive the item was of their household on a scale of 1- “not at all” to 5- “definitely”.

Mothers at every age point reported if they were breast-feeding their infant part-time, full-time, or not at all.

Infant sleep arrangements. The Sleep Practices Questionnaire (SPQ) was used to broadly measure parental perceptions regarding their infants’ sleep behavior (Goldberg & Keller, 2007). Mothers responded to the item “Where does your baby usually sleep at night?” was used to determine infant sleep arrangements at each age point. Four sleep categories were scored at each age point: Solitary sleep (infant sleeping in separate room), room sharing (infant sleeping in same room as parents, but a different sleep surface than parents), bed sharing (infant sleeping in same bed as parents), and combination (infant sleeping in a mixture of any of three arrangements across the same night).

Based upon the complete sleep arrangements data available for all 149 families who completed the study through 12 months, five sleep arrangement categories were created across the five age points: Consistent solitary sleep (infant slept in their own separate room all night from 1 through 12 months, $n = 34$), early switch to solitary sleep (infant switched to a solitary sleep arrangement by 3 or 6 months, $n = 52$), late switch to solitary sleep (infant switched to a solitary sleep arrangement by 9 or 12 months, $n = 13$), consistent co-sleeping (infant was in room-sharing or bed-sharing arrangements from 1 through 12 months, $n = 21$), and inconsistent (no real pattern in infant sleep arrangements used across age points 1,3,6,9, and 12 months). Within the consistent co-sleeping group, three families engaged in consistent bed sharing from 1 through 12 months, and five families through 6 months. This study will focus on three of the five sleep arrangement groups: consistent co-sleepers, early switchers, and consistent solitary

sleepers. Also within the consistent co-sleeping group only one family consistently room shared through 12 months. Therefore, the majority of families in the consistent co-sleeping group were alternating between room sharing and bed sharing arrangements across the infants' first year.

Depressive Symptoms. At each time point, mothers completed SCL-90-R Depression subscale. This is a reliable and valid measure that qualifies severity of depressive symptoms (Derogatis, 1994). The 13-item subscale asked mothers to rate severity of symptoms such as “feeling hopeless about the future” and “feelings of worthlessness”. The items were answered using a Likert-type 5 point scale ranging from 0 (*not at all*) to 4 (*extremely*). A depressive symptom severity score was obtained by summing all 13 items.

Observational Measures

Parent emotional availability at bedtime. Parent emotional availability (EA) with infants during bedtime was observed on digital video recording and scored using the Emotional Availability Scales (EAS) (Biringen, Robinson, & Emde, 1998). The videos were recorded with a Bosch Divar XF digital video recorder (DVR), Infrared Color CCD night-vision cameras, Channel Vision 5104 microphones, and a portable DVD player. Up to four cameras and microphones were able to be input into the DVR system, all of which were time synched. The video images could be viewed together or individually.

The usual bedtime setup included a camera-microphone in whatever room the infant slept overhanding the crib or bed containing the infant; a second camera-microphone setup in the room facing the door providing a wide-angle view of the room to record who is entering and exiting the room; a third camera-microphone setup on an area such as a rocking chair, sofa, or

changing table, where the parent typically sat with infant during bedtime; occasionally a fourth camera-microphone setup in a separate room if the parent indicate that time is spent with the infant in that room during bedtime. It was indicated that parents should begin recording approximately one hour before bedtime began with infant, and to end the video recording once the infant woke up in the morning.

The EAS was designed to capture the emotional quality of parenting through observing parent child interactions. The EAS has a well-established construct validity (Moehler, Biringen, & Poustka, 2007; Trapolini, Ungerer, & McMahon, 2008), and evidence supports that maternal EA is associated with secure infant-mother attachment and autonomous attachment in mothers (Biringen et al., 2000; Biringen et al., 2005)

Four scales are used in the EAS to assess parental emotional availability: Sensitivity, structuring, non-intrusiveness, and non-hostility. Sensitivity uses a 9-point scale to assess the parent's ability to read accurately and respond contingently to child signals with warmth and emotional connectedness. Structuring uses a 5-point scale to read parent's capacity for appropriate scaffolding of child activities and setting appropriate limits. Non-intrusiveness is reverse scored on a 5-point scale and reflects parent's capacity to respect the child's autonomy and personal space. Non-hostility is also reversed scored on a 5-point scale assessing the parent's ability to interact with the child without signs of covert or overt irritability or anger. Two additional EAS scales tap the child's EA to the parent, including responsiveness and involvement. Child responsiveness is measured on a 7-point scale to rate the infant's quality of response to the parent. Involvement is measured on a 7-point scale assesses the infant's ability to initiate and involve the parent in ongoing activities. However, due to the age of, limited

behavioral repertoire, and context of bedtime settings, these two scales were not utilized in the present study.

In the present study EA was coded by a Project SIESTA staff member who was trained and certified in emotional availability coding. The rater was blind to all the other observational data collected on the participating families. EA could not be scored if the video recordings began once the infant was already sleeping, or if the interaction between infants and parents was under five minutes. The videos clearly showed that mothers were more likely to be putting their infants to bed than fathers. At 1,3,6,9, and 12 months bedtime EA for mothers and infants were collected from 103,103,102,104, and 105 families. Bedtime EA on fathers however could only be obtained from 44, 37,37,31, and 37 families at the respective time points. However, upon further analysis, these numbers when subdivided by sleep arrangement groupings yielded cell sizes too small for meaningful analyses.

At each age point all four EA scales for mothers were standardized and summed to create a maternal EA composite. The internal reliability of the composite was adequate (standardized item alphas = .81, .77, .88, and .82 at 1, 3, 6, 9, and 12 months, respectively). Inter-rater reliability [intraclass correlation (ICC), absolute agreement] on the maternal EA composite was established between the 4th and 1st author, who was also trained and certified on the EAS system. The ICC on the maternal EA composite was .98, based on 42 mother-infant dyads evenly distributed across all five age points (eight at 1, 3, and 12 months, nine at 6 and 9 months). Stability of maternal EA across infant age was moderate-to-strong ($r_s = .28$ to $.63$).

Parent- Infant Sleep Quality

Actigraphy. At each time point, infants, mothers, and fathers wore a Respironics/Mini Mitter actiwatch (model AW – 64) for seven consecutive days. The actiwatch assesses sleep-wake activity during nighttime. The actiwatch was worn on the infants' upper ankles (affixed with a soft elastic band), while mothers and fathers wore the actiwatches on their wrists. Sampling epoch length for the actiwatches was 1 minute, and a medium (40 activity counts) wake threshold value was used. Actiware (Version 5.0) software was used to upload actigraphy data, in actigram format, onto personal computers. The software was used to determine sleep fragmentation, which provides an overall measure of restless sleep (percent of mobile bouts + percent of immobile bouts less than 1 minute in duration) and wake after sleep onset, or simply the number of minutes spent awake between sleep onset and morning wake time. Sleep bouts were identified by The Sadeh algorithm (Sadeh, Sharkey, & Carskadon, 1994), which identifies sleep onset as first of at least 3 continuous minutes of sleep, and sleep offset as the last of at least 5 continuous minutes of sleep. These measures were taken for each infant, mother, and father, for each of the seven nights at each age point, and the mean of these measures were obtained for each week of data collection. The daily sleep diaries (The 24-Hour Sleep Patterns Interview) (Meltzer, Mindell, & Levandoski, 2007) were used to cross-check and confirm when each parent went to bed against the against the actigraphy record.

Infant sleep diary. All participating mothers completed an infant sleep diary (adapted from Burnham, Goodlin-Jones, Gaylor, & Anders, 2002) each morning for the full week of data collection at each age point. The mothers were asked to record when the infant was put down to sleep and when the infant fell asleep the previous night and to record the frequency of infant night waking for the previous night. The purpose of the diary to crosscheck the infant onset of

sleep time and morning wake time against the actigraphy record. The diaries also provided information directly from the mother about the frequency of night waking. The index was obtained by summing the seven nights of data collections at each age point (Teti & Crosby, 2012).

Data Analytic Plan

The plan for data analysis is to examine group differences between sleep arrangements, maternal sleep fragmentation, maternal depressive symptoms, and maternal emotional availability at bedtime. Where applicable Pearson correlations will be used to examine the strength of the associations between variables. All analyses will be conducted by using IBM SPSS software.

Chapter 3

Results

Hypothesis 1

Hypothesis 1, that consistent cosleeping arrangements would be associated with greater sleep fragmentation in mothers compared to mothers in consistent solitary sleeping or early switching arrangements, was addressed with one-way ANOVA. Results are presented in Table 1. There was a statistically significant difference between groups ($F(2,89) = 8.28$) $p = .001$). Student-Newman-Keuls post-hoc test determined group differences between consistent cosleepers and other sleep arrangement groups. Mothers who practiced consistent cosleeping with their infants across first 9 months had significantly more sleep fragmentation than mothers categorized as consistent solitary sleepers and early switchers. There were no statistically significant differences between the consistent solitary sleepers and early switchers.

Table 1.

Descriptive Information for Sleep Arrangements and Mean Maternal Sleep Fragmentation

Sleep Arrangements	<i>n</i>	<i>M</i>	<i>SD</i>
Consistent Solitary Sleepers	29	27.77	5.84
Early Switchers	45	30.92	6.12
Consistent Cosleepers	18	35.18	6.35

Note. Significance based on $p < .05$. Significant differences found between consistent cosleepers and consistent solitary sleepers, as well as consistent sleepers and consistent early switchers.

Hypothesis 2

The second hypothesis was that average maternal sleep fragmentation across the first 9 months would be associated with maternal depressive symptoms across the first 9 months. A Pearson correlation revealed that average maternal fragmented sleep was not significantly associated ($r = .015$; $p = .887$) with average maternal depressive symptoms.

Hypothesis 3

A Pearson correlation was also used to look at the relationship between maternal depressive symptoms, averaged across the first 9 months, and quality of mother-infant interaction as measured by the mother's emotional availability at bedtime when the infant was 9 months old. The results show insignificant association between the variables ($r = -.185$, $p = .101$).

Post-Hoc Analyses

To further investigate the relationships among variables, based on the significant finding that mothers who practiced consistent cosleeping with their infants across first 9 months had significantly more sleep fragmentation than mothers in the other sleep arrangements examined, additional tests were run to compare maternal depressive symptoms and maternal emotional availability at bedtime across different sleep arrangements. Although no statistical significance

was found linking maternal depressive symptoms and sleep fragmentation, a statistically significant difference of maternal depressive symptoms was found between sleep arrangements determined by a one-way ANOVA ($F(2,104) = 4.76, p = .011$). Post-hoc Student-Newman-Keuls established that consistent cosleepers had significantly higher maternal depressive symptoms across the first 9 months than did solitary sleepers and early switchers. One-way ANOVA analysis also determined a significant relationship between maternal emotional availability levels and varying sleep arrangements ($F(2,79) = 5.15, p = .008$). Post-hoc Student-Newman-Keuls established that consistent cosleepers had significantly lower maternal emotional availability at bedtime at the 9 month visit than did solitary sleepers and early switchers. See results in Table 2.

Table 2.

Descriptive Information for Sleep Arrangements, Maternal Depressive Symptoms, and Maternal Emotional Availability

Sleep Arrangements	Mean Maternal Depressive Symptoms			Maternal Emotional Availability at Bedtime		
	<i>n</i>	<i>M</i>	<i>SD</i>	<i>n</i>	<i>M</i>	<i>SD</i>
Consistent Solitary Sleepers	33	5.95	3.97	26	1.12	1.65
Early Switchers	52	6.13	5.26	39	0.46	2.64
Consistent Cosleepers	20	10.23	7.57	17	-1.94	5.31

Note. Significance based on $p < .05$. Significant differences found between consistent cosleepers and consistent solitary sleepers, as well as consistent sleepers and consistent early switchers for both mean maternal depressive symptoms and maternal emotional availability at bedtime.

When testing Hypotheses 2 and 3 it was determined there was no association between maternal sleep fragmentation and maternal depressive symptoms, or between maternal depressive symptoms and maternal emotional availability. Building off of results from testing Hypothesis 1, the association between sleep arrangements and sleep fragmentation; a Pearson correlation was used to examine the association between sleep fragmentation and maternal emotional availability at bedtime. A significant negative correlation was determined ($r = -.238$, $n=74$, $p = .041$), showing that increases in average maternal sleep fragmentation across 9 months were correlated with lower maternal emotional availability during bedtime at 9 months.

A univariate ANOVA was utilized to examine the relationship between sleep arrangements for the first 9 months, average maternal sleep fragmentation across the first 9 months, and maternal emotional availability at 9 months. Statistically controlling for maternal sleep fragmentation was a method to see if maternal sleep fragmentation was mediating the relationship between sleep arrangements and maternal emotional availability at bedtime. The results showed a significant association between sleep arrangements and maternal emotional availability at bedtime at 9 months ($F(2,70) = 4.098$, $p = .02$) independent of average maternal sleep fragmentation across the first 9 months.

Chapter 4

Discussion

This study examined the associations between sleep arrangements, maternal sleep fragmentation, and mother-infant interaction defined by maternal emotional availability at bedtime. The hypothesized model initially proposed that consistent cosleeping arrangements would be predictive of lower maternal quality of sleep across the first 9 months, which would predict increased maternal depressive symptoms across the first 9 months, which would be predictive of lower maternal emotional availability at bedtime at 9 months. While this model was not supported in its entirety, some of the hypothesized relationships were confirmed.

Hypothesis 1

It was predicted that sleep arrangements would be associated with the quality of maternal sleep. As hypothesized, the results demonstrate a significant relationship between mother-infant sleep arrangements and average maternal sleep fragmentation across the first 9 months of the study. Post-hoc analyses were used to determine which sleep arrangement groups were differing in maternal sleep fragmentation levels. Hypothesis 1 was supported as the results confirmed that consistent cosleeping arrangements had significantly higher sleep fragmentation for mothers than those practicing solitary sleep arrangements or switching to solitary sleep arrangements by 6 months. This can be interpreted as cosleeping arrangements predicting lower maternal sleep

quality, as research suggests that increased maternal fragmented sleep is detrimental to maternal subjective sleep (Gress et al., 2010). This comes as little surprise as previous research has determined a strong association between fatigue and onset of depressive symptoms, specifically caused by chronic sleep fragmentation (Dennis & Ross, 2005). It has also been suggested that mothers with low sleep quality are more attuned to infant night wakings (Gress et al., 2010). This makes sense in the context of cosleeping, as mothers are closer and more aware of their infant in their bed, and this may be a cause of increased maternal sleep fragmentation for our consistent cosleeping group.

Hypothesis 2

Based upon the previous hypothesis that established a link between cosleeping and increased maternal sleep fragmentation, it was expected increased maternal sleep fragmentation would predict increased maternal depressive symptoms, both averaged across the first 9 months. Upon analysis however, this hypothesis was not supported. This means that maternal sleep fragmentation alone is not predictive of increased maternal depressive symptoms. This was somewhat surprising because sleep disruption has been found to have significant impacts on mood (Meltzer & Montgomery-Downs, 2011). However, upon completion of post-hoc analyses, we were able to predict maternal depressive symptoms through sleep arrangements. Cosleeping was associated with higher average maternal depressive symptoms across the first 9 months.

Hypothesis 3

Results did not support the hypothesis that maternal depressive symptoms across the first 9 months would be associated with lower maternal emotional availability at bedtime at 9 months. It is possible that the subset of the sample used for the current study was composed of mothers with subclinical ranges of depressive symptoms, as was also seen in a 2014 study by Kim and Teti that used the same sample. This tells us that maternal depressive symptoms alone may not be predictive of maternal emotional availability at bedtime. Perhaps if we had looked at maternal well being on a broader scale, incorporating depressive symptoms, quality of the coparenting relationship, quality of the marital relationship and feelings parenting efficacy, it would have been a more accurate predictor of maternal emotional availability.

Post Hoc tests did establish a significant link between sleep arrangements and maternal emotional availability at bedtime at 9 months, which validates maternal emotional availability as a relevant outcome variable for this study. Maternal emotional availability can give us a window into the mother-infant relationship as it has been seen that emotionally unavailable parents in the context of bedtime can lead to young children being predisposed to disordered sleep. In addition to low emotional availability predisposing these children to poor sleep, but it also can contribute to the development of stressed relationships with their parents (Teti et al., 2010).

Another variable also was significantly associated with maternal emotional availability at bedtime: sleep fragmentation. This finding is supported by ample research that states that sleep loss can be a risk factor to compromised parenting, as parents subjected to chronic disturbed sleep have negative impacts to their mood and overall functioning (Hiscock & Wake, 2001; Meltzer & Mindell, 2007; Tikotzky et al., 2010).

Taking this relationship one step further we analyzed the relationship that all three variables of interest: sleep arrangements, average maternal fragmented sleep across 9 months, and maternal emotional availability at bedtime at 9 months. To clarify this relationship we again compared sleep arrangements to measurement of maternal emotional availability at bedtime, but this time we controlled for sleep fragmentation to see if it was a mediator of this association. The results show that even when you control for mothers' sleep fragmentation, the association between sleep arrangements patterns and bedtime EA remains statistically significant. This means that sleep fragmentation is not a strong mediator of the link between sleep arrangements and mothers' bedtime EA. There appears to be a direct effect of sleep arrangements on mothers' emotional availability with their infants at bedtime, unaffected by the mothers' sleep quality.

Implications

All together these results tell us interesting things about cosleeping mother-infant pairs compared to their solitary sleeping counterparts. Mothers who practice consistent cosleeping arrangements across the first 9 months are more likely than consistent solitary sleepers or early switchers to have increased sleep fragmentation, increased maternal depressive symptoms, as well as decreased maternal emotional availability at bedtime. This is a concern for maternal well being as a whole, because diminished sleep quality as well as elevated maternal depressive symptoms can jeopardize the mother-child relationship. Also, as we have established earlier, decreased maternal emotional availability is a sign of reduced parenting efficacy, which also puts the child at risk.

Since maternal emotional availability at bedtime was decreased in mothers who consistently cosleep, independent of the amount of maternal sleep fragmentation, this tells us that consistent cosleeping mothers are different from the start; it is not a result of reduced sleep quality. What we have not concluded from this study is how they are different from mothers who begin practicing solitary sleep arrangement from 1 month to 6 months. It is possible that these cosleeping mothers have elevated depressive symptoms and anxiety before the study began. Another possibility is that the cosleeping mothers have higher levels of enmeshment with their infants. Enmeshment is defined as a lack of appropriate boundaries between mother and child, for example a mother's own emotional needs trumping the child's emotional needs (Trapolini et al., 2008). Lastly, a very possible explanation for the patterns we have observed is that cosleeping mothers are suffering from increased sleep fragmentation, increased depressive symptoms, and lower emotional availability because they are living in a culture that does not support cosleeping. Past research has cited that many parents in the United States feel unsupported about their choice to cosleep that they will hide that choice from their childcare physicians (Goldberg & Keller, 2007). All of this knowledge is important to the development of future interventions that address maternal and infant sleep problems.

Limitations and Future Directions

There are several limitations in this study that should be noted. First the sample size was relatively small with 149 families maintained throughout the duration of the study, and relatively small number of consistent cosleepers across the first 9 months, which could affect the ability to generalize to a larger population of cosleepers. However, we were still able to obtain statistically

significant findings, even with the limited number of participants. While recruitment of participants attempted to attain a diverse group of subjects, the majority of the sample was comprised of low-risk participants, with the majority of mothers being White (85%) and having achieved a college education or higher (60%). This study is also limited due to the videos coded for maternal emotional availability at bedtime. These videos were recorded one night at the each time point, which may be less representative of parenting behavior compared to if videos were recorded for on multiple occasions at each time point.

In future studies it would be interesting to study these variables in the context of a culture that is supportive of cosleeping. In cultures where cosleeping is viewed as a normal practice, conducting a study similar to the present study may yield more positive outcomes for the mother and child.

Conclusion

In summary, this study shows that sleep arrangements has an impact on maternal sleep fragmentation, maternal depressive symptoms, and maternal emotional availability at bedtime. Cosleeping arrangements in particular were associated with signs compromised maternal well being and insensitive parenting. While sleep fragmentation was also associated with lower maternal emotional availability at bedtime, cosleeping mothers still demonstrated compromised emotional availability independent of sleep fragmentation. Future studies should investigate how mothers who choose cosleeping arrangements are fundamentally different from their counterparts that select solitary sleeping arrangements, as well as examine these outcomes for mothers in the context of a culture that supports cosleeping.

BIBLIOGRAPHY

- Biringen, Z., Brown, D., Donaldson, L., Green, S., Krcmarik, S., & Lovas, G. (2000). Adult Attachment Interview: linkages with dimensions of emotional availability for mothers and their pre-kindergarteners. *Attachment & Human Development*, 2(2), 188–202. <http://doi.org/10.1080/14616730050085554>
- Biringen, Z., Robinson, J., & Emde, R. N. (1998). Emotional availability scales (3rd ed.). Unpublished manual, Department of Human Development and Family Studies, Colorado State University, Fort Collins, CO.
- Biringen, Z., Damon, J., Grigg, W., Mone, J., Pipp-Siegel, S., Skillern, S., & Stratton, J. (2005). Emotional availability: Differential predictions to infant attachment and kindergarten adjustment based on observation time and context. *Infant Mental Health Journal*, 26(4), 295–308. <http://doi.org/10.1002/imhj.20054>
- Burnham, M. M., Goodlin-Jones, B. L., Gaylor, E. E., & Anders, T. F. (2002). Nighttime sleep-wake patterns and self-soothing from birth to one year of age: A longitudinal intervention study. *Journal of Child Psychology and Psychiatry and Allied Disciplines*, 43(6), 713–725. <http://doi.org/10.1111/1469-7610.00076>
- Cohn, J. R., Matias, R., Tronick, E., Connell, D., & Karlen, L. (1986). Face to Face Interactions of Depressed Mothers and Their Infants, (34), 31–45.
- Dennis, C.-L., & Ross, L. (2005). Relationships among infant sleep patterns, maternal fatigue, and development of depressive symptomatology. *Birth (Berkeley, Calif.)*, 32(3), 187–93. <http://doi.org/10.1111/j.0730-7659.2005.00368.x>
- Derogatis, L. R. (1994). SCL-90-R Symptom Checklist-90-R: Administration, scoring, and procedures manual. Minneapolis, MN: National Computer Systems.
- Dyer, K., Youngclarke, D., & Jane, E. (2007). Parental Perceptions of Sleep Problems Among Co-Sleeping and Solitary Sleeping Children, 431, 417–431. <http://doi.org/10.1002/icd>
- Field, T. (2010). Postpartum depression effects on early interactions, parenting, and safety practices: a review. *Infant Behavior & Development*, 33(1), 1–6. <http://doi.org/10.1016/j.infbeh.2009.10.005>

- Field, T., Sandberg, D., Garcia, R., Vega-Lahr, N., Goldstein, S., & Guy, L. (1985). Pregnancy problems, postpartum depression, and early mother–infant interactions. *Developmental Psychology*, *21*(6), 1152–1156. <http://doi.org/10.1037/0012-1649.21.6.1152>
- Gelfand, D. M., & Teti, D. M. (1990). The Effects of Maternal Depression on Children. *Clinical Psychology Review*, *10*, 329–353. [http://doi.org/10.1016/0272-7358\(90\)90065-I](http://doi.org/10.1016/0272-7358(90)90065-I)
- Germo, G. (2009). Learning to sleep through the night: Solution or strain for mothers and young children? *Infant Mental Health* ..., *30*(3), 223–244. <http://doi.org/10.1002/imhj>.
- Goldberg, W., & Keller, M. (2007). Parent-Infant Co-Sleeping: Why Interest and Concern? *Infant and Child Development*, *3*, 3–5. <http://doi.org/10.1002/icd.523>
- Goodman, S. H. (2007). Depression in mothers. *Annual Review of Clinical Psychology*, *3*, 107–35. <http://doi.org/10.1146/annurev.clinpsy.3.022806.091401>
- Goodman, S. H., & Brumley, H. E. (1990). Schizophrenic and depressed mothers: Relational deficits in parenting. *Developmental Psychology*, *26*(1), 31–39. <http://doi.org/10.1037/0012-1649.26.1.31>
- Gress, J. L., Chambers, A. S., Ong, J. C., Tikotzky, L., Okada, R. L., & Manber, R. (2010). Maternal subjective sleep quality and nighttime infant care. *Journal of Reproductive and Infant Psychology*, *28*(4), 384–391. <http://doi.org/10.1080/02646831003727918>
- Hiscock, H., & Wake, M. (2001). Infant Sleep Problems and Postnatal Depression: A Community-Based Study. *Pediatrics*, *107*(6), 1317–1322. <http://doi.org/10.1542/peds.107.6.1317>
- Karlsson, A. U., Nilsson, J. P., & So, M. (2005). Less effective executive functioning after one night 's sleep deprivation, 1–6.
- Kim, B.-R., & Teti, D. M. (2014). Maternal emotional availability during infant bedtime: An ecological framework. *Journal of Family Psychology : JFP : Journal of the Division of Family Psychology of the American Psychological Association (Division 43)*, *28*(1), 1–11. <http://doi.org/10.1037/a0035157>
- Loutzenhiser, L., Ahlquist, A., & Hoffman, J. (2011). Infant and maternal factors associated with maternal perceptions of infant sleep problems. *Journal of Reproductive and Infant Psychology*, *29*(5), 460–471. <http://doi.org/10.1080/02646838.2011.653961>
- McDaniel, B. T., & Teti, D. M. (2012). Coparenting quality during the first three months after birth: the role of infant sleep quality. *Journal of Family Psychology : JFP : Journal of the Division of Family Psychology of the American Psychological Association (Division 43)*, *26*(6), 886–95. <http://doi.org/10.1037/a0030707>

- McKenna, J., Ball, H., & Gettler, L. (2007). Mother–infant cosleeping, breastfeeding and sudden infant death syndrome: what biological anthropology has discovered about normal infant sleep and pediatric. *American Journal of Physical ...*, *161*, 133–161. <http://doi.org/10.1002/ajpa>
- Meltzer, L. J., & Mindell, J. a. (2007). Relationship between child sleep disturbances and maternal sleep, mood, and parenting stress: a pilot study. *Journal of Family Psychology : JFP : Journal of the Division of Family Psychology of the American Psychological Association (Division 43)*, *21*(1), 67–73. <http://doi.org/10.1037/0893-3200.21.1.67>
- Meltzer, L. J., Mindell, J. a, & Levandoski, L. J. (2007). The 24-hour sleep patterns interview: a pilot study of validity and feasibility. *Behavioral Sleep Medicine*, *5*(4), 297–310. <http://doi.org/10.1080/15402000701557441>
- Meltzer, L. J., & Montgomery-Downs, H. E. (2011). Sleep in the family. *Pediatric Clinics of North America*, *58*(3), 765–74. <http://doi.org/10.1016/j.pcl.2011.03.010>
- Mindell, J. A., Telofski, L. S., Wiegand, B., & Kurtz, E. S. (2009). A nightly bedtime routine: impact on sleep in young children and maternal mood. *Sleep*, *32*(5), 599–606. Retrieved from <http://www.pubmedcentral.nih.gov/articlerender.fcgi?artid=2675894&tool=pmcentrez&rendertype=abstract>
- Mindell, J., Sadeh, A., Kwon, R., & Goh, D. (2013). Cross-cultural comparison of maternal sleep. *Sleep*. Retrieved from <http://www.ncbi.nlm.nih.gov/pmc/articles/PMC3792388/>
- Moehler, E., Biringen, Z., & Poustka, L. (2007). Emotional availability in a sample of mothers with a history of abuse. *The American Journal of Orthopsychiatry*, *77*(4), 624–628. <http://doi.org/10.1037/0002-9432.77.4.624>
- Sadeh, A., Mindell, J. a, & Owens, J. (2011). Why care about sleep of infants and their parents? *Sleep Medicine Reviews*, *15*(5), 335–7. <http://doi.org/10.1016/j.smr.2011.03.001>
- Sadeh, A., Sharkey, K. M., & Carskadon, M. a. (1994). Activity-based sleep-wake identification: an empirical test of methodological issues. *Sleep*, *17*(3), 201–207. <http://doi.org/7939118>
- Sadeh, A., Tikotzky, L., & Scher, A. (2010). Parenting and infant sleep. *Sleep Medicine Reviews*, *14*(2), 89–96. <http://doi.org/10.1016/j.smr.2009.05.003>
- Teti, D. M., & Crosby, B. (2012). Maternal depressive symptoms, dysfunctional cognitions, and infant night waking: the role of maternal nighttime behavior. *Child Development*, *83*(3), 939–53. <http://doi.org/10.1111/j.1467-8624.2012.01760.x>
- Teti, D. M., Kim, B.-R., Mayer, G., & Counterline, M. (2010). Maternal emotional availability at bedtime predicts infant sleep quality. *Journal of Family Psychology : JFP : Journal of the*

Division of Family Psychology of the American Psychological Association (Division 43),
24(3), 307–15. <http://doi.org/10.1037/a0019306>

Tikotzky, L., Chambers, A. S., Gaylor, E., & Manber, R. (2010). Maternal sleep and depressive symptoms: links with infant Negative Affectivity. *Infant Behavior & Development*, 33(4), 605–12. <http://doi.org/10.1016/j.infbeh.2010.07.012>

Trapolini, T., Ungerer, J. a, & McMahon, C. a. (2008). Maternal depression: relations with maternal caregiving representations and emotional availability during the preschool years. *Attachment & Human Development*, 10(1), 73–90. <http://doi.org/10.1080/14616730801900712>

ACADEMIC VITA

Sara Navarro
1 Hopeton Lane, Villanova PA 19085
sbn5036@psu.edu

EDUCATION **The Pennsylvania State University, University Park, PA | May 2015**
Schreyer Honors College
B.S. in Human Development and Family Studies
Life Span Developmental Science Option
Minor in Spanish

RESEARCH

Project SIESTA II | Undergraduate Research Assistant | Spring 2014- Spring 2015

- Codes and analyzes nighttime video diaries of infant sleep patterns and parent-infant interaction
- Works closely with Graduate Student supervisor when coding infant videos ranging from 1 month to 24 months of age
- Gained experience working with SPSS Software

RELEVANT EXPERIENCE

Bryn Mawr Hospital | Volunteer | July - August 2014

- Volunteered in the Emergency Department and helped the nurses and technicians with organizational tasks to keep the ER running smoothly
- Interacted with patients and assisted in making their experience comfortable
- Gained valuable experience observing the fast-paced environment of the Emergency Department and shadowing nurses and physicians assistants

Study Abroad, Seville, Spain | CIEE Language and Culture Program | May - June 2014

- Completed coursework contributing to fulfill Spanish Minor and Honors College Credits
- Studied the History of Andalucía focused on the role Flamenco plays in the Spanish culture
- Gained improved fluency in Spanish

Tekni-Plex, Inc. , King of Prussia PA | Tax Intern | May - August 2013

- Assisted Senior Tax Manager with International, Federal, State & Local tax projects
- Maintained and organized tax filings at corporate headquarters
- Acquired valuable experience communicating, corresponding and interacting with corporate professionals

LEADERSHIP

Penn State IFC/Panhellenic Dance Marathon (THON)

- Hospitality Logistics Captain | Fall 2014 – Spring 2015
- Hospitality Concessions Captain | Fall 2013-Spring 2014

AWARDS

Dean's List | Spring 2012- Fall 2015