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Eye of the beholder? Maternal mental health and the quality of infant sleep

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Abstract

Transactional models of parenting and infant sleep call attention to bidirectional associations among parenting, the biosocial environment, and infant sleep behaviors. Although night waking and bedtime fussing are normative during infancy and early childhood, they can be challenging for parents. The current study, conducted in the United States between 2003 and 2009, examined concurrent and longitudinal associations between maternal mental health and infant sleep during the first year. Concurrent associations at 6 and 12 months and longitudinal associations from 6 to 12 months were studied in a non-clinic referred sample of 171 economically and culturally diverse families. Mothers with poorer mental health reported that their infants had more night waking and bedtime distress and were more bothered by these sleep issues. Associations between infant sleep and maternal mental health were moderated by culture (Hispanic/Asian vs. other) and by stressors that included high parenting stress, more stressful life events, and low family income. Individual differences in maternal well-being may color mothers' interpretations of infants' sleep behaviors. It may be prudent to intervene to support maternal mental health when infants are referred for sleep problems.

Keywords

night waking; infancy; sleep problems; depressive symptoms; anxiety; United States; mothers; ethnicity

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Introduction

Transactional models of parenting and infant sleep call attention to bidirectional associations among parenting, the biosocial environment, and infant sleep (Anders, 1994; Sadeh & Anders, 1993; Sadeh et al., 2010). The strength of this model lies in its comprehensive, contextual representation of the complexities of dyadic interactions and bidirectional influences between infant sleep and the infant's environment. According to this model, infant sleep-wake regulation is influenced mainly by intrinsic infant factors (e.g., temperament, development-maturation) in interaction with what the authors describe as the parent-infant mediating and the proximal extrinsic contexts. The parent-infant mediating context includes the dyadic parent-infant attachment relationship and parental interactive nighttime behaviors such as soothing, limit setting, and co-sleeping (Anders, 1994; Sadeh & Anders, 1993). The proximal extrinsic context encompasses parental factors such as psychopathology. At the most distal extrinsic level, culture (i.e., social and cultural norms), environment (e.g., socioeconomic factors, caretaking arrangements), and family processes (e.g., family stress/traumatic life events) are suggested to influence parental factors first, and infant sleep secondarily (Sadeh & Anders, 1993). This model allows for simultaneous exploration of how infant sleep affects the larger family system and how systemic influences affect infant sleep (Anders, 1994).

An important adaptation to this model is the increasingly relevant role of parental expectations, attitudes, and interpretations regarding infant sleep (Sadeh et al., 2010). Whether infant sleep disruptions are considered problematic depends on factors such as parental psychopathology, social values, and cultural norms. In the current study, we test propositions of this transactional model of parenting and infant sleep by concurrently and longitudinally examining bidirectional relations between infant sleep behaviors, maternal perceptions, and the proximal extrinsic factor of maternal mental health, while taking into account intrinsic infant factors (i.e., temperament) and extrinsic context (i.e., family income, stressful life events, parenting stress, culture).

Normative and Problematic Infant Sleep

It is normative for infants to wake during the night, but the duration and frequency depend on infant age as well as other factors; night waking is common early in infancy and tends to decline as infants move into toddlerhood (Goodlin-Jones et al., 2001). Frequent night-wakers are more likely to be male, have been breastfed at 6 and 15 months, have more difficult temperaments, and have mothers who reported more depressive symptoms (Weinraub et al., 2010). Although it can be challenging to parents, night waking is not inherently a sleep problem (Weinraub et al., 2010); cultural context and parenting attitudes/beliefs influence whether infant sleep behavior is seen as problematic (Giannotti & Cortesi, 2009). Indeed, whether night waking or resistance at bedtime is a problem may depend on the perceiver (i.e., "eye of the beholder"), making it important to obtain parental reports of sleep behaviors and their reactions to them.

Direction of Associations Between Infant Sleep and Maternal Mental Health

A goal of the current study was to broaden infant sleep research by clarifying the direction of associations between maternal mental health (specifically both anxiety and depressive symptoms) and infant sleep. Although transient episodes of crying and waking at night are unlikely to cause long-term duress for parents, persistent and/or frequent night waking in particular has been associated with maternal depression and overall stress (Dennis & Ross, 2005; Hiscock & Wake, 2002; Sadeh et al., 2010), as well as parenting stress and child behavior problems (Wake et al., 2006) and poorer parental physical and mental health (Bayer et al., 2007). A possible mechanism is that infant night waking leads to more active

nocturnal care by the mother, which in turn interferes with her sleep quality (Gress et al., 2010) and could make her vulnerable to depressive symptoms (Dennis & Ross, 2005).

Maternal mental health may also influence infant sleep. Maternal mental health explains in part how mothers understand their environment and their relationships with their infants (Sadeh et al., 2010). Depression has received the most empirical attention. Compared to mothers without depression, depressed mothers have less positive and more negative interactions with their infants (Coyle et al., 2002) and are more likely to have children with negative temperaments (Field et al., 2006). Mothers with depression often find it difficult to provide children with the necessary resources to cope with stress or maintain behavioral and physiological regulation (Field, 1994). However, there has been a call for those who study maternal mental health to consider anxiety in addition to depression (Austin, 2004; Matthey, 2004); these conditions often are comorbid (Cassano et al., 2003). Of the two conditions, anxiety is more strongly linked with stress (O'Connor et al., 2007), which has demonstrated negative physiological effects (McEwen, 1998). Although maternal anxiety in relation to infant functioning has been studied far less than maternal depression, symptoms in both areas during pregnancy are related to later infant sleep problems (O'Connor et al., 2007).

Research with clinical samples reveals that maternal depression places infants at higher risk for sleep disorders (Pinheiro et al., 2011); non-human animal research supports this direction of causal influence (Dugovic et al., 1999). Improvements in maternal mood have been noted due to sleep interventions that help clinic-referred infants through the night (Hiscock & Wake, 2002) without adverse long-term effects on toddlers' behavior (Hiscock et al., 2008). However, some research indicates that extinction-based interventions leave infants and mothers distressed at a physiological level (Middlemiss et al., 2012). Even at subclinical levels, maternal depressive symptoms are associated with more sleep disturbances in early infancy (Armitage et al., 2009), sleep problems persisting until 3 years of age (Zuckerman et al., 1987), and perceiving infant sleep issues as problematic (Germon et al., 2007). Maternal depression measured prenatally also predicts night waking and total sleep time during early childhood (O'Connor et al., 2007). Thus, there is evidence to support a pathway from maternal mental health to disrupted infant sleep.

Potential Moderators

More potent than isolated or single types of stressors are interactions between stressors and their cumulative effects over time (Turner et al., 2000). For instance, individuals experiencing chronic stress are more likely to suffer mental health problems when exposed to daily hassles than individuals with less chronic stress (Serido et al., 2004). In this study, we considered proximal and distal life stressors that have been linked with both maternal well-being and infant sleep, including parenting stress, multiple life-event stressors, and low income (Almeida et al., 2002). We hypothesized that mothers who reported high levels of parenting stressors, reported many life stressors, or who were low income would be more likely to suffer symptoms of anxiety or depression than other mothers when their infants displayed problematic sleep.

We also included the distal factor of culture. Normative sleep practices vary by culture; for example, mothers from Asian and Hispanic cultures are more likely to co-sleep and have parent involvement during the night compared to families from Western European backgrounds (Lozoff et al., 1984; Schachter et al., 1989). Where co-sleeping is the norm, sleep practices are more child-centered, interdependency is valued over autonomy, and night waking is not viewed as a problem (Baddock, 2011). Cultural variation in sleep practices could affect infant sleep behaviors and mothers' reactions to them and therefore was included as a potential moderator in the current study.

The Current Study

Based on the transactional model of infant, family, and parent factors and infant sleep (Anders, 1994; Sadeh & Anders, 1993; Sadeh et al., 2010), the objective of the current study was to examine the bidirectional associations between infant sleep and maternal well-being in a short-term longitudinal study of a community, non-clinic sample. Unlike most previous studies, we do not consider bedtime and nighttime sleep issues as one category nor are they seen as intrinsically problematic. We focus on the first year of infancy, a time when sleep is less consolidated. Study hypotheses were: (1) infant sleep and maternal mental health would be associated concurrently at 6 and 12 months, (2) infant sleep and maternal reports of being bothered by infant sleep at 6 months would predict maternal well-being at 12 months; and (3) maternal well-being at 6 months would predict infant sleep and maternal reports of being bothered by infant sleep at 12 months. Also examined were the roles of other potential stressors and ethnicity/culture as moderators of associations between the primary constructs of interest.

Method

Participants

The full sample of mothers and infants ($N = 179$; 54.7% male) were drawn from a longitudinal study of prenatal stress (Sandman et al., 2012) and infant development conducted between 2003–2009 at a university medical center in Southern California in full compliance with the ethics and standards of the Institutional Review Board. Mothers (age: 18–44 years; $M = 28.87$, $SD = 5.22$) visited the laboratory at 6 ($n = 179$) and 12 ($n = 151$) months after their child's birth. The sample participants had diverse backgrounds: 52.0% were non-Hispanic European American ($n = 93$), 25.7% were Hispanic American ($n = 46$), 10.1% were Asian American ($n = 18$), 9.5% were from other backgrounds ($n = 17$), and 2.8% ($n = 5$) did not provide this information. Nearly all mothers provided information about their highest level of education: 2.8% ($n = 5$) had less than a high school diploma, 17.8% ($n = 32$) completed high school, a technical school or had a high school equivalency certificate 24.1% ($n = 43$) had some college, 11.7% ($n = 21$) held a two-year college degree, 26.3% ($n = 47$) held a four-year college degree, and 15.1% ($n = 27$) had a post-baccalaureate degree. Most mothers (87%) were either married or living with the infants' biological father. The sample of mothers in this study were compared to the larger sample from which they were drawn using chi square statistics; there were no significant differences in child sex, maternal age, level of education, or marital status. However, the current sample had significantly more non-European American mothers than the larger study, $\chi^2(1) = 10.83$, $p < .001$.

Measures

Means and standards deviations for the major study variables are displayed in Table 1.

Measures of infant sleep—The Sleep Practices Questionnaire (SPQ; Keller & Goldberg, 2004) was the primary source of information about infant sleep and maternal reactions to sleep behaviors.

Bedtime distress was a single item of maternal reports of duration of infant crying at bedtime (1 = never, 2 = 5 minutes or less, 3 = 6–15 minutes, 4 = 16–30 minutes, 5 = more than 30 minutes) at both 6 and 12 months.

Nighttime sleep issues were the average of maternal responses to three items: (1) how many times the infant usually wakes up during the night (1 = 0–rarely, 2 = 1–2 times per night, 3 = 3 or more times per night), (2) how many minutes the infant is usually awake at night (1 = not applicable, 2 = less than 1 minute, 3 = 1–5 minutes, 4 = 6–15 minutes, 5 = 16–30

minutes, 6 = more than 30 minutes), and (3) how long the infant cries when he/she wakes (1 = no night waking or cries; 2 = 5 minutes or less, 3 = 6–15 minutes, 4 = 16–30 minutes, 5 = more than 30 minutes). Cronbach's alpha at 6 months $\alpha = .64$ and at 12 months $\alpha = .69$.

At 6 and 12 months, mothers reported the extent to which they perceived their child's sleep-related behaviors as problematic. Mothers reported on a 5-point scale how much of a problem it was to settle their infant to sleep (bedtime distress) and how much their infant's night waking was a problem (nighttime distress). Higher scores indicated mothers being more bothered (1 = not at all, 3 = somewhat a problem, 5 = definitely a problem). Due to skew, for the bedtime distress at 6 and 12 months and nighttime distress at 12 months, scores of 5 were recoded to 4 for data analysis.

Maternal depression and anxiety—The short form of the Center for Epidemiological Studies Depression Inventory (CES-D; Radloff, 1977) was used to evaluate depressive symptoms. Responses to each of the 9 items were recorded on a 4-point (0–3) scale. Anchor points were “rarely or none of the time (less than 1 day)” to “most or all of the time (5–7 days).” The CES-D has demonstrated reliability and validity and is sensitive to mood disturbances below clinically significant levels (Radloff, 1977). In the current sample, at 6 months $\alpha = .88$ and at 12 months $\alpha = .86$.

The extent to which mothers were experiencing anxiety-related symptoms was measured using the 10-item State Anxiety subscale of the State-Trait Anxiety Inventory (STAI; Spielberger et al., 1983). Responses were made on a 4-point scale ranging from 1 (not at all) to 4 (very much). At 6 months $\alpha = .88$ and 12 months $\alpha = .86$.

Potential moderators—Parenting stress was assessed at both time points using the Revised Parenting Stress Index (PSI; Abidin, 1995; Loyd & Abidin, 1985). The PSI is a widely-used and well-validated measure of stress in the parent-child relationship (Loyd & Abidin, 1985). Six-month concurrent and longitudinal analyses utilized 6-month PSI reports; 12-month concurrent analyses used 12-month reports. Two scales from the PSI were used in the current study: Parent Domain (PSI-PD) to measure parenting stress and Life Events (PSI-LE) to measure stressful life events. The PSI-PD scale had a response scale from 1 (strongly agree) to 5 (strongly disagree). Forty-five items were used that represented the domains of parenting stress: attachment, parent health, relationship with spouse, role restrictions, sense of competence, and social isolation. The depression subscale was omitted due to potential collinearity with the CES-D. A total mean score for PSI-PD was created in which higher scores represented more stress (6 months: $M = 1.69$, $SD = 0.53$, $\alpha = .90$; 12 months: $M = 1.69$, $SD = 0.53$, $\alpha = .91$). The PSI-LE scale gathered information about important stressful events that had occurred within the preceding 12 months. The 19 items had a yes (=1) /no (=0) response scale; mothers indicated whether or not life events such as divorce, marriage, pregnancy, relocation, promotion, and legal problems had occurred. “Yes” scores were summed (possible range = 0–19) with higher scores indicating more stressful life events (6 months: $M = 8.64$, $SD = 8.30$; 12 months: $M = 7.77$, $SD = 7.34$).

At a prenatal visit for the larger study, mothers provided information about their family income on a scale with 12 levels ranging from under \$5000 to over \$100,000.

Ethnicity/Culture: A dichotomous variable (1=Hispanic or Asian American; 0 = other) was created based on information provided by mothers.

Covariates—A dichotomous variable was used to represent infant gender (0=boy, 1=girl). Infant temperament was assessed at both time points through maternal report on the Pictorial Assessment of Temperament (PAT): Infant Version (Clarke-Stewart et al., 2000). The PAT

presents the parent with 10 vignettes that portray possible infant responses to potentially distressing situations (e.g., loud noise). The response scale ranged from 1 to 3 and yields a single, continuous score of temperamental difficulty, including negative mood, lack of approach to strangers, slow adaptability to change, and high intensity of emotional expression. A mean score was calculated such that higher scores reflected a more difficult temperament (6 months: $M = 1.80$, $SD = 0.28$, $\alpha = .52$; 12 months: $M = 1.82$, $SD = 0.28$; $\alpha = .53$). The PAT is reliable and valid as a current and retrospective account of temperament (Clarke-Stewart et al., 2000).

Data Analysis

The first, second, and third hypotheses, which concerned concurrent and longitudinal associations between infant sleep and maternal mental health, were tested using partial correlations controlling for infant gender and temperament. The role of potential moderators was tested using interaction terms in a series of regression models. All variables were centered prior to the computation of the multiplicative interaction terms. Regressions included lower-order terms, infant gender, and temperament as controls; the longitudinal analyses included the 6-month measure of the 12-month outcome as controls.

Results

Concurrent Associations between Infant Sleep and Maternal Mental Health

Table 1 has the partial correlations between infant sleep and maternal mental health at 6 and 12 months. At 6 months, depressive symptoms and anxiety were positively associated with maternal reports of being bothered by both bedtime distress (i.e., crying) and nighttime issues (i.e., frequency and duration of awakening and crying); mothers with lower well-being reported being more bothered by infant distress at bedtime and more bothered by the frequency and duration of night waking. No other infant sleep behaviors were significantly associated with depressive symptoms. More anxiety was significantly associated with more nighttime but not bedtime sleep issues.

At 12 months, both depressive symptoms and anxiety were positively associated with more bedtime distress; depressive symptoms also were positively related to mothers' reports of being bothered by both bedtime and nighttime sleep issues. There were no significant associations between depressive symptoms and nighttime sleep issues, or between anxiety and any other sleep variable at 12 months. At both 6 and 12 months, most significant correlations were small-to-moderate in size; those between infant sleep problems and maternal reports of being bothered were moderate-to-large in size.

Pathway from Infant Sleep to Maternal Mental Health

Longitudinal evidence—As shown in Table 1, mothers who reported more bedtime distress and who were more bothered by bedtime and nighttime sleep issues at 6 months reported significantly higher levels of depressive symptoms and anxiety at 12 months. Significant partial correlations were small in size. There were no significant associations between other 6-month infant sleep-related behaviors and 12-month indicators of maternal mental health.

The role of potential stressors and ethnicity/culture—There were several significant interactions between infant sleep and maternal mental health and the potential stressors of parenting stress, life events stress, and low income (see Table 2). All of these interactions followed the same pattern: more sleep issues were related to poorer maternal mental health under conditions of high stress (i.e., high levels of parenting stress, many life event stressors, low income); under conditions of low stress, sleep issues were either not

related or inversely related to maternal mental health (see Figure 1). With regard to culture, significant interactions indicated that sleep issues were more predictive of mental health problems only for Hispanic and Asian American mothers (see Table 2).

Most of the significant interactions occurred in the concurrent analyses at 6 months: under conditions of high stress in the parenting domain (but not under conditions of lower stress), more bedtime and nighttime issues were related to more symptoms of depression and anxiety. Similarly, under high but not low levels of parenting stress, being bothered by both bedtime and nighttime was related to more depressive (but not anxiety) symptoms. When mothers were from low-income families only, nighttime issues also concurrently predicted both symptoms of depression and anxiety at 6 months.

Concurrently at 12 months, the two significant interactions were both in relation to depressive symptoms: under conditions of high parenting and life-event stress, bedtime issues were related to more depressive symptoms; the same pattern was not evident under low levels of stress. In the longitudinal analyses from 6 to 12 months, there was only one significant interaction: only under conditions of high life-event stressors, nighttime issues predicted more anxiety.

Ethnicity/culture moderated the concurrent relation between maternal mental health and sleep at 6 but not 12 months (see Table 2). Only Hispanic and Asian American mothers who reported more bedtime distress at 6 months also reported more anxiety; in addition, more difficulty with bedtime distress at 6 months was associated with higher levels of depressive symptoms and anxiety only for Hispanic and Asian American mothers. There was a significant interaction for the longitudinal analyses: only Hispanic and Asian American mothers who reported more 6-month bedtime distress reported more 12-month depressive symptoms.

Pathway from Maternal Mental Health to Infant Sleep

Longitudinal evidence—There were two significant longitudinal associations between maternal mental health at 6 months and infant sleep at 12 months (see Table 1). Mothers who reported more depressive symptoms at 6 months reported being more bothered by bedtime distress at 12 months. Mothers who reported more anxiety at 6 months had infants who reportedly showed more bedtime distress at 12 months.

The role of potential stressors and culture—There were three instances in which other stressors moderated associations between maternal mental health and infant sleep (see Table 3). Each of the significant interactions supported the hypothesis that experiencing other stressors exacerbated the effects of the mental health stressors. Concurrently at 6 months, mothers who reported high levels of parenting stress and more anxiety had infants with more bedtime distress; for mothers who reported low levels of parenting stress, there was a negative association between anxiety and bedtime distress. The same pattern was evident longitudinally for depressive symptoms and life events in relation to bedtime distress. Among mothers who reported more stressful life events, more depressive symptoms were associated with more infant distress at bedtime. Under conditions of low stress, better mental health was either unrelated to infant sleep or associated with lower levels of infant sleep issues.

In regard to ethnic/cultural affiliation, the pattern again suggested a stronger relation between mental health and sleep issues for Hispanic and Asian American mothers than for other mothers. There were three significant interactions at 6 months: more anxiety was related to more bedtime distress and maternal reports of being bothered by bedtime distress for Hispanic and Asian mothers but not for other mothers; similarly, more depressive

symptoms were related to being more bothered by bedtime distress only for Hispanic and Asian mothers. Again at 12 months, depressive symptoms were related to more bedtime distress only for Hispanic and Asian American mothers. In contrast to the concurrent analyses, there were no significant longitudinal interactions between ethnicity/culture and mental health in relation to infant sleep.

Discussion

Concurrent analyses indicated that mothers with lower well-being had infants of 6 and 12 months with more sleep issues at bedtime and during the night and reported being more bothered by those issues. Longitudinal associations provided support for pathways from infant sleep to maternal well-being and vice versa. Moderator analyses revealed that more sleep issues were related to poorer maternal mental health under conditions of high stress and for Hispanic and Asian families more so than other ethnicities/cultures.

Cross-sectional and Longitudinal Associations between Infant Sleep and Maternal Well-being

Although night waking and fussing at bedtime are normative during infancy and toddlerhood (Goodlin-Jones et al., 2001), they can be challenging for parents. At 6 and at 12 months, there were moderate-to-large associations between infant fussing and nocturnal waking and maternal reports of being bothered by those behaviors. However, bed- and nighttime problems in children are defined by their caregiver (Morgenthaler et al., 2006). In both cross-sectional and longitudinal analyses, mothers who were feeling more poorly psychologically characterized their infants' sleep behaviors as more problematic.

In both concurrent and longitudinal analyses, mothers who reported more symptoms of depression and anxiety were more bothered by these common infant sleep behaviors, thus providing evidence for an "eye of the beholder" phenomenon. Individual differences in maternal mental health may color how mothers interpret their infants' nocturnal behavior. Perhaps mothers who were more bothered harbored unreasonable expectations, suggesting that mothers might benefit from information about what constitutes normative infant sleep behaviors. Parental perceptions of sleep problems are influenced by intrinsic (e.g., temperament) and extrinsic (e.g., parenting) factors (Morgenthaler et al., 2006) and by culture (Mindell et al., 2010). It is also possible that mothers who are more bothered by infant sleep issues have a lower threshold and are more easily distressed than other mothers by infant nocturnal behaviors. If these mothers of infants are themselves sleep-deprived (Dorheim et al., 2009), it could be that a third variable, such as over reactivity to negative stimuli due to sleep deprivation (Anderson & Platten, 2011), is related both to experiencing feeling bothered by infant sleep issues and more symptoms of depression and anxiety.

Apart from feeling bothered by infant sleep, evidence in this study was found linking maternal mental health anxiety directly to infants' sleep behaviors (as reported by mothers). Higher levels of anxiety were associated with 6-month nighttime issues (i.e., more frequent, longer night wakings and more distress when awakened), although the observed effect was small in magnitude. Sleep is still consolidating over the first year (Goodlin-Jones et al., 2001; Scher et al., 2004). By 12 months, the association between anxiety and infant night issues dropped out. However, longitudinally, more bedtime distress at 6 months was associated with more symptoms of anxiety and depression at 12 months. In an apparent developmental shift, by late infancy, bedtime distress rather than during-the-night issues were linked to poorer maternal mental health. This developmental change is consistent with past research; issues around settling at bedtime can be expected to persist throughout toddlerhood but lessen by the end of preschool (Petit et al., 2007). Nonetheless, night waking and bedtime protests remain common throughout early childhood (Mindell et al.,

2009) and future research on maternal mental health and child sleep should extend through this period.

In the current study, there was some evidence to support both hypothesized paths of influence between maternal well-being and infant sleep; effect sizes were comparably small in magnitude. Although causality cannot be ascertained, the findings are congruent with the explanation that infant bedtime fussiness and mothers being bothered by infant sleep issues in mid-infancy are taking a toll on mothers' mental health by the end of that year. Young infants' fussing at bedtime may challenge maternal resources or diminish their sense of parental competence, thus contributing to poorer maternal well-being at 12 months. In the other direction, mothers who had more symptoms of depression at 6 months were more bothered by bedtime issues at 12 months, and more anxious mothers at 6 months reported that their infants showed more distress at bedtime at 12 months. These findings are consistent with the eye of the beholder perspective: mothers who experienced more mental health challenges at 6 months may then perceive their infant less favorably, have a lower threshold for feeling annoyed or bothered by infant behaviors that infringe on mothers' personal time (i.e., sleep), and then report more infant sleep problems at 12 months.

When sleep issues cross the threshold into being a problem for the parents, some action is needed. Findings of asynchrony in mother-infant physiology suggest that extinction-type intervention programs may have biobehavioral consequences that are not optimal (Middlemiss et al., 2012). Nonetheless, mothers who are motivated to seek a residential program because of infant sleep problems report improved mood (fewer symptoms of depression and anxiety) following improvements in infant sleep behavior (Matthey & Speyer, 2008). Although extinction-based interventions may not have lasting negative effects on the young child (Hiscock et al., 2008), less intensive interventions, such as establishing a bedtime routine, have been shown to be effective in improving child sleep and maternal mood (Mindell et al., 2009). Less intensive means may be particularly well-suited to families with subclinical sleep issues.

Potential Moderators: Role of Stressors and Ethnicity/Culture

We examined whether the experience of other potent and theoretically important life stressors – high levels of parenting stress, numerous stressful life events, and low-income – moderated the associations between infant sleep and maternal mental health. Although a minority of the interactions was significant, increasing the risk of a Type I error, the pattern of all interactions was consistent. The hypothesis that there would be a stronger association between maternal mental health and infant sleep for mothers experiencing additional stressors was supported. Findings are consistent with the position that interactions between stressors and their combined, cumulative effect are more important for adults' well-being and functioning than are individual stressors (Turner et al., 2000); we extend this work to the domain of infant sleep and maternal mental health.

Stress moderators appeared to be most important in the path from infant sleep to maternal well-being. At 6 months, mothers who had high levels of stress in the parenting domain *and* had infants with bedtime or nighttime issues had the highest levels of depression and anxiety symptoms; mothers displayed higher levels of depressive symptoms when they experienced both stress in the parenting domain and feelings of being bothered by their infants' sleep issues. At 12 months, mothers had the highest levels of depressive symptoms when they experienced stress in the parenting domain *and* their infants cried longer at bedtime.

Congruent with past research (Almeida et al., 2002), income and life events were also important moderators. At 12 months, lower-income mothers and mothers who experienced more stressful life events appeared most susceptible to negative mental health associations

with nighttime and/or bedtime difficulties. Limited psychological and financial resources are challenging in their own right; also these mothers may view their infants more negatively (Pinderhughes et al., 2000) and be less likely to respond sensitively to their infants when they are sleep deprived (Anderson & Platten, 2011; Dorheim et al., 2009).

Although there were fewer instances in which these other stressors moderated the prediction of infant sleep based on maternal mental health, each significant result supported the same pattern as above, with the other stressor appearing to exacerbate the relation between maternal mental health problems and infant sleep. Mothers with limited psychological resources due to many stressors may not be able to adequately soothe their infants at bedtime, leading to longer bouts of crying and more difficulty falling asleep. It may be difficult for these mothers to engage in sensitive parenting, i.e., parenting organized around the child's behavior and not driven by maternal anxiety (Gunnar & Davis, 2003).

The current study provides new data on the moderating role of Hispanic and Asian ethnic/cultural background for associations between maternal mental health and infant sleep. Support was found for the position that cultural background affects attitudes about sleep and whether a sleep behavior is perceived as problematic (Baddock, 2011). Consistently, poorer mental health and more bedtime sleep problems were associated only for Hispanic and Asian mothers. The Hispanic and Asian mothers with more symptoms of depression and anxiety reported more bedtime difficulties and were more bothered by bedtime issues; mothers from other backgrounds did not show this pattern to the same extent. Because of the value placed on interdependency in Hispanic and Asian cultures and the high frequency of co-sleeping (bedsharing and roomsharing) in these cultures (Schachter et al., 1989), Hispanic and Asian mothers may be more likely than other mothers to be actively engaged at bedtime. Sleep routines often take place in the same room in which they sleep, and perhaps they become more susceptible to perceiving bedtime protests as problems and feel anxiety and more despair as the distress lingers.

Interestingly, although associations with bedtime distress were significant, ethnicity/culture did not moderate associations between maternal mental health and nightwaking. The lack of parallel findings speaks to the importance of separate examination of bedtime and during-the-night sleep behaviors when studying infant sleep. There could be cultural group differences in daytime sleep patterns; in an internet study, shorter daytime sleep was offered as a possible explanation for bedtime difficulties in a Japanese sample (Kohyama et al., 2011). Future research on infant sleep in relation to maternal well-being should include information on sleep arrangements and duration of naps and should explore why these cultural differences exist.

Limitations and Conclusions

Limitations include reliance on maternal report for both symptoms of their mental health and reports of infant sleep behaviors. Although most observed associations were small in magnitude, they are consistent with past research linking psychological, relational, and sleep characteristics (Bayer et al., 2007). Future research should continue to examine proximal and distal factors that predict both infant sleep and maternal mental health. Given the importance of context and the effect sizes observed in this study, clinical interventions to improve maternal mental health or infant sleep should consider factors beyond those assessed in this study. Aspects of infant sleep other than quality (e.g., duration) might be examined in future research. In addition, further research should include observations of maternal sensitivity at bedtime and during the night as they relate to infant sleep and maternal well-being. Recent findings that maternal mental health preconception predicts night waking in the first year postpartum (Baird et al., 2009) suggests that future research

should include prenatal measures of maternal mental health in relation to sleep behavior and maternal well-being during early childhood.

Results of the current study have implications for assessing maternal well-being and multiple life stressors at pediatric well-child appointments and when infants are referred for sleep problems. Variations were found by mothers' cultural background, suggesting the importance of cultural sensitivity in clinical settings. Mothers with poorer mental health seem to characterize sleep-related behaviors as more problematic. Depressed/anxious mothers may have a lower threshold for bedtime and nighttime issues and become easily distressed especially when facing other stressors. Treating maternal symptoms also with infant sleep issues could reduce mothers' mental health risk and improve infant well-being. However, we caution that a problem for some is not a problem for all: whether infant sleep behaviors are considered normative or are found to be distressing may be in the eye of the beholder.

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Highlights

- Concurrent and longitudinal analyses revealed bidirectional associations between infant sleep and maternal mental health in the USA
- Mothers with poorer mental health reported more infant sleep issues and were more bothered by these issues.
- Infant sleep issues and maternal health were moderated by high stress and culture/ethnicity.

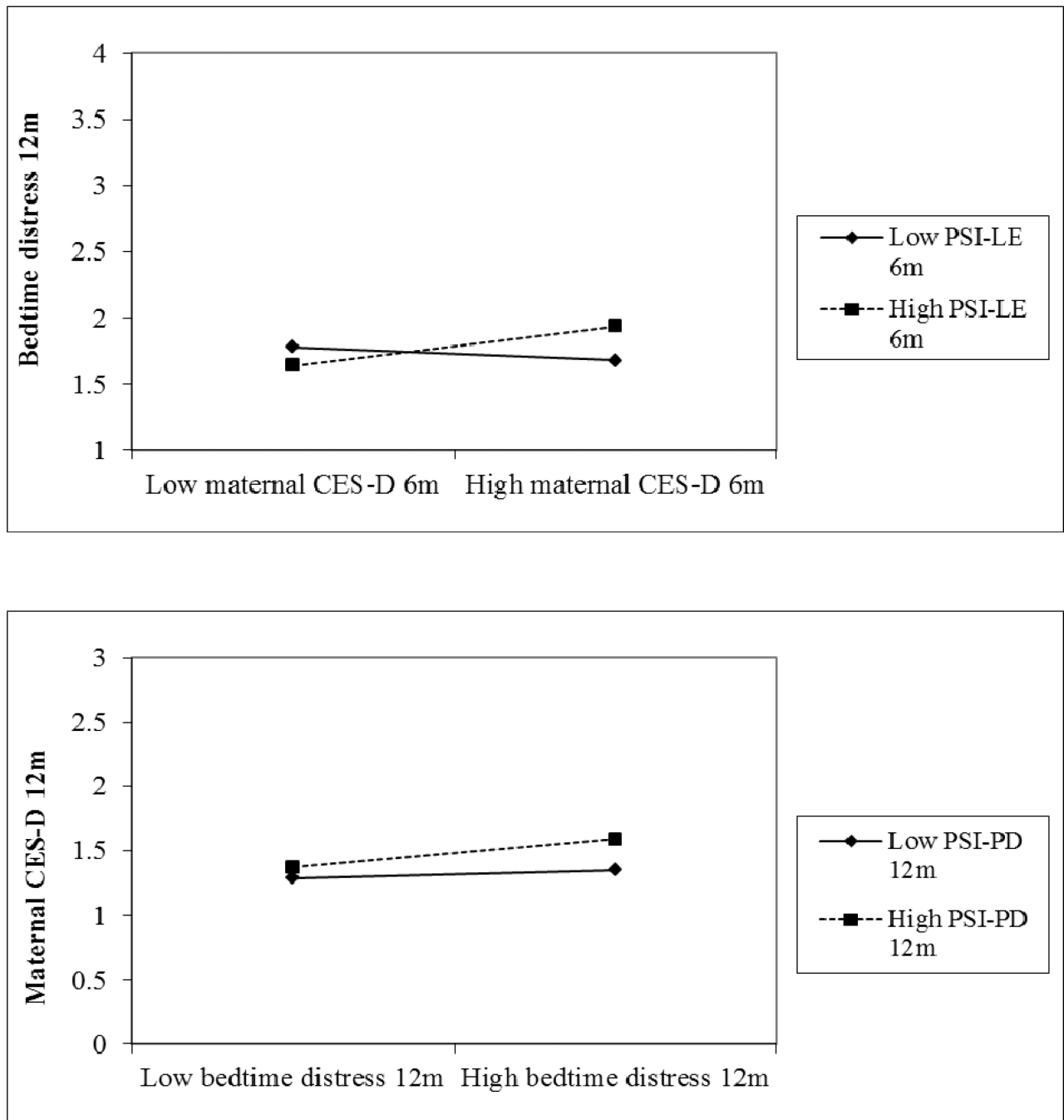


Figure 1.
Patterns of associations between maternal mental health and infant sleep for different levels of stress.

Partial Correlations, Means, and SDs Among Major Study Variables at 6 months and 12 Months, Controlling for Infant Gender and Temperament^a

Table 1

	Child sleep 6m						Maternal mental health 6m			Child sleep 12m				Maternal mental health 12m		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Child sleep, 6m																
1. Bedtime distress	X	.37***	.51***	.28***	.13	.10	.27**	.32**	.11	.23**	.24**	.20*				
2. Nighttime sleep issues		X	.27***	.50***	.14	.17*	.12	.40***	.17*	.24**	.08	.13				
3. Bothered by bedtime distress			X	.36***	.19*	.17*	.18*	.24**	.31**	.23**	.19*	.16*				
4. Bothered by nighttime issues				X	.24**	.30***	.10	.26**	.18*	.36***	.21**	.17*				
Maternal mental health, 6m																
5. Depressive symptoms					X	.76***	.15	-.01	.19*	.14	.63***	.45***				
6. Anxiety						X	.19*	-.01	.06	.12	.51***	.58***				
Child sleep, 12m																
7. Bedtime distress							X	.15	.41***	.17*	.24**	.20*				
8. Nighttime sleep issues								X	.18*	.55***	.08	.06				
9. Bothered by bedtime distress									X	.36***	.20*	.10				
10. Bothered by nighttime issues										X	.21**	.15				
Maternal mental health, 12m																
11. Depressive symptoms											X	.72***				
12. Anxiety													X			
Mean	1.80	2.06	1.67	1.89	1.51	1.69	1.81	1.95	1.71	2.05	1.42	1.68				
Standard Deviation	0.81	0.68	0.81	1.01	0.54	0.52	0.83	0.65	0.84	1.35	0.47	0.51				

^a Ns range from 151 to 179.

* $p < .05$

** $p < .01$

*** $p < .001$

Table 2
Regression Analyses Testing Interactions Between Potential Moderators and Infant Sleep in Relation to Maternal Mental Health^a

	6m concurrent ^b		12m concurrent ^b		6m to 12m longitudinal ^b	
	Depressive symptoms	Anxiety	Depressive symptoms	Anxiety	Depressive symptoms	Anxiety
PSI-PD × bedtime distress	.18 ^{c**}	.18 ^{**}	.20 ^{**}	.10	.06	-.05
PSI-PD × night issues	.17 [*]	.14 [*]	.01	-.06	.11	-.04
PSI-PD × bothered by bedtime distress	.17 [*]	.13	.11	.03	.12	.02
PSI-PD × bothered by nighttime issues	.14 [*]	.03	.11	.02	.11	.00
PSI-LS × bedtime distress	.01	.00	.23 [*]	.10	.09	-.01
PSI-LS × nighttime issues	.14	.13	.08	.07	.01	-.14 [*]
PSI-LS × bothered by bedtime distress	.06	.07	.13	.07	.02	-.05
PSI-LS × bothered by nighttime issues	.08	.11	.05	.03	.07	-.08
Income × bedtime distress	-.05	-.09	-.10	-.06	-.14 [*]	-.08
Income × nighttime issues	-.18 [*]	-.15 [*]	-.13	-.05	-.01	-.07
Income × bothered by bedtime distress	-.09	-.09	-.12	-.13	.01	-.02
Income × bothered × nighttime issues	-.10	-.02	-.12	-.09	.01	-.06
Hispanic/Asian v. other × bedtime distress	.11	.24 [*]	.08	.12	.20 [*]	.00
Hispanic/Asian v. other × nighttime issues	.04	.09	.15	.09	.06	.06
Hispanic/Asian v. other × bothered by bedtime distress	.24 [*]	.24 [*]	-.03	.05	-.07	-.10
Hispanic/Asian v. other × bothered by nighttime issues	-.08	-.08	.03	.10	.00	.02

^a λ s ranged from 151 to 179. All models controlled for lower-order terms, infant gender, temperament, and 6-month mental health.

^b Concurrent model at 6 months and longitudinal model include the 6-month PSI; 12m concurrent model includes the 12-month PSI.

^c Standardized regression coefficients.

* $p < .05$

** $p < .01$

Table 3

Regression Analyses Testing Interactions Between Potential Moderators and Maternal Mental Health in Relation to Infant Sleep^a

	6m concurrent ^b				12m concurrent ^b				6m to 12m longitudinal ^b			
	Bedtime distress (BD)	Bothered by BD	Nighttime issues (NI)	Bothered by NI	Bedtime distress (BD)	Bothered by BD	Nighttime issues (NI)	Bothered by NI	Bedtime distress (BD)	Bothered by BD	Nighttime issues (NI)	Bothered by NI
PSI-PD × CESD	.20 ^c	.10	.16	.15	-.14	.02	.01	-.10	.00	.06	.11	.05
PSI-PD × STAI	.22 [*]	.07	.15	.05	-.06	-.18	-.06	-.02	-.08	-.00	.02	.01
PSI-LS × CESD	-.03	.01	.09	.05	-.14	-.27	.01	-.12	.18 [*]	.13	.08	.06
PSI-LS × STAI	-.02	-.01	.05	.04	-.03	-.06	-.01	.01	.10	.15	.04	.08
Income × CESD	-.02	-.18 [*]	-.05	-.08	-.09	-.11	-.12	-.06	-.06	.07	-.05	.04
Income × STAI	-.10	-.12	-.03	.03	-.10	-.17 [*]	-.05	-.08	-.03	.10	.00	.00
Hispanic/Asian v. other × CESD	.10	.20 [*]	-.10	-.05	.27 [*]	.04	.13	.06	.15	.05	-.04	.04
Hispanic/Asian v. other × STAI	.22 [*]	.26 [*]	.02	-.05	.19	.10	.09	.16	.01	-.02	-.07	-.04

^a N_s ranged from 151 to 179. All models controlled for lower-order terms as well as gender, temperament, and 6-month sleep problems.

^b Concurrent model at 6 months and longitudinal model include the 6-month PSI; 12-month concurrent model includes the 12-month PSI.

^c Standardized regression coefficients.

^{*} $p < .05$