Maternal Depressive Symptoms, Dysfunctional Cognitions, and Infant Night Waking: The Role of Maternal Nighttime Behavior

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Mechanisms were examined to clarify relations between maternal depressive symptoms, dysfunctional cognitions, and infant night waking among 45 infants (1–24 months) and their mothers. A mother-driven mediational model was tested in which maternal depressive symptoms and dysfunctional cognitions about infant sleep predicted infant night waking via their impact on mothers’ bedtime and nighttime behavior with infants (from video). Two infant-driven mediational models were also examined, in which infant night waking predicted maternal depressive symptoms, or dysfunctional cognitions, via their impact on nighttime maternal behavior. Stronger support for the mother-driven model was obtained, which was further supported by qualitative observations from video-recordings. This study provides important insights about maternal depression’s effects on nighttime parenting, and how such parenting affects infant sleep.

Signaled night waking among infants (crying or calling out to parents after waking up) presents as a chief complaint of parents during visits to pediatric offices (Boyle & Cropley, 2004; Rosen, 1997). Prevalence estimates of sleep problems range from 25% to 46% among children in the infancy and preschool years (Halbower & Marcus, 2003; Lozoff, Wolf, & Davis, 1985), and sleep disruption in childhood is associated with child dysfunction across a broad developmental spectrum (Meltzer & Mindell, 2006).

Although infant night waking decreases in frequency with maturation (Davis, Parker, & Montgomery, 2004), much variability characterizes infant sleep behavior (McKenna & Volpe, 2007), and there is general agreement that infant sleep patterns are complexly determined, dynamic, and coregulated, with ongoing contributions from both infant and parent (Middlemiss, 2004; Mindell, Kuhn, Lewin, Meltzer, & Sadeh, 2006). In this study, we specifically examine an important parental correlate of infant night waking, maternal depressive symptoms (Warren, Howe, Simmens, & Dahl, 2006) and attempt to articulate and provide empirical support for behaviorally based mechanisms underlying this linkage, using direct observations of mothers’ bedtime and nighttime behavior. Because associations between maternal depressive symptoms and infant night waking can be explained using “mother-driven” and “infant-driven” models of influence, both mother- and infant-driven mediational models are examined in the present study.

Maternal Depressive Symptoms and Infant Sleep

The association between maternal depressive symptoms and infant sleep disturbance is well known (Bayer, Hiscock, Hampton, & Wake, 2007; Messer & Martin, 1993; Warren et al., 2006). Less clear, however, are the mechanisms underlying this association. At least some of the variance may be traced to biological vulnerabilities (e.g., higher pregnancy and perinatal cortisol and norepinephrine levels in depressed mothers), as suggested by recent findings of linkages between prenatal maternal depression and infant night waking very early in life (Armitage et al., 2009; Field et al., 2007). Associations between maternal depression and infant night waking persist beyond early infancy, however (Messer & Martin, 1993; O’Connor et al., 2007; Warren et al., 2006), and very little data are available that address psychosocial pathways...
of influence. This is noteworthy for at least two reasons: (a) Prior work has indicated that parenting practices at bedtime and night-time bear directly on the sleep quality of infants and young children (Mindell, Meltzer, Carskadon, & Chervin, 2009; Teti, Kim, Mayer, & Countermine, 2010). Infants who remain in close physical contact with parents throughout much of the night have been found to experience more frequent signaled night waking than infants who do not (Mao, Burnham, Goodlin-Jones, Gaylor, & Anders, 2004; Morrell & Steele, 2003; Sadeh, Tikotzky, & Scher, 2010). Others have reported that the mere presence of a parent at bedtime and nighttime was a strong predictor of poorer sleep quality in young children (Adair, Bauchner, Philipp, Levenson, & Zuckerman, 1991; Mindell, Meltzer, et al., 2009). Presumably, these practices interfere with infants’ ability to soothe themselves to sleep, without parental intervention, such that when infants wake during the night, they signal to their parents rather than put themselves back to sleep. (b) Alternatively, there is evidence that suggests that infant night waking, if chronic and prolonged, can lead to high levels of maternal intervention at night (and, consequently, sleep loss), which in turn predisposes mothers to become dysphoric (Bayer et al., 2007; Meltzer & Mindell, 2007; Scott & Richards, 1990). This infant-driven path of influence is supported by prior work documenting linkages between reductions in infant night waking in response to intervention and, in turn, reductions in mothers’ depressive symptoms (Hiscock & Wake, 2002).

In this study, we examine both mother- and infant-driven paths of influence between maternal depressive symptoms and infant night waking, considering in both cases the mediational role played by maternal presence with infants and close mother–infant contact at bedtime and at night. A mother-driven model of influence would receive support if elevations in maternal depressive symptoms predicted higher levels of maternal presence or close physical contact with infants, especially when intervention is not required (e.g., when infants are not distressed or signaling to parents), and if increased maternal presence and/or physical contact in turn predicted increased infant night waking. By contrast, support for an infant-driven model of influence would be obtained if infant night waking predicted maternal behavior with infants at night, which in turn predicted maternal depressive symptoms. We view both such models as theoretically defensible and hypothesis driven, based on prior work.

**Depressive Symptoms, Dysfunctional Cognitions, and Infant Sleep**

We also pay particular attention in this study to the theoretical link between maternal depressive symptoms and dysfunctional cognitions about infant sleep behavior, and to the nature of the associations between mothers’ maladaptive cognitions about infant sleep behavior, parenting, and infant night waking. Consistent with cognitively based theories of depression (Abramson, Metalsky, & Alloy, 1989; Beck, 1987; Nolen-Hoeksema, 1990), which give primacy to negative cognitions in the etiology and maintenance of depression, depressed mothers are more likely than nondepressed mothers to perceive themselves as inadequate parents (Teti & Gelfand, 1991), to enjoy parenting less (Fleming, Ruble, Flett, & Shaul, 1988; Whiffen & Gotlib, 1989), and to view their children’s behavior negatively, relative to nondepressed mothers (Cornish et al., 2006; Fergusson, Horwood, Gretton, & Shannon, 1989; Panacci & Wahler, 1986). The link between negative cognitions and depressed affect appears to be reciprocal. Negative thoughts and thought patterns lead to depressed mood, and depressed mood appears to “prime” individuals to have negative thoughts (Bower, 1981; Isen, 1984; Teasdale & Fogarty, 1979). This perhaps explains why depression tends to persist despite the availability to depressed individuals of more positive interpretations of events (Teti & Gelfand, 1997). Theoretical accounts of parenting view cognition as a central organizing influence on parenting behavior (Bornstein & Putnick, 2007; Goodnow, 1988), and Dix and his colleagues (Dix, 1991; Dix & Lochman, 1990; Dix & Reinhold, 1991) conceptualize parenting as a process influenced by parental attributions about child behavior, intentions, and developmental status.

In the context of infant sleep, mothers who harbor cognitions that their infant will feel abandoned if they are not by the infant’s side during the night, or that their infant will go hungry if not fed (even when the infant is not distressed), may be more likely to spend more time with their infants at bedtime and at night and in turn awaken their infants more frequently or keep them awake longer than mothers who do not harbor such cognitions. Several studies already attest to the link between infant sleep problems and maternal cognitions. Mothers of infants with sleep difficulties reported higher levels of worry about their parenting competence, about their ability to set limits, and about their infant’s physical and emotional well-being (Morrell, 1999; Morrell & Steele, 2003; Sadeh, Flint-Ofir,
Tirosh, & Tikotzky, 2007), and these cognitions are associated with infant sleep quality and mothers’ attempts to soothe infants to sleep (Morrell & Steele, 2003; Tikotzky & Sadeh, 2009). Further, linkages between parental cognitions and behavior in the context of infant sleep may be bidirectional, which is consistent with transactional perspectives on this topic (Sadeh et al., 2010). It is possible, for example, for mothers to develop dysfunctional cognitions about infant sleep behavior after repeated maternal interventions with infants in response to chronic infant night waking.

The Present Study

In this study, we examined several theoretically defensible models of influence addressing the expected associations between infant night waking, maternal depressive symptoms, and maternal dysfunctional cognitions about infant sleep. In all models, the mediational role of maternal presence with infants and close mother–infant contact at bedtime and night was assessed. First, a mother-driven model was assessed in which both maternal depressive symptoms and dysfunctional cognitions about infant sleep jointly and uniquely predicted maternal behavior (at bedtime or during the night), which in turn predicted infant night waking (Figure 1). Second, two infant-driven models were assessed, one in which infant night waking predicted maternal behavior with infants at night, which in turn predicted maternal depressive symptoms, and another in which infant night waking predicted maternal behavior with infants at night, which in turn predicted mothers’ dysfunctional cognitions about infant sleep (Figures 2a and 2b).

The following hypotheses were proposed:

1. Mothers’ depressive symptoms and dysfunctional cognitions about infant sleep will be significantly intercorrelated and be significantly associated with infant night waking.
2. Mothers’ depressive symptoms and dysfunctional cognitions will correlate significantly with maternal behavior (maternal presence with infants, and close physical contact with infants) at bedtime and during the night, and maternal behavior will be significantly associated with infant night waking.
3. Maternal behavior will mediate relations between maternal depressive symptoms, dysfunctional cognitions, and infant night waking, and such mediation will receive theoretical support in both mother- and infant-driven models of influence. Thus, we examined the mediational role of maternal behavior in both mother- (Figure 1) and infant-driven (Figures 2a and 2b) models of influence. To further clarify patterns of influence, we also conducted qualitative descriptions of mother–infant behavior at bedtime and at night from our video-recordings obtained throughout the night.

![Figure 1. Mother-driven path of influence to be evaluated.](image1)

![Figure 2. Infant-driven paths to be evaluated.](image2)
Method

Participants

Forty-five socioeconomically diverse mothers and their healthy, typically developing infants (from maternal report), ranging in age from 1 to 24 months, participated in a cross-sectional study that consisted of five infant cohorts: 1, 3, 6, 12, and 24 months of age. Twenty-three infants were female. All families were recruited to participate in a study of relations between parenting and infant sleep quality across the first 2 years of life, under the direction of the first author. Mothers of healthy 1- and 3-month-old infants were first approached at a local hospital and given information about the study. Mothers who expressed interest in participating were contacted by phone about 2 weeks following their infants’ hospital discharge, and approximately 30% of mothers (n = 17) agreed to participate. Mothers of 6-, 12-, and 24-month infants were recruited from a database of local birth announcements. These families were sent a letter describing the study and indicating a date and time that the project’s coordinator would be calling to further acquaint them with the study. Twenty-three families (or approximately 28% of those contacted) agreed to join the study. Finally, five additional families with 12-month-old infants were recruited using a one-time advertisement for the study that was placed in the local newspaper. Once recruited, families were assigned an identification number and a first visit was scheduled, at which point informed consent was obtained.

The sample was predominantly White (91%), with 7% Asian American (3 mothers), and 2% African-American (1 mother). Mothers were 22–42 years of age (M = 30.5, SD = 4.9). Most mothers (73%) had completed some postsecondary education, and 93% were married. Annual family income varied widely, ranging from $20,000 to $200,000 (M = $63,750, SD = $36,151). Family income and parental education did not vary by cohort. Table 1 contains an age and sex breakdown for infants in each of the five cohorts.

Twenty infants were firstborns, and 25 were laterborns. Birth order was unrelated to cohort and infant gender. Twenty-four mothers were employed outside the home, with 13 employed full-time (36 or more hours per week) and 11 employed part-time. Forty-five percent of the infants were being breastfed at least part of the time. Eighty percent of breastfeeding infants were 6 months of age or younger, and breastfeeding frequency was not correlated with infant night waking after infant age was statistically controlled. Mothers’ age, education, family income, and employment status also were not associated with infant night waking. Although some fathers were involved with infants at bedtime and at night, the mean percentages of time fathers spent tending to their infants at bedtime (3.5%) and during the night (0.8%) were much less than the percentages of time mothers spent with their infants at bedtime (41.5%) and during the night (13%). Only three families reported they were using a sleep training method, which precluded conducting meaningful comparisons with families who were not using sleep training.

All analyses in this study were repeated with sleep training method (dummy coded: 0 = not currently using sleep training, 1 = currently using sleep training) statistically controlled. No differences were obtained in any of the results.

Thirteen infants shared a room with their parents at night. These infants were significantly younger (M = 5.12 months) than infants who slept in separate rooms (M = 11.40 months), F(1, 43) = 5.53, p < .05. Of the 13 infants who room-shared, 5 slept in the same bed as their parents for at least part of the night. No information was available to determine whether these 5 parents proactively chose to sleep with their infants or were doing so in reaction to infant sleep problems. Not surprisingly, there was more close contact between mothers and infants when they shared the same room at night, F(1, 38) = 20.04, p < .05.

Table 1

<table>
<thead>
<tr>
<th>Cohort (months)</th>
<th>n</th>
<th>M</th>
<th>Range</th>
<th>SD</th>
<th>No. girls</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>9</td>
<td>5.0 weeks</td>
<td>4.0–6.0 weeks</td>
<td>1.0 weeks</td>
<td>5</td>
</tr>
<tr>
<td>3</td>
<td>8</td>
<td>2.9 months</td>
<td>2.5–3.0 months</td>
<td>0.19 months</td>
<td>3</td>
</tr>
<tr>
<td>6</td>
<td>8</td>
<td>6.2 months</td>
<td>5.0–7.0 months</td>
<td>0.65 months</td>
<td>4</td>
</tr>
<tr>
<td>12</td>
<td>12</td>
<td>12.3 months</td>
<td>10.0–14.0 months</td>
<td>1.06 months</td>
<td>7</td>
</tr>
<tr>
<td>24</td>
<td>8</td>
<td>25.3 months</td>
<td>24.0–27.0 months</td>
<td>1.10 months</td>
<td>4</td>
</tr>
</tbody>
</table>
Procedure

Data were collected during home visits with each family across 7 consecutive days. Data collection consisted of a measure of depressive symptom severity (Day 1), maternal cognitions about infant sleep behavior (Day 1), a daily diary of infant sleep behavior (each of 7 days), and continuous video-recordings of parent–infant interactions at bedtime and nighttime (evening and night of Day 6).

Measures

Depressive symptoms. On the first visit, mothers completed the Depression subscale of the SCL-90-R, a measure of depressive symptom severity that has well-established reliability and validity (Derogatis, 1994). This subscale consisted of 13 items asking mothers to rate the severity of such symptoms as “loss of sexual interest or pleasure,” “feeling hopeless about the future,” and “feelings of worthlessness.” Each item was answered using a 5-point Likert-type scale, ranging from 0 (not at all) to 4 (extremely). A depressive symptom severity score was obtained by summing the 13 items.

Maternal cognitions about infant sleep. Also on the first home visit, mothers completed the Maternal Cognitions about Infant Sleep Questionnaire (MCISQ; Morrell, 1999). The MCISQ is a 20-item questionnaire inquiring about the parental thoughts about infant behavior at night, geared specifically around parental reactions to infant night waking. Items include “My child will feel abandoned if I don’t respond immediately to his/her cries at night” and “When my child doesn’t sleep at night, I doubt my competence as a parent.” Items are answered on a 6-point Likert scale (0 = strongly disagree, 5 = strongly agree). In an earlier study, Morrell (1999) found that MCISQ items assessing maternal cognitions about mothers’ ineffectiveness in limit setting at night and parenting competence related significantly to infant night waking.

Principal components analysis identified two factors with eigenvalues > 2.0, defined by at least three items with factor loadings > .40 and tapping a conceptually coherent dimension of mothers’ thoughts about infant sleep. The first, which we labeled “worries about infant physical/emotional needs,” was composed of 9 items, all of which related to mothers’ expressed anxieties about infant night waking and how to respond to them (see Table 2). This factor accounted for 25.19% of the variance shared among all 20 items, and had strong internal reliability (α = .89). The second, which we labeled “helplessness/loss of control,” consisted of 3 items that assessed mothers’ doubts about their parenting competencies in handling infant night wakings, worries about losing control and harming the infant when she or he cried at night, and regrets about having a child (see Table 2). This factor accounted for 10.99% of the variance among all 20 items, and had adequate internal reliability (α = .77). Items in each factor were summed to create a score on each dimension for each mother.

Table 2
Dimensions of Mothers’ Cognitions About Infant Sleep, Identified From Principal Components Analysis

<table>
<thead>
<tr>
<th>Worry About Infant’s Physical/Emotional Needs (α = .89)</th>
</tr>
</thead>
<tbody>
<tr>
<td>My child will feel abandoned if I don’t respond immediately to his/her cries at night.</td>
</tr>
<tr>
<td>My child might go hungry if I don’t give him/her a feed at night.</td>
</tr>
<tr>
<td>It is all right to allow my child to cry at night.</td>
</tr>
<tr>
<td>I should be getting up during the night to check that my child is still all right.</td>
</tr>
<tr>
<td>If I try to resist my child’s demands at night, then he/she will get even more upset.</td>
</tr>
<tr>
<td>If I say no to my child’s demands at night, then it means I’m a bad mother.</td>
</tr>
<tr>
<td>I should respond straightaway when my child wakes crying at night.</td>
</tr>
<tr>
<td>I am able to resist my child’s demands when he/she wakes at night.</td>
</tr>
<tr>
<td>If I give up feeding at night, then he/she will never sleep.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Helplessness/Loss of Control (α = .77)</th>
</tr>
</thead>
<tbody>
<tr>
<td>When my child cries at night, I think I might lose control and harm him/her.</td>
</tr>
<tr>
<td>When my child cries at night, I can find myself thinking I wish I had never had a child.</td>
</tr>
<tr>
<td>When my child doesn’t sleep at night, I doubt my competence as a parent.</td>
</tr>
</tbody>
</table>

Note. Varimax rotation, all eigenvalues > 2.0, all factor loadings > .40, all items scored on a 6-point scale (0 = strongly disagree to 5 = strongly agree).

*Reverse scored.
Infant sleep diary. On each morning for 7 consecutive days, mothers were asked to complete an infant sleep diary (adapted from Burnham, Goodlin-Jones, Gaylord, & Anders, 2002), which obtained information on the infant’s sleep location, the number of times during the previous night the infant woke up, and the duration of each night waking bout. Data from this diary were totaled across the 7 full days of data collection. Total frequency of night waking bouts was strongly correlated with total number of minutes infants were awake during the night, \( r(43) = .72, p < .05 \), and thus both variables were converted to \( z \) scores and added together to create a composite infant night waking score for each infant.

Although this measure assesses mothers’ perceptions of infant night waking, we note that infant sleep diary scores of infant night waking were concordant with video-recordings (which were limited to one night only) of the amount of time infants were awake and distressed during the night, \( r(38) = .35, p < .05 \); the amount of time infants were asleep during the night, \( r(38) = -.48, p < .05 \); and the amount of time infants were awake and non-distressed during the night, \( r(38) = .36, p < .05 \). These associations did not appreciably change when maternal depressive symptoms were statistically controlled, \( r(37) = .32, p < .05 \); \( r(37) = -.54, p < .001 \); and \( r(37) = .43, p < .05 \), and when maternal worries about infant nighttime needs were statistically controlled, \( r(35) = .43, p < .05 \); \( r(35) = -.35, p < .05 \); and \( r(35) = .27, p = .11 \), suggesting that mothers’ reports of infant night waking were not unduly biased by levels of maternal depressive symptoms or worries about infant nighttime needs. We chose the sleep diary measure of night waking because it provides a more representative assessment of infant night waking (i.e., across 7 consecutive days) than one night of video.

Video-recordings of parent–infant interactions at bedtime and nighttime. On Day 6 of data collection, the project coordinator consulted with parents about where the infant typically slept and where parents might take the infant if the infant woke up at night. The digital video-recording system was set up in a separate area, the second microphone was taped to a camera in the infant’s primary sleeping location (which has two night-vision cameras (Channel Vision, Costa Mesa, CA) were used to record video data, Channel Vision (CV-5104MIC) microphones (Channel Vision, Costa Mesa, CA) were used for audio-recordings, and two infrared illuminators (CS-IR200) were used to provide adequate illumination for recording at night. The DVR recorded all video data directly onto a portable, 250 GB hard drive cassette that fit directly into the DVR. Each cassette held continuous bedtime/nighttime data for up to 15 families. During setup, a small TV monitor that received a feed from the DVR was used to help determine optimal placement of the cameras.

Preliminary work with this video set up indicated that up to three cameras could be used to obtain high-quality recordings of parent–infant interactions. The final setup, which worked well for all families with infants ranging from 1 to 24 months, was as follows: One camera was suspended directly above the infant using an over-hanging boom stand (sufficiently out of reach of older infants who could stand up). This camera was trained directly on the infant and surrounding crib or bed area. If the infant slept in a separate room (very typical at older ages), a second camera was set up on a tripod behind the infant’s crib and trained on the doorway of the room, which enabled us to identify anyone (mother or father) entering and leaving the room. To provide adequate lighting for nighttime recording, an infrared illuminator was set up behind the cameras and trained at an angle on one of the walls in the room, which provided adequate bounce lighting. Finally, if the parent indicated that she or he took the infant to a separate place (e.g., a rocking chair, or another room) for night feedings or when responding to infant night crying, a third camera was set up on a tripod and was trained on that area, and a separate infrared illuminator set up in that area as well. One of the two microphones was taped to a camera in the infant’s primary sleeping location (which has two cameras in close proximity). If a third camera was set up in a separate area, the second microphone was taped to that camera.

All cameras and microphones were connected to the same DVR with extension cables. Each camera generated its own “screen” on the TV monitor that could be viewed in conjunction with the other
camera-generated screens to get a clear picture of where the infant was, who was in the room with her or him, who entered and exited the room, and the interactions that took place between each parent and the infant. The entire video set could be turned on and off from a single switch on a surge protector, and parents were instructed to turn the switch to “on” when they began their bedtime activities with their infants, and to turn the switch to “off” in the morning after the infant woke up. Due to technical difficulties parents encountered in operating the video equipment, bedtime video data could not be obtained on 6 families, and nighttime videos were not obtained on 5 of these 6 families. Thus, 39 families had codable bedtime video data, and 40 families had codable nighttime video-recordings. One-way analyses of variance found no differences between families with and without video data on maternal depressive symptoms, maternal worries about infant nighttime needs, mothers’ presence with infants at bedtime and at night, mothers’ close physical contact with infants at bedtime and at night, and infant night waking.

Videos from each camera input were time-stamped. When coding behavior, the DVR provided users the option of enlarging and just watching one of the screens (if that was where all the activity was taking place). The DVR also enabled the coder to scan forward and backward rapidly to facilitate the location of specific events in the video record. We used this flexible setup with all infants and found that it captured virtually all of the interactions that took place between parents and infants at bedtimes and at night.

Observational data coded from video. An interval sampling (30 s) coding system was developed to code infant and parent behavior during bedtimes and night wakings. Presence or absence of each behavior was coded in each interval. Behaviors coded at bedtime and nighttime were similar, but separate summary variables were derived for bedtimes and nighttimes. The end of bedtime (and the beginning of nighttime) was defined by 10 consecutive intervals of the infant being asleep (i.e., 5 min of continuous infant sleep). Video data were coded by two coders, trained by the first author, both of whom were blind to other data on the families.

Two maternal behaviors were coded from bedtime and nighttime videos: (a) maternal presence, or the total number of intervals mothers spent in proximity to the infant (i.e., by the infant’s bedside, in the infant’s same room) and (b) close mother–infant physical contact. Summary data for bedtimes and nighttimes were obtained by summing up the number of intervals in which a particular behavior occurred and then dividing by the total number of intervals for either bedtime or nighttime. Interrater reliability (between two coders) on summary behavior codes, based on 10 videos that were equally distributed across the 1-, 3-, 6-, 12-, and 24-month age groups, was quite adequate (bedtime: Pearson $r = .71–1.00$, $M = .95$, mean intraclass correlation = .89; nighttime: Pearson $r = .71–1.00$, $M = .96$, mean intraclass correlation = .91).

Results

Preliminary Analyses

From the infant sleep diary, infants’ mean number of night wakings across the full week of data collection was 8.96 ($SD = 7.43$), with a range of 0 to 27 waking bouts. Mean total infant wake time across the same week was 143.9 min ($SD = 195.29$ min), with a range of 0 to 840 min. The mean of the standardized night waking score, which was used in analyses, was 0.00 ($SD = 0.92$), with a range of −0.97 to 2.22 (skewness = 0.93). Mothers’ mean SCL–90 depressive symptoms score was 9.08 ($SD = 6.97$), with a range of 0 to 26. Ten mothers in the present sample had depressive symptom scores above the clinical cutoff score of 13 (Derogatis, 1994). Mothers’ mean scores on anxieties about infant nighttime needs was 21.05 ($SD = 10.97$), with a range of 5 to 42, and on loss of control/helplessness was 1.39 ($SD = 2.14$), with a range of 0 to 9.

Mothers’ age, education, family income, and employment status were not associated with infant night wakeings. As expected, younger infants in this sample had higher levels of night waking, and mothers of younger infants were generally more involved with their infants at bedtime and nighttime than were mothers of older infants. Infant age correlated significantly and inversely with infant night waking, $r(43) = -.53$, $p < .05$. From bedtime video data, infant age was marginally associated with the amount of time mothers spent in physical proximity to their infants (maternal presence), $r(37) = -.28$, $p = .08$, and significantly associated with the amount of time in close physical contact with their infants, $r(37) = -.49$, $p < .05$. From nighttime video, infant age was not associated with maternal presence, $r(38) = -.26$, $p = .11$, or with the amount of time mothers spent in close physical contact with their infants, $r(38) = -.09$, $p = .58$. Infant age was also not associated with maternal depressive symptoms, $r(43) = -.02$, $p = .85$. Infant age was
significantly and inversely related to mothers’ scores on worries about infants’ physical/emotional needs, \( r(41) = -0.55, p < .05 \), but only marginally associated with scores on helplessness/loss of control, \( r(43) = -0.25, p = .09 \). No relations were found between infant gender and infant night waking, mothers’ involvement with infants at bedtime and nighttime, and mothers’ dysfunctional cognitions. Given the many significant associations involving infant age in this study, infant age was statistically controlled in all analyses. In addition, multiple regression analyses, following Aiken and West’s (1991) procedures using centered main effect and multiplicative interaction terms, were performed to determine whether infant age moderated relations between all predictor variables and infant night waking.

**Hypothesis 1**

The first hypothesis was that mothers’ depressive symptoms and dysfunctional cognitions about infant sleep would be significantly intercorrelated and be associated with infant night waking. This hypothesis was addressed with partial correlations, controlling for infant age (see Table 3). As hypothesized, mothers with higher levels of depressive symptoms had infants who experienced more night waking, and material worries about infant night needs, but not thoughts of helplessness/loss of control, were significantly associated with infant night waking. Also as predicted, maternal depressive symptoms were positively associated with mothers’ worries about their infants’ physical/emotional needs and with mothers’ thoughts of helplessness/loss of control in response to infant night waking. Maternal worries about infants’ physical/emotional needs and helplessness/loss of control were uncorrelated (see Table 3). Separate multiple regression analyses, using centered main effect and interaction terms, revealed that relations between infant night waking and maternal depressive symptoms, mothers’ worries about infant night needs, and mothers’ thoughts of helpless/loss of control were not moderated by infant age.

**Hypothesis 2**

The second hypothesis, that mothers’ depressive symptoms and dysfunctional cognitions would correlate with bedtime and nighttime maternal behavior and that maternal behavior would be associated with infant night waking, was again assessed with partial correlations, controlling for infant age. As indicated in Table 3, mothers’ depressive symptoms and mothers’ worries about infant physical/emotional needs at night were positively associated with maternal presence with infants during the night and with the amount of time mothers spent in close physical contact with their infants during the night. Mothers’ thoughts of helplessness/loss of control were correlated only with the amount of close physical mother–infant contact at night, but not with infant night waking. No significant relations were found between mothers’ depressive symptoms and bedtime behavior, or between moth-

<table>
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<th>Maternal cognitions</th>
<th>Maternal bedtime behavior</th>
<th>Maternal nighttime behavior</th>
<th>Infant night waking</th>
</tr>
</thead>
<tbody>
<tr>
<td>Worry (a)</td>
<td>Presence</td>
<td>Presence</td>
<td>.41** (37)</td>
</tr>
<tr>
<td>Helpless/lose control (b)</td>
<td>Close contact</td>
<td>Close contact</td>
<td>.45** (37)</td>
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<tr>
<td>Depressive symptoms</td>
<td>.41** (40)</td>
<td>.09 (36)</td>
<td>.40** (42)</td>
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<tr>
<td>Cognitions</td>
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<td>.36* (37)</td>
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<td>.12 (34)</td>
<td>.17 (42)</td>
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<td>Helpless/lose control (b)</td>
<td>.07 (36)</td>
<td>.16 (36)</td>
<td></td>
</tr>
<tr>
<td>Maternal bedtime behavior</td>
<td>.59*** (36)</td>
<td>.10 (36)</td>
<td>.23 (36)</td>
</tr>
<tr>
<td>Close physical contact</td>
<td>.17 (36)</td>
<td>.34* (36)</td>
<td></td>
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<tr>
<td>Maternal nighttime behavior</td>
<td>—</td>
<td>—</td>
<td>.61*** (37)</td>
</tr>
<tr>
<td>Presence</td>
<td></td>
<td>.43** (37)</td>
<td></td>
</tr>
<tr>
<td>Close physical contact</td>
<td>—</td>
<td>—</td>
<td>.37* (37)</td>
</tr>
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Note. Partial correlations, with infant age statistically controlled. Numbers in parentheses are degrees of freedom.

\(a\)Worries about infant’s physical/emotional needs at night.

\(b\)Helplessness/loss of control.

*p < .05, **p < .01, ***p < .001.
Mothers’ bedtime behavior was not associated with infant night waking. However, maternal presence with infant at night was strongly associated with infant night waking, and the amount of time mothers spent in close physical contact with infants at night was also associated with infant night waking. Mother–infant close physical contact at bedtime was associated with close physical contact during the night, but maternal presence at bedtime did not correlate with either maternal presence with infants at night, or mother–infant close physical contact (see Table 3). Multiple regression analyses, again using centered main effect and interaction terms, revealed no moderating effect of infant age on relations between maternal bedtime and nighttime behavior and infant night waking.

Hypothesis 3

We proposed in Hypothesis 3 that maternal behavior would mediate relations obtained between maternal depressive symptoms and infant night waking, and between maternal dysfunctional cognitions and infant night waking, although we left open whether mother- versus infant-driven models would better support such mediation. Criteria and procedures set forth by Baron and Kenny (1986) and MacKinnon (2008) were used to assess the role of maternal behavior at bedtime and at night in mediating relations between mothers’ dysfunctional cognitions about infant sleep and infant night waking. Preliminary criteria to be satisfied before testing for mediation are that (a) the “predictor” variable correlates with the theoretical mediator variable(s), (b) the predictor variable correlates with the “criterion” variable, and (c) the mediator variable(s) correlate with the criterion variable. These criteria were satisfied (see Table 3) for one variable tetrad: maternal depressive symptoms, maternal worries about infant physical/emotional needs, maternal presence at night, and infant night waking, all of which were significantly intercorrelated. Mediation is supported if (a) specific tests of the mediated pathway are statistically significant, and (b) the predictor–criterion link is no longer significant after statistically controlling for the mediator variable. Infant age was statistically controlled in all mediation analyses, and because mediational paths were hypothesis driven and positive associations were hypothesized to occur among all variables regardless of whether mother- or infant-driven models were tested, mediated paths were evaluated with one-tailed tests.

Mother-driven mediational models. The first mediational model to be tested was that depicted in Figure 1, in which both maternal depressive symptoms and mothers’ worries about infant nighttime needs were joint predictors of infant night waking via the mediational influence of maternal presence. Mediation was assessed using regression-based bootstrapping procedures (1,000 iterations, convergence = 0.00001) outlined by MacKinnon (2008), which yields a more robust test of mediation than conventional procedures outlined by Baron and Kenny (1986).

Support for each mediational path in this model was obtained. The specific mediational path from maternal depressive symptoms to maternal presence to infant night waking was found to be significant, standardized estimated effect = .15, estimated effect/standard error = 1.79, $p < .05$, as was the specific mediational path from maternal worries about infant nighttime needs to maternal presence to infant night waking, estimated effect = .14, estimated effect/standard error = 1.66, $p < .05$. The fully analyzed model, with standardized estimated effects for each direct pathway, is presented in Figure 3.

![Figure 3](image-url). Statistically significant mediated paths in which mothers’ nighttime presence with infant mediated relations between maternal depressive symptoms, maternal worries about infant nighttime needs, and infant night waking.

Note. Both mediated paths found to be statistically significant ($p < .05$), using bootstrapping procedures (1,000 iterations, convergence criterion = 0.00001) as outlined by MacKinnon (2008). Infant age was statistically controlled.

*p < .05. **p < .01. ***p < .001.
Additional analyses were conducted in which each of these mediated paths was examined independent of the other, in separate models. These analyses revealed a significant mediated path from maternal depressive symptoms to maternal presence with infants at night to infant night waking, standardized estimated effect = .21, estimated effect/standard error = 2.51, p < .05, and a significant mediated path from maternal worries about infant nighttime needs to maternal presence at night to infant night waking, standardized estimated effect = .22, estimated effect/standard error = 2.44, p < .05. Additional multiple regression analyses provided further support for these mediated paths, in that the links between maternal depressive symptoms and infant night waking, and between maternal worries about infant nighttime needs and infant night waking, were no longer statistically significant after statistically controlling for maternal presence with infant at night (p = .18 and p = .42, respectively; Baron & Kenny, 1986).

Infant-driven mediational models. The two hypothetical “infant-driven” models of influence were then assessed, one in which infant night waking predicted maternal presence with infants at night, which in turn predicted maternal depressive symptoms (Figure 2a), and one in which infant night waking predicted maternal nighttime presence with infants, which in turn predicted mothers’ worries about infant nighttime needs (Figure 2b). The mediated path from infant night waking to maternal nighttime presence with infants to maternal depressive symptoms was not significant (standardized estimated effect = .15, estimated effect/standard error = 1.42, p = .08), nor was the mediated path from infant night waking to maternal nighttime presence to maternal worries about infant nighttime needs (standardized estimated effect = .17, estimated effect/standard error = .06). It is important to note, however, whereas both of these paths did not reach conventional levels of significance, both approached significance.

Post hoc analyses. A final set of analyses was performed to determine whether linkages between maternal depressive symptoms, mothers’ worries about infant nighttime needs, and maternal presence with infants at night would remain even after controlling for infant night waking. If such relations were maintained under these conditions, it would provide additional support for the mother-driven models of influence presented earlier. Two multiple regressions analyses were thus conducted, one that regressed maternal presence with infants at night on maternal depressive symptoms, and another that regressed maternal presence with infant at night on mothers’ worries about infant nighttime needs, with infant age and infant night waking statistically controlled. These regressions revealed that the significant associations reported earlier between maternal depressive symptoms and maternal nighttime presence and between mothers’ worries about infant nighttime needs and maternal nighttime presence persisted even when infant night waking was statistically controlled (β = .32, p < .05 and β = .33, p < .05, respectively).

Qualitative Observations of Maternal Behavior

Additional descriptive observations of nighttime video-recordings were undertaken to obtain a clearer sense of what mothers high versus low in depressive symptoms were doing with their infants during the night. We chose an SCL–90 depressive symptom level of 11 to differentiate mothers low versus high in depressive symptoms. One-way analyses of variance revealed that the low versus high depressive symptoms groups differed not only in terms of mean depressive symptoms—Ms = 4.77 versus 16.75, F(1, 42) = 91.67, p < .05, partial eta squared = .69—but also in terms of mean scores on maternal worries about infant night needs—Ms = 18.57 versus 26.00, F(1, 42) = 4.66, p < .05, partial eta squared = .10.

In general, most mothers (88%) engaged in calming bedtime routines with their infants that typically included feeding younger infants and activities such as reading with those who were older. However, mothers reporting higher depressive symptoms represented a majority (75%) of those who did not have a calming bedtime routine for their infant. Prior to the infants’ bedtime, these mothers had the television on, allowed older children to play rough/make loud noises near the infant, appeared insensitive to the infant’s needs (e.g., hunger), and kept their infants awake after the infant appeared ready for sleep.

Several specific behaviors were observed among mothers with higher depressive symptoms that seemed to impact infants’ ability to maintain sleep and/or soothe themselves back to sleep during the night. Mothers who reported higher depressive symptoms were observed responding very quickly to infant vocalizations. For example, one mother of a 12-month-old infant appeared to be hyperattentive to her infant during the night. She responded to nondistressed vocalizations very quickly throughout the night (sometimes < 40 s) and nursed her infant three times in a period of < 10 h. Two other
mothers were observed waking their sleeping infants unexpectedly during the night. Consider the mother of a 1-month-old infant who woke her non-distressed, sleeping infant during the night (i.e., not for the purposes of feeding) and brought the baby to the parents’ bed for the rest of the night. This behavior was only observed among mothers reporting higher symptoms of depression. A final behavior observed included mothers’ inability to set appropriate limits with their children during bedtime and during the night, especially among older children. Although most mothers were able to establish effective limits, a majority (60%) of those who were not able to were those who reported higher symptoms of depression. The most striking example of this included a mother who appeared unable to structure bedtime for her 24-month-old infant. As the rest of the family went to sleep, this infant remained awake until 2:00 a.m. watching a TV that remained on in the bedroom, occasionally wandering out of the bedroom to other areas of the home. This mother eventually brought her infant close to her and held her until she fell asleep.

In sum, although most mothers implemented a calming bedtime routine, ignored nondistressed vocalizations, and had children who sleep through the night (aside from expected night feedings for younger infants), mothers reporting more depressive symptoms displayed much more variability in nighttime interactions with their infants, intervened with their infants when there did not appear to be a clear need for intervention (e.g., going to the infant when the infant was awake but not distressed, or when the infant was sound asleep), and had difficulty in setting limits with their infants during bedtime and at night.

**Discussion**

In this study, support was obtained for the hypothesized and well-established linkage between maternal depressive symptoms and infant night waking, and between maternal dysfunctional cognitions (specifically, maternal worries about infant nighttime needs) and infant night waking. These findings are consistent with earlier reports of associations between infant sleep disturbance and maternal depressive symptoms (Bayer et al., 2007; Messer & Martin, 1993; Warren et al., 2006) and mothers’ dysfunctional cognitions about infant sleep (Morrell & Steele, 2003; Tikotzky & Sadeh, 2009). Support was also obtained for the hypothesis that mothers’ depressive symptoms and dysfunctional cognitions would be intercorrelated and associated with maternal behavior with infants, although this was limited to maternal nighttime behavior (maternal presence and close mother–infant contact). Finally, the present study revealed that maternal presence with infants during the night and mother–infant close physical contact at night related significantly with infant night waking, which is consistent with earlier work (Mao et al., 2004; Mindell, Meltzer, et al., 2009; Morrell & Steele, 2003; Sadeh et al., 2010).

Importantly, analyses examining maternal behavior as a mediator of relations between maternal depressive symptoms and infant night waking provided support for a mother-driven model in which maternal presence with infants during the night mediated relations between maternal depressive symptoms and infant night waking, and between maternal dysfunctional cognitions about infant sleep behavior and infant night waking (Figure 3). This mother-driven model was further supported by findings that relations between maternal depressive symptoms and maternal nighttime presence, and between mothers’ worries about infant nighttime needs and maternal nighttime presence persisted even when infant night waking was statistically controlled. By contrast, statistical support was not obtained for the two infant-driven models depicted in Figure 2, in which infant night waking predicted maternal depressive symptoms and maternal nighttime presence, and between mothers’ worries about infant nighttime needs and maternal nighttime presence via the meditational role of maternal nighttime presence.

One must use caution in making inferences about causal relations from these results. Causal influences are difficult to ascertain in a cross-sectional data set, and although statistically significant support was found for mother-driven influences on infant night waking, it is important to note that the mediated paths in both infant-driven models approached significance. It is very possible that both mother- and infant-driven influences are at play in terms of linkages between maternal depressive symptoms and infant night waking. In some cases, mothers with elevated depressive symptoms and/or excessive worries about infants’ well-being at night may engage in behaviors with infants at night that leads to increased night waking. In other cases, chronic infant night waking, particularly if it is accompanied by infant distress, could elicit increases in maternal intervention that, over time, could lead to increases in maternal distress. On balance, however, the bulk of the evidence in this study suggests that maternal behavioral effects on infant night waking, stemming from elevations in
mothers’ depressive symptoms and dysfunctional cognitions about infant sleep, are worthy of additional study. Indeed, very little is known of the effects of maternal depression on parenting at night, and on the consequences of depressed nighttime parenting on infant development. Qualitative observations revealed that mothers with elevated depressive symptoms and worries about infant nighttime needs were more likely than mothers with low symptom levels to be hyperresponsive to nondistressed infant vocalizations at night (i.e., vocalizations such as babbling or cooing that did not appear to function as a signal for parental assistance), to pick up and nurse the infants even when it appeared that the infants were not in need of nursing, to go to their soundly sleeping infants and move them from their cribs to the parents’ bed to sleep (and, in the process, wake their infants up), and to poorly structure bedtimes that in turn led to prolonged infant wakefulness. We suspect that mothers who worry excessively about their infants’ well-being at night may be motivated to seek out and intervene with their infants, regardless of whether the infants require intervention or not, in order to alleviate mothers’ anxieties about whether their infants are hungry, thirsty, uncomfortable, and so on. We suspect that mothers with elevated depressive symptoms may be motivated to spend time with their infants at night in order to satisfy mothers’ emotional needs. Unfortunately, we did not obtain information from mothers about their motives for engaging with their infants during the night, which is a clear limitation of this study. We believe such information would be important to obtain in future work examining the effects of maternal depression and dysfunctional cognitions on nighttime parenting.

Interestingly, no associations were found between mothers’ feelings of helplessness/loss of control and infant night waking, although such cognitions were strongly associated with maternal depressive symptoms, as expected. This suggests that depressed mothers are at risk for feeling helpless and out of control with their infants at night, regardless of whether their infants cry frequently during the night or not. We believe that mothers with elevated depressive symptoms are important targets for psychopharmacological treatments aimed at reducing mothers’ depressive symptoms, and for psychoeducational interventions (e.g., mindfulness parenting-based interventions; Duncan, Coatsworth, & Greenberg, 2009) designed to help mothers understand more clearly the reasons behind infant nighttime crying, regulate more effectively the negative emotions that infant night crying might elicit, and think and reflect about how best to respond to promote infants’ capacities for self-soothing and, in turn, the parent–infant relationship.

In contrast to mothers’ nighttime behavior, which was significantly associated with infant night waking, the present study revealed no associations between maternal presence with infants at bedtime, mother–infant close physical contact at bedtime, and infant night waking. It may be the case that these specific maternal behaviors at bedtime are less important in predicting infant sleep behavior across the night than other behaviors or behavioral routines (e.g., Mindell, Telofski, Wiegand, & Kurtz, 2009). It was not surprising that maternal presence and mother–infant close physical contact were associated at bedtime and at night, given that one’s ability to be in close physical contact with another depends on one’s presence with that individual in the same location. More interesting, however, was that with one exception (mother–infant close physical contact at bedtime with mother–infant close physical contact during the night), maternal behavior at bedtime was not associated with maternal behavior during the night. Indeed, in the present observational study of bedtime and nighttime parenting with infants, nighttime and bedtime parenting were largely independent, and only nighttime parenting was associated with infant night waking, with maternal depressive symptoms, and maternal dysfunctional cognitions.

This study had several additional limitations. First, the sample size was small, which compromised statistical power. We were encouraged, nevertheless, that the effect sizes in this study were of sufficient magnitude that statistically significant findings were obtained. Second, this study’s cross-sectional design precluded our ability to draw strong conclusions about causal influences. Although analyses and qualitative observations of mothers’ behavior at night suggest that mother-driven influences are at work, it is impossible, in the present cross-sectional sample, to rule out the possibility that infant night waking predisposed mothers to spend more time with their infants at night, which in turn led mothers to feel more depressed or to become excessively worried about infant nighttime needs. Future, longitudinal studies of these phenomena are warranted, which make use of actual observations of parenting during child bedtimes and at night, which could better clarify paths of influence. Third, although we regard our video-recorded observations of bedtime...
and nighttime parenting to be a strength of this study, these recordings were obtained during one night only, and thus it may not be as representative of a sample of parenting behavior as would be the case if recordings were obtained across more than one night. Fourth, mothers provided information about maternal depressive symptoms, cognitions about infant night waking, and infant night waking. Despite the fact that mothers’ diary-based reports of infant night waking, summed across 7 consecutive days, were significantly associated with video assessments of infant sleep behavior, and that these associations did not change when maternal depressive symptoms and dysfunctional cognitions were statistically controlled, we cannot rule out the possibility that the relations obtained among the maternal reported variables were due in part to shared method variance. Fifth, the present study targeted a relatively low-risk sample, and it is not clear to what degree the present findings generalize to other racial/ethnic groups.

We propose that parent–infant sleep and interactional patterns at night are complexly coregulated. It is likely that both infant- and parent-driven paths of influence will be identified in future attempts to identify linkages between parenting in infant sleep contexts and infant sleep behavior, and in attempts to understand the roles played in these linkages by parental depressive symptoms and parental distress. Importantly, genetic influences may also play an important role in shaping these parent–infant patterns. At least one study (Armitage et al., 2009) suggests that infant sleep disturbance might be a function of genetic influences shared between depressed mothers and infants, suggesting that future work on the interplay of genetics, parenting behavior, and infant sleep behavior is needed. What is clear is that, to date, very little is known about parenting in infant sleep contexts, about the effects of maternal depression on mothers’ parenting of infants during the night, and what this portends not simply for infant sleep quality but for child development in the long term. We argue that observational studies of parenting during bedtimes and at night with children are needed to address these important questions. We hope that this study is a significant step in that direction.

References


