Published in final edited form as:

J Appl Dev Psychol. 2007 December ; 28(5-6): 493–498.

Night Waking in 6-Month-Old Infants and Maternal Depressive Symptoms

Katherine Hildebrandt Karraker and Marion Young

West Virginia University

Abstract

Relations between night waking in infants and depressive symptoms in their mothers at 6 months postpartum were examined using the data from the National Institute for Child Health and Human Development Study of Early Child Care. Although more depressive symptoms were only weakly correlated with a higher frequency of infant waking, longer wake times, and more total time awake, the rate of clinically significant depression scores was about double in mothers of chronically waking infants in comparison with mothers whose infants did not awaken during the night. The value of comparing subgroups to elucidate relations identified through correlations is discussed.

Keywords

Infant sleep; Night waking; Maternal depression; Sleep deprivation

1. Introduction

One of the many challenges mothers face in caring for a young infant is coping with the sleep fragmentation and deprivation caused by infant night waking. Nearly all infants awaken regularly for feeding during their early weeks and months because of their need for nutrition. By 3 to 4 months, however, the majority of infants no longer physiologically require nighttime feedings, yet many continue to awaken (Anders, 1994). Although many infants learn to self-soothe following an awakening, many others signal to their parents and require intervention to return to sleep.

Because mothers provide most of the nighttime care for infants, their sleep is often disrupted by their infants' night waking. Further, mothers are susceptible to depressive symptoms during the postpartum period. Because sleep deprivation is known to have deleterious effects on mood (Pilcher & Huffcutt, 1996), the sleep deprivation produced by infant night waking may contribute to postpartum depression (Ross, Murray, & Steiner, 2005). Alternately, because depressed mothers tend to provide less effective parenting than nondepressed mothers (National Institute of Child Health and Human Development Early Child Care Research Network [NICHD ECCRN], 1999), depressed mothers may engage in parenting practices that produce poorer sleep in their infants. Depressed mothers may also be more inclined to report and to be concerned by infant night waking than are nondepressed mothers. Further, infant night waking and maternal mood suppression may covary because of some shared genetic tendencies (Warren, Howe, Simmens, & Dahl, 2006).

Publisher's Disclaimer: This is a PDF file of an unedited manuscript that has been accepted for publication. As a service to our customers we are providing this early version of the manuscript. The manuscript will undergo copyediting, typesetting, and review of the resulting proof before it is published in its final citable form. Please note that during the production process errors may be discovered which could affect the content, and all legal disclaimers that apply to the journal pertain.

The purpose of the analyses reported here was to examine relations between mothers' reports of their infants' night waking and their own depressive symptoms at 6 months postpartum using the data from the National Institute for Child Health and Human Development Study of Early Child Care (NICHD SECC). This longitudinal study of more than 1000 infants and mothers was designed to examine the effects of nonparental child care on infants and children, but also included mothers' reports of infant night waking and maternal depressive symptoms at several infant ages (6, 15, and 24 months). The age of 6 months was selected for study because the rates of infant night waking and postpartum depression are both relatively high at that time.

Important to note is that this study, like most others on this topic, relies on mothers' reports of infant night waking. Comparisons of maternal reports of infant night waking with objective measures such as actigraphy or videotape recordings of sleep reveal that mothers do not perceive, and therefore do not report, all infant awakenings (Minde, Popiel, Leos, & Falkner, 1993; Sadeh, 1994; Scher & Asher, 2004). However, only those signaled awakenings that mothers perceive have the potential to influence mothers' wellbeing through the mechanisms of sleep deprivation or fragmentation.

Previous studies have observed concurrent relations between infant sleep behaviors and maternal depression (e.g., Dennis & Ross, 2005; Goodlin-Jones, Eiben, & Anders, 1997). Although the argument that infant night waking impacts maternal mood by producing sleep deprivation has intuitive appeal, Warren et al. (2006) presented findings, also based on the NICHD SECC data, that maternal depression affects infant sleep behavior, rather than the reverse, during toddlerhood. They found that maternal depressive symptoms predicted an increase in the frequency of child awakenings from 15 to 24 months, and an increase in the length of awakenings from both 15 to 24 and 24 to 36 months.

A number of changes in infant sleep behaviors take place between 6 and 15 months. Overall, the frequency of night waking declines, but some infants who previously did not wake at night begin to wake again between 9 and 12 months (Anders, 1979; Nover, Shore, Timberlake, & Greenspan, 1984; Paret, 1983). These transitions, as well as the long interval between 6 and 15 months, may account for the lack of prediction from 6 to 15 months in the Warren et al. study. To better understand these findings and previous findings of significant correlations between infant sleep and maternal depression, in the present analyses, we examined relations between infant night waking and maternal depression at 6 months in detail. Information concerning mothers' depression at 1 month also was available (although information about infant sleep was not), allowing consideration of how infant night waking relates to changes in maternal depression in the early postpartum months. The large size of the sample allowed for examination of subgroups of mothers and infants, such as mothers who met criteria for clinically significant depression, mothers whose depression levels changed between 1 and 6 months, and infants who chronically or rarely awakened at night.

2. Method

2.1. Participants and Procedure

The analyses reported here were conducted with data from the NICHD SECC. Details concerning participant recruitment and assessment are available elsewhere (NICHD ECCRN, 2001). In sum, an ethnically and socioeconomically diverse group of 1,364 mothers and infants was recruited and enrolled in this longitudinal study by researchers at 10 study sites soon after the infants' births in 1991. The primary goal of the study was to examine the effects of child care on infants and children. To that end, information on a variety of aspects of child and family functioning was collected when the infants were 1, 6, 15, 24, and 36 months (Phase I), as well as at subsequent ages (Phases II through IV, the latter of which is ongoing). The focus of the present study was infant night waking behavior at 6 months of age. Participants who provided

complete data on infant night waking and mothers' depression at that time were included in the analyses reported here ($N = 1,275$).

2.2. Measures

2.2.1. Infant Night Waking—At the 6-month interview, mothers were asked several questions about their infants' sleep behaviors. The questions were as follows: (1) In the last week, has BABY wakened you at night? (2) On how many nights in the past week? (3) How many times each night did BABY generally wake up? (4) On average, for about how long would you say BABY was up each time BABY awakened? (5) How much of a problem has BABY's awakening been for you? Response options for the last question included 1 = not much of a problem, 2 = somewhat of a problem and 3 = quite a bit of a problem.

Answers to the first four questions were used to derive three continuous variables designed to characterize the night waking behavior of each infant. Infants whose mothers reported that they did not awaken at night during the past week were assigned values of zero for these variables. The first variable was the total number of times the infant awakened (frequency of waking) during the week, and was calculated by multiplying the number of nights the infant awakened by the number of times the infant usually awakened each night. From the mother's perspective, this variable can be construed as an indicator of her sleep fragmentation. The second variable was the average length of time the infant stayed awake each time the infant awakened (length of waking). From the mother's perspective, this variable indicates the time and effort expended getting the infant back to sleep following an awakening. The third variable was the total amount of time the infant was awake during the week (total time awake). This variable was calculated by multiplying the frequency of waking by the length of waking and can be considered a measure of the mother's sleep deprivation.

Some of the analyses reported below are based on comparisons of extreme groups. Infants who did not awaken their mothers during the previous week were compared with infants who met the criteria for a sleep problem according to Richman (1981). These infants awakened five or more nights per week and either awakened three or more times per night or stayed awake on average more than 20 minutes. These infants are labeled "chronic wakers" rather than referring to a sleep "problem," as mothers varied in the extent to which they considered their infants' sleep behavior to be a problem.

2.2.2. Maternal Depressive Symptoms—Mothers completed the Center for Epidemiological Studies Depression Scale (CES-D) (Radloff, 1977). This scale is frequently used as a measure of depressive symptoms in nonclinical populations. The scale consists of 20 items, each scored from 0 to 3, and thus the possible range of scores is 0–60. Scores of 16 and above are considered to be clinically significant, although a diagnosis of clinical depression requires further evaluation. For the purposes of this report, some analyses are reported using mothers' scores on this assessment (a continuous variable indicating the extent of depressive symptoms), whereas others divide mothers into "nondepressed" (scores <16) and "depressed" (≥ 16) groups. In addition, scores from an administration of this scale to mothers when their infants were 1 month old are used in some analyses.

3. Results

3.1. Descriptive Information

Mothers reported that of the 1,275 infants included in these analyses, 378 (30%) did not awaken them during the previous week, whereas 897 (70%) did. Within the group of waking infants, 28% of the mothers reported that their infant's awakening was either somewhat or quite a bit of a problem for them. The modal number of nights the waking infants awakened was 7, and

the modal number of times they awakened each night was 1. The mean number of weekly awakenings was 7.05 ($SD = 6.53$, range 0–49), and the mean length of each awakening for the waking infants was 22.86 minutes ($SD = 30.79$, range 1–300). On the basis of Richman's (1981) criteria, 138 infants (11% of the total) were identified as chronic wakers. These infants awakened an average of 15.67 times per week ($SD = 8.87$), with an average length of awakening of 32.82 minutes ($SD = 32.15$). Fifty-eight percent of the mothers of these infants reported that their infant's awakening was either somewhat or quite a bit of a problem for them.

The mean CES-D score for the mothers at 6 months was 8.98 ($SD = 8.35$, range 0–52), and at 1 month was 11.24 ($SD = 9.02$, range 0–53). The 6- and 1-month CES-D scores were significantly correlated, $r(1273) = .52$, $p < .001$. At 6 months, 223 mothers (18%) were categorized as depressed; at 1 month, 319 mothers (25%) were categorized as depressed.

3.2. Relations Between 6-Month-Old Infants' Night Waking and Concurrent Maternal Depressive Symptoms

All three night waking measures were found to be significantly correlated with CES-D scores, with more depressive symptoms associated with a higher frequency of waking, $r(1273) = .11$, $p < .01$; longer wake times, $r(1273) = .08$, $p < .01$; and more total time awake, $r(1273) = .16$, $p < .01$. Although statistically significant, these correlations were quite low and accounted for very little variance (r^2 less than 3% in each case). Additional analyses were conducted to determine the strength of the relationship between night waking and maternal depressive symptoms in extreme groups of infants (see Table 1). The rate of clinically significant CES-D scores in mothers of chronic wakers (29%) was about double that of mothers whose infants did not awaken during the night (15%), $\chi^2(1, N = 516) = 12.81$, $p < .01$, odds ratio = 2.30, $CI_{.95} = 1.45, 3.65$.

Change or stability in mothers' depression category from 1 to 6 months also was considered. In the entire group of mothers, 865 mothers remained in the nondepressed category, 91 changed from the nondepressed category to the depressed category, 132 remained in the depressed category, and 187 changed from the depressed category to the nondepressed category from 1 to 6 months. Table 1 provides the counts for mothers with nonwaking and chronically waking infants only. Mothers who changed from nondepressed to depressed were of particular interest because of the possibility that sleep deprivation or fragmentation caused by infant night waking contributed to mothers' depressive symptoms. Among mothers who were nondepressed at 1 month, clinically significant CES-D scores at 6 months were more frequent in mothers of chronic wakers (18%) than nonwakers (7%), $\chi^2(1, N = 378) = 9.55$, $p < .01$, odds ratio = 2.86, $CI_{.95} = 1.44, 5.70$. Among mothers who were depressed at 1 month, clinically significant CES-D scores were equally likely among mothers of chronic wakers (50%) and nonwakers (39%), $\chi^2(1, N = 138) = 1.48$, $p > .05$.

Hierarchical multiple regression was used to determine if maternal depressive symptoms at 6 months were more strongly associated with sleep fragmentation (indicated by the frequency of waking), time and effort expended getting the infant back to sleep (length of waking), or sleep deprivation (total time the infant spent awake), and to determine if mothers' depressive symptoms were associated with the extent to which they perceived their infants' waking as a problem. In the first analysis, all mothers were included. CESD scores at 1 month were entered in the first step, and the sleep variables were entered simultaneously in the second step. The overall equation was significant, $R = .53$ ($N = 1275$, $p < .01$). Both 1-month CES-D scores, $\beta = .51$, and total wake time, $\beta = .10$, significantly contributed to the equation, $ps < .01$, whereas frequency of waking and length of waking did not. Although the R^2 change was significant for both steps of the analysis, the R^2 change for the sleep variables was only .013, indicating that only about 1% of the variance in depression scores was accounted for by the sleep variables beyond the effect of 1-month depression scores.

This analysis was then repeated with just the mothers whose infants awakened at all, with the mother's rating of the extent to which her infant's waking was a problem for her entered in the last step of the analysis. Again, the overall equation was significant, $R = .53$ ($N = 896$, $p < .01$). Significant contributors were 1-month CES-D scores, $\beta = .49$, total wake time, $\beta = .10$, and mothers' problem ratings, $\beta = .07$. The R^2 change for each step of the analysis indicated that the sleep variables accounted for 1.6% of the variance beyond the effect of 1-month depression scores, and mothers' problem ratings accounted for an additional .4% of the variance.

4. Discussion

These analyses reiterate the frequently reported positive association between infant night waking and maternal depressive symptoms (e.g., Dennis & Ross, 2005; Goodlin-Jones et al., 1997; Hiscock & Wake, 2001; Zuckerman, Stevenson, & Bailey, 1986). The correlations between night waking and depression were quite low, however, suggesting that the relationship between these variables is weak, at least when considering mothers as a group. Nonetheless, analyses of selected subgroups of mothers and infants suggest that the relationship between infant sleep and maternal depression is stronger and perhaps more practically significant in some cases than in the overall sample. In particular, the approximate doubling of the risk of clinically significant depression scores for mothers of chronically waking infants in comparison with mothers of infants who did not awaken at night suggests that concurrent high levels of sleep deprivation resulting from infant night waking may increase the risk of clinical depression for some mothers. Further suggestive evidence that infant night waking may contribute to depression in some mothers was provided by the finding that mothers who were not depressed at 1 month were about two and a half times more likely to be depressed at 6 months if their infant was a chronic waker than if their infant did not awaken at night.

The results of this study, in combination with findings from other studies, suggest a complex, transactional model of the relations between infant night waking and maternal postpartum depression (see also Sadeh & Anders, 1993). This model incorporates both the assumption that chronic infant night waking is linked with contemporaneous increases in depressive symptoms in some mothers due to sleep deprivation and the assumption that maternal depression, regardless of its source, can lead to increases over time in night waking in some infants as a result of ineffective parenting practices. These processes may operate simultaneously, with a tired and depressed mother of a wakeful infant engaging in parenting behaviors that prolong or increase the night waking, thus leading to increased exhaustion and depression, and so on.

Experimental studies of sleep deprivation (see review by Pilcher & Huffcutt, 1996) support the contention that decrements in mood can result from both sleep loss and sleep fragmentation. Further support for the argument that infant night waking can contribute to maternal depression through the mechanism of sleep deprivation comes from findings that interventions that reduce infant night waking also improve mothers' moods (Armstrong, Van Haeringen, Dadds, & Cash, 1998; Hiscock & Wake, 2001). Consistent with this model, most studies that report a relationship between infant night waking and maternal depression examine either concurrent or very recent infant night waking (Dennis & Ross, 2005; Goodlin-Jones et al., 1997; Hiscock & Wake, 2001; Zuckerman et al., 1986).

The complementary argument that maternal depression causes increases in infant night waking comes from longitudinal studies that have examined the relationship between these variables across several months or years (Warren et al., 2006; Zuckerman et al., 1986). The proposed mechanism for this causal relationship is that maternal depression leads mothers to engage in parenting behaviors that are likely to produce or maintain infant night waking. This effect of

depression on night waking likely develops over time, and is thus more likely to be evident in analyses that cover extended periods.

The NICHD SECC was not explicitly designed to study infant night waking or maternal depression. The choices of measures and time intervals therefore restrict the types of questions about infant sleep and maternal depression that can be asked. However, certain advantages of secondary data analysis also are illustrated by the analyses presented here. Although the very large sample size produces statistical significance even for very low correlations, it also allows selection of specific subgroups of participants for analysis. The large sample size, multiple variables, and longitudinal design of the NICHD SECC have encouraged many authors to use complex analytic strategies and to study developmental processes in ways that are not possible with smaller samples and less complex studies (e.g., Warren et al., 2006). The findings described here illustrate how relatively simple analyses and comparisons can also be used to address targeted questions and to assess the parameters of relations among variables.

The results of the analyses reported here confirm that by 6 months, some infants have developed a pattern of frequent and prolonged night waking. Mothers of these infants appear to be at increased risk of clinically significant levels of depressive symptoms. Educating mothers about how to encourage infant nighttime sleep and how to deal with the sleep deprivation that can result from infant night waking (such as through good time management and brief naps [e.g., Cottrell & Karraker, 2002]) may alleviate potentially deleterious effects on parental and infant functioning and prevent the development of long-term mental health problems.

Author Note

Katherine Hildebrandt Karraker, Marion Young, Department of Psychology, West Virginia University.

This study was conducted by the NICHD Early Child Care Research Network supported by NICHD through a cooperative agreement that calls for scientific collaboration between the grantees and the NICHD staff.

Correspondence concerning this article should be addressed to Katherine Karraker, Department of Psychology, West Virginia University, P.O. Box 6040, Morgantown, West Virginia 26506-6040. E-mail: kkarrake@mail.wvu.edu.

References

- Anders T. Night-waking in infants during the first year of life. *Pediatrics* 1979;63:860–864. [PubMed: 450522]
- Anders T. Infant sleep, nighttime relations, and attachment. *Psychiatry* 1994;57:11–21. [PubMed: 8190824]
- Armstrong KL, Van Haeringen AR, Dadds MR, Cash R. Sleep deprivation or postnatal depression in later infancy: Separating the chicken from the egg. *Journal of Paediatrics and Child Health* 1998;34:260–262. [PubMed: 9633974]
- Cottrell LE, Karraker KH. Correlates of nap taking in mothers of young infants. *Journal of Sleep Research* 2002;11:209–212. [PubMed: 12220316]
- Dennis CL, Ross L. Relationships among infant sleep patterns, maternal fatigue, and development of depressive symptomatology. *Birth* 2005;32:187–193. [PubMed: 16128972]
- Goodlin-Jones B, Eiben L, Anders T. Maternal well-being and sleep-wake behaviors in infants: an intervention using maternal odor. *Infant Mental Health Journal* 1997;18:378–393.
- Hiscock H, Wake M. Infant sleep problems and postnatal depression: A community-based study. *Pediatrics* 2001;107:1317–1322. [PubMed: 11389250]
- Minde K, Popiel K, Leos N, Falkner S. The evaluation and treatment of sleep disturbances in young children. *Journal of Child Psychology and Psychiatry* 1993;34:521–533. [PubMed: 8509492]
- National Institute of Child Health and Human Development Early Child Care Research Network. Chronicity of maternal depressive symptoms, maternal sensitivity, and child functioning at 36 months. *Developmental Psychology* 1999;35:1297–1310. [PubMed: 10493655]

- National Institute of Child Health and Human Development Early Child Care Research Network. Nonmaternal care and family factors in early development: An overview of the NICHD Study of Early Child Care. *Journal of Applied Developmental Psychology* 2001;22:457–492.
- Nover A, Shore M, Timberlake E, Greenspan S. The relation of maternal perception and maternal behavior: a study of normal mothers and their infants. *American Journal of Orthopsychiatry* 1984;54:210–223. [PubMed: 6731589]
- Paret, I. Night waking and its relation to mother-infant interaction in 9-month-olds. In: Call, J.; Glanason, E.; Tyson, R., editors. *Frontiers of infant psychiatry*. New York: Basic Books; 1983. p. 171-177.
- Pilcher JJ, Huffcutt AJ. Effects of sleep deprivation on performance: A meta-analysis. *Sleep: Journal of Sleep Research & Sleep Medicine* 1996;19:318–326.
- Radloff LS. The CES-D scale: A self-report depression scale for research in the general population. *Applied Psychological Measurement* 1977;1:385–401.
- Richman N. A community survey of characteristics of one- to two-year-olds with sleep disruptions. *Journal of the American Academy of Child and Adolescent Psychiatry* 1981;20:281–291.
- Ross LE, Murray BJ, Steiner M. Sleep and perinatal mood disorders: A critical review. *Journal of Psychiatry and Neuroscience* 2005;30:247–256. [PubMed: 16049568]
- Sadeh A. Assessment of intervention for infant night waking: Parental reports and activity-based home monitoring. *Journal of Consulting and Clinical Psychology* 1994;62:63–68. [PubMed: 8034831]
- Sadeh A, Anders TF. Infant sleep problems: Origins, assessment, interventions. *Infant Mental Health Journal* 1993;14:17–34.
- Scher A, Asher R. Is attachment security related to sleep–wake regulation? Mothers' reports and objective sleep recordings. *Infant Behavior & Development* 2004;27:288–302.
- Warren SL, Howe G, Simmens SJ, Dahl RE. Maternal depressive symptoms and child sleep: Models of mutual influence over time. *Development and Psychopathology* 2006;18:1–16. [PubMed: 16478549]
- Zuckerman B, Stevenson J, Bailey V. Sleep problems in early childhood: Continuities, predictive factors, and behavioral correlates. *Pediatrics* 1986;80:664–671. [PubMed: 3670967]

Table 1

Incidence of Clinically Significant Center for Epidemiologic Studies Depression Scale (CES-D) Scores in Mothers of Nonwaking and Chronically Waking Infants

1-month CES-D category	6-month CES-D category	Nonwaking infants	Chronically waking infants
	Nondepressed	321 (85%)	98 (71%)
	Depressed	57 (15%)	40 (29%)
Nondepressed	Nondepressed	265 (93%)	75 (82%)
Nondepressed	Depressed	21 (7%)	17 (18%)
Depressed	Nondepressed	56 (61%)	23 (50%)
Depressed	Depressed	36 (39%)	23 (50%)

Note. Reported percentages were calculated separately for mothers of nonwaking and chronically waking infants within each panel.