

RESEARCH ARTICLE

Longitudinal changes in term and preterm infant night wakings: The role of caregiver anxious-depression

Michelle Lobermeier¹  | Amanda Hicks¹ | Angela D. Staples¹ |
 Alissa C. Huth-Bocks² | Seth Warschausky⁴ | H. Gerry Taylor^{2,3} |
 Angela Lukomski¹ | Judi Brooks¹ | Renée Lajiness-O'Neill^{1,4}

¹Eastern Michigan University, Ypsilanti, Michigan, USA

²Case Western Reserve University/ University Hospitals, Cleveland, Ohio, USA

³Nationwide Children's Hospital, Columbus, Ohio, USA

⁴University of Michigan, Ann Arbor, Michigan, USA

Correspondence

Michelle Lobermeier, Eastern Michigan University, Ypsilanti, 48197 Michigan, USA.

Email: mloberme@emich.edu

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Abstract

Changes in infant night waking during the first year of life are associated with individual (e.g., prematurity) and family (e.g., caregiver psychopathology) factors. This study examined the association between infant night waking and caregiver anxious-depressive symptoms during the first year of life in preterm and term infants. We considered between-person differences and within-person changes in caregiver anxious-depressive symptoms in relation to changes in infant night waking from 2- to 9-months. Racially (30.0% Black, 60.4% White, 9.5% multiracial/other) and socioeconomically (40.0% below median household income) diverse caregivers ($N = 445$) of full term ($n = 258$) and preterm ($n = 187$) infants were recruited from hospitals and clinics in two midwestern states. Caregivers completed measures of anxious-depression and their infant's night waking at four sampling periods (2-, 4-, 6-, and 9-months). Infant night wakings declined from 2- to 9-months. Between-person differences were observed, such that caregivers with higher average anxious-depressive symptoms or infants born full term reported more night wakings. Within-person effects of caregiver anxious-depressive symptoms were not significant. Caregiver anxious-depression is closely associated with infant night wakings. By considering a caregiver's average severity of anxious-depression, healthcare providers can more effectively plan infant sleep interventions. If caregiver anxious-depressive symptoms are ameliorated, night wakings may also decrease.

KEYWORDS

caregiver anxious-depression, infant sleep, longitudinal design, night wakings

1 | INTRODUCTION

During the first year of life, infants' sleep patterns undergo major changes. Before newborns have an established circadian rhythm, they sleep in seemingly random intervals of 2–3 h, which are largely dependent on their feeding schedule (Galbally et al., 2013). As infants develop, they

begin to establish a circadian rhythm and their nutritional needs change, at which time they can be expected to wake less during the night (Ball, 2003). While many children experience the expected decline in night wakings during the first year of life, up to one-quarter of children struggle to achieve sleep that is well-regulated (Sadeh et al., 2009). Therefore, identifying infants who are experiencing

Key Findings

1. When using a brief one-question screener of infant sleep similar to those used in pediatric primary care, caregivers who reported more anxious-depressive symptoms were also likely to report that their infants experienced more night wakings.
2. Since symptoms of caregiver anxious-depression and problems with infant night wakings co-occur, if one is reported as a concern, healthcare providers may find it beneficial to screen for the other in order to target intervention.
3. This study highlights the importance of screening both infant and caregiver functioning during well-child visits regardless of socioeconomic background or prior diagnosis of caregiver psychopathology.

Statement of Relevance

Understanding the association between infant night wakings and caregiver anxious-depression can inform the screening and intervention efforts of infant and early childhood mental health providers. Irrespective of infant term status, sociodemographic characteristics, and prior depression diagnosis, more caregiver anxious-depression co-occurred with more frequent infant night wakings. By working toward a more nuanced understanding of how infant night wakings and caregiver anxious-depression are intertwined, early interventions can be implemented before infant sleep problems become a chronic issue that may be more difficult to modify.

sleep difficulties and implementing an early intervention is crucial, as research shows that sleep in infancy impacts other areas of functioning such as cognitive and attentional abilities as well as social-emotional and behavioral development (Lobermeier et al., 2022; Mindell et al., 2017; Sadeh et al., 2015).

Assessing infant sleep patterns and screening for sleep difficulties is often done by pediatric primary care providers. Screening at well-child visits typically consists of gathering information via parental report, often by ask-

ing only one question about how the infant is sleeping (Honaker & Meltzer, 2016). Though screening with a single item does not capture a comprehensive picture of the infant's sleep, it is common practice to use this information to draw conclusions about which infants are experiencing difficulties and may benefit from intervention. Therefore, it is important to understand factors associated with poor infant sleep as reported on single-item screenings in order to guide the practice of primary care providers.

Infants are inextricably embedded in their family context and dependent upon their caregivers; therefore, it is important to consider family factors that may play a role in an infant's sleep development and parental reporting of infant sleep. Caregiver depression is one such factor for which an association with infant sleep has been demonstrated, such that higher levels of caregiver depressive symptoms are correlated with increased infant night wakings and overall sleep problems (Armitage et al., 2009; Hiscock et al., 2007; Karraker & Young, 2007). Despite considerable research demonstrating the association between caregiver depressive symptoms and infant sleep, our knowledge about the relation between these constructs is limited because research has been either cross-sectional or has not considered both constructs at all measurement periods.

Some evidence suggests that caregiver depression plays a role in the development or maintenance of infant sleep problems, such that caregiver depressive symptoms at an earlier time period predict infant sleep difficulties at a later time. For instance, Gress-Smith and colleagues (2012) reported that infant night wakings at 9 months were predicted by caregiver depression at 5 months. The severity and chronicity of caregiver depressive symptoms are also important, as Pinheiro and colleagues (2011) found that infants had a higher risk of sleep problems if their mothers had severe and/or chronic depression compared to infants whose mothers had mild and/or transient depression or no depressive symptoms. Other research, however, suggests that the reverse may also be true, and poor infant sleep may lead to increased caregiver depressive symptoms. In one study, Karraker & Young (2007) examined symptoms of caregiver depression and infant night wakings at 1 month and 6 months postpartum. Their results suggest that mothers who were not experiencing depression at 1 month postpartum were two times as likely to experience clinically significant depression at 6 months postpartum if their infant experienced chronic signaled night wakings, which are wakings in which the infant signals distress and typically require caregiver intervention to return to sleep.

Previous research leaves many unanswered questions about the relationship between caregiver depressive symptoms and infant sleep, and often does not examine how the

association between these variables changes over time. It is also of note that depression and anxiety are highly comorbid in the postnatal period (Nagata et al., 2000; Prenoveau et al., 2017; Ross & McLean, 2006) with studies showing anywhere from 30% to 50% comorbidity in the first months after giving birth. Comorbid anxiety and depression, often termed anxious-depression, is usually associated with higher severity of symptoms that are more difficult to treat (Miller et al., 2006). As a result, individuals with anxious-depression often experience poorer outcomes compared to individuals who experience major depression without comorbid anxiety (Pollack, 2005). Therefore, consideration of comorbid anxious and depressive symptoms may enhance our understanding of caregiver psychological distress in the postnatal period and infant adjustment.

Between-person processes are often used to examine how caregiver depressive symptoms and infant sleep are related, but can lead to assumptions that the relation between variables functions the same within individuals. Within-person processes must also be explored to gain an understanding of how the relationship between changes in both caregiver depressive symptoms and infant sleep fluctuates over time for each caregiver-infant dyad. When between-person associations are attributed to within-person relations, researchers risk committing an ecological fallacy (Curran & Bauer, 2011). Therefore, it is important to determine whether within-person fluctuations in depressive symptoms impact infant sleep in a similar manner as between-person differences in symptoms. This is an especially crucial distinction for primary care providers, who care for the caregiver-infant dyads throughout a child's development and must consider not only the baseline association between caregiver depressive symptoms and infant sleep, but also the trajectory of these constructs over time.

1.1 | Current study

To our knowledge, this is only the second study to use a prospective, longitudinal design to examine change in both infant sleep and caregiver symptoms of anxious-depression from 2 to 9 months postpartum. Tikotzky and colleagues (2021) found that change in maternal depression from 3- to 18-months was unrelated to change in infant night wakings over the same time period. Our study differs in a number of ways, primarily in that we considered both *between*-person differences as well as *within*-person changes in the relationship between caregiver anxious-depressive symptoms and infant night wakings. Consistent with prior research (cf. France et al., 2020), infant night wakings were examined as an indicator of poorly regulated

infant sleep, as these infants may have shorter periods of sleep and be unable to self-soothe after waking without the help of a parent. Because data were gathered via parent report, the night wakings reported in the current study are, by necessity, signaled night wakings that the parent heard or was aware of throughout the night. This is in contrast to other methods of assessing infant sleep, such as video-somnography, that can capture night wakings when the infant does not make sufficient noise to awaken a caregiver and soothes themselves back to sleep.

The current study extends prior research, which has largely been conducted with homogeneous low-risk samples, by examining data from a racially and socioeconomically diverse sample of caregivers. Prior research has suggested that younger caregiver age as well as lower socioeconomic status (SES), including low caregiver education and household income, is associated with more infant night wakings (Barazzetta & Ghislandi, 2017; Grimes et al., 2019) and with increased risk for postpartum depression (Goyal et al., 2010; Mayberry et al., 2007). Therefore, the current study included caregiver age and SES as covariates. Given past findings that the frequency of infant night wakings may be higher in males, infant biological sex was also included as a covariate (Anuntaseree et al., 2008). Though little research has focused on racial differences in infant night wakings, prior studies have suggested racial differences in other sleep-wake behaviors, such as sleep duration (Dias & Figueiredo, 2020; Yu et al., 2021). Therefore, we included caregivers' race as a covariate. Similarly, previous research has suggested that infants born premature have longer sleep duration than their full-term counterparts (Guyer et al., 2015; Luijk et al., 2019), but research exploring differences in night wakings by gestational age shows conflicting results. Some studies suggest that gestational age does not affect night wakings, while other research indicates that preterm infants may wake more (Luijk et al., 2019). Given these potential differences, infant gestational age was included as another covariate. Furthermore, depression has a high rate of recurrence, indicating that individuals who have experienced one depressive episode are likely to experience additional depressive episodes in their lifetime (Burcusa & Iacono, 2007). Because depression is highly recurrent, caregiver history of depression was included as a covariate.

We hypothesized that caregivers who reported more anxious-depressive symptoms on average would also report that their infant woke more frequently at night. Additionally, we expected that within-person changes in anxious-depressive symptoms would predict changes in infant night waking, such that when a caregiver experienced an increase in anxious-depressive symptoms compared to their baseline, they would also report a concurrent increase in infant night wakings.

2 | METHOD

2.1 | Participants

Participants were recruited as part of a longitudinal, multi-site investigation aimed at developing and validating PediaTrac (Lajiness-O'Neill et al., 2018) a caregiver-report, web-based tool to monitor and track infant and toddler development. Families ($N = 554$) were included in this study if they had data for at least 2 of 4 sampling periods (2-, 4-, 6-, and 9-months). Of the 554 caregivers who were included in this study, and thus provided information about infant sleep, 537 were mothers, 12 were fathers, and 3 did not specify. Caregiver-infant dyads ($n = 318$) were enrolled in the term gestation group if the infant's gestational age was ≥ 37 weeks at birth. Exclusion criteria for this group included a birth weight of ≤ 2500 grams, history of prenatal or intrapartum complications, brain injury, neurological illness or disease (e.g., seizures), or known genetic disorders. Caregiver-infant dyads ($n = 236$) were enrolled in the preterm group if the infant's gestational age was < 37 weeks at birth. Additionally, exclusion criteria for both groups included neonatal abstinence syndrome or Down Syndrome. Participating caregivers were required to be the infant's primary caregivers and a minimum of 18 years old. Caregivers were also required to have access to a smartphone, tablet, computer, or other devices to access the internet and complete surveys. Measures were provided in English, requiring caregivers to have English-language competence to participate. Consent was obtained at the newborn sampling period and all procedures were approved by the Institutional Review Boards at all three sites where data were collected. Study methods and sample characteristics are detailed in Lajiness-O'Neill et al. (2021).

2.2 | Procedures

Data for this study are from an ongoing sample of caregivers who were enrolled at the birth of their infant and followed longitudinally for 18 months (Lajiness-O'Neill et al., 2021). Caregivers were recruited from three sites. Great importance was placed on recruiting a diverse sample of caregiver-infant dyads; therefore, sites were selected that, when combined, would result in a wide range of sociodemographic characteristics. Since caregivers recruited from the first ($n = 95$) and second ($n = 229$) sites were demographically similar except that caregivers at Site 1 were approximately 3 years older, on average, they are collectively referred to as Site 1|2 (see Table S1). There were several demographic differences between the caregivers from this combined site and those from Site 3 ($n = 230$) (see Table 1). Once enrolled, caregivers

completed the PediaTrac survey at eight time periods corresponding to well-child visits at newborn (NB), 2, 4, 6, 9, 12, 15, and 18 months. Caregivers also completed measures of the parent-child relationship and emotional well-being of the caregiver, including measures of anxious-depressive symptoms at 2, 4, 6, and 9 months.

2.3 | Measures

2.3.1 | Anxious-depressive symptoms

PediaTrac Early Relational Health (ERH) anxious-depression

PediaTrac is designed to monitor and track caregiver-reported infant and toddler development in the domains of sleep, feeding/elimination, sensorimotor, social/communication/cognition, early relational health, and social/sensory information processing (Lajiness-O'Neill et al., 2018; 2021). Responses on the PediaTrac ERH anxious-depression scale were on a 5-point ordinal scale from "never" (0) to "always" (4). The anxious-depression average score includes six items, administered at all sampling periods, about having felt "down", "blue," or "sad" and "anxious or keyed up" over the last month. These items showed longitudinal factorial invariance with equality constraints on correlated lagged residuals, factor loadings, and item means at all sampling periods, RMSEA = .037 (90% C.I. [.034, .040]), CFI = .962, TLI = .955.

History of depression

In the PediaTrac general medical domain, caregivers indicated whether they had a history of diagnosed depression by answering "yes" or "no" to a single item.

2.3.2 | Infant sleep

PediaTrac

For the current study, information on night waking was obtained from one item in the PediaTrac sleep domain: "On a typical night, how many times does your child awaken?" Caregivers indicated whether their child typically awakens zero, one, two, three, four, or more than four times per night.

2.4 | Statistical analyses

Analyses were conducted with R v 4.1 (R Core Team, 2020) with the lme 4 (Bates et al., 2015) and sjPlot (Ludecke, 2018) packages. Descriptive information is provided as

TABLE 1 Demographic characteristics and statistical differences by site

	Sites 1/2 (<i>n</i> = 324)	Site 3 (<i>n</i> = 230)	
Term status			^a <i>p</i> = .07
Full term	197 (60.80%)	121 (52.61%)	
Preterm	0127 (39.20%)	109 (47.39%)	
Infant sex			^a <i>p</i> = .42
Female	159 (49.07%)	104 (45.22%)	
Male	165 (50.92%)	126 (54.78%)	
History of depression			^a <i>p</i> = .61
Yes	73	57	
No	251	173	
Maternal age <i>M</i> (<i>SD</i>)	28.35 (5.94)	32.45 (4.89)	^b <i>p</i> < .001
Educational attainment			^a <i>p</i> < .001
Some/completed high school	115	12	
Some college/trade	101	51	
College graduate	63	72	
Post-grad/professional	45	95	
Maternal race/ethnicity ^c			^a <i>p</i> < .001
Black	170	17	
Multiracial/other	31	24	
White	119	188	
Household income			^b <i>p</i> < .001
Below poverty	137	23	
Below median	43	24	
At/above median	62	59	
Above twice median	24	64	
Above \$150,000	17	49	

^aChi-square independence test.^bTwo-sample *t*-test.^cRace/ethnicity was self-identified by participants.

means, standard deviations, and bivariate Pearson correlations. Multilevel models using maximum likelihood estimation were fit to the data with a random effect for participant to account for repeated measures across sampling periods and the inclusion of a time-varying covariate. Since anxious-depression was a time varying covariate, two values were computed to separately estimate the between-person and within-person effects of anxious-depressive symptoms (Curran & Bauer, 2011). To capture an individual caregiver's average level of anxious-depressive symptoms from 2- to 9-months, we computed a between-person value. Between-person anxious-depressive symptoms were the mean anxious-depression score for each caregiver (i.e., averaged across all four sampling periods) minus the grand mean of the anxious-depression scores (i.e., an average of all anxious-depression scores). If significant, this effect indicates that infants of caregivers with more overall anxious-depressive symptoms tend to awaken more (or less) frequently than infants of caregivers with

less overall anxious-depressive symptoms. To capture an individual caregiver's change in anxious-depressive symptoms relative to their average level, we calculated a within-person value. Within-person anxious-depressive symptoms was the deviation between the mean anxious-depression score across all four sampling periods and the anxious-depression score at each sampling period. This effect indicates whether changes in the frequency of night wakings for a given infant are related to changes in their caregiver's level of anxious-depressive symptoms.

The first model tested the fixed effects of sampling period, term status, between- and within-person anxious-depressive symptoms, and history of diagnosed depression while accounting for the random effect of participants. Next, models tested whether change in night waking was moderated by term status and history of caregiver depression. Finally, demographic covariates for child biological sex, caregiver age, caregiver education, caregiver race, and household income were added to the best-fitting model.

TABLE 2 Descriptive statistics for infant night wakings and maternal depressive symptoms by sampling period and site with bivariate Pearson correlation coefficients for the whole sample

Variable	Site 1 2	Site 3	<i>p</i>	1	2	3	4	5	6	7
	<i>M</i> (<i>SD</i>)	<i>M</i> (<i>SD</i>)								
1. Night wakings 2 m	1.88 (.95)	1.99 (.99)	.40							
2. Night wakings 4 m	1.42 (.97)	1.61 (1.17)	.09	.40***						
3. Night wakings 6 m	1.40 (1.07)	1.48 (1.18)	.45	.30***	.55***					
4. Night wakings 9 m	1.32 (1.12)	1.18 (1.24)	.38	.27***	.39***	.56***				
5. ERH 2 m	.98 (.79)	1.12 (.67)	.03	.12***	.04	.02	.01			
6. ERH 4 m	1.00 (.78)	1.19 (.66)	.003	.09***	.12***	.07**	.07**	.60***		
7. ERH 6 m	.91 (.76)	1.15 (.68)	< .001	.06**	.12***	.11***	.08***	.38***	.51***	
8. ERH 9 m	1.00 (.77)	1.12 (.69)	.08	.10***	.13***	.05*	.14**	.35***	.40***	.62***

p-values are for two-sample *t*-tests of site differences for sleep and depression measured at each sampling period. All *p*-values are two-tailed.

Abbreviation: ERH, Early Relational Health Anxious-Depression mean score.

p* < .05. *p* < .01. ****p* < .001.

Model comparison was based on a log-likelihood ratio test where more complex models were retained if there was a statistically significant increase in variance explained.

3 | RESULTS

3.1 | Sample characteristics

Table 1 contains sample characteristics by site for the participants included in this study. Compared to Site 1|2, caregivers at Site 3 tended to be older, attained more education, were more likely to be White, and had a higher average household income.

3.2 | Cross-sectional results

Sites were not statistically different in the number of infant wakings (Table 2). Site 3 caregivers reported more anxious-depressive symptoms at 2-, 4-, and 6-sampling periods than Sites 1|2. In general, there was moderately strong rank order stability across sampling periods for both infant night wakings and caregiver anxious-depressive symptoms. Finally, more frequent night wakings were concurrently associated with greater anxious-depressive symptoms at 2-, 4-, and 6-month sampling periods. Additionally results examining correlations separately for Site 1|2 and Site 3 can be found in Table S2.

3.3 | Longitudinal results

Table 3 presents parameter estimates for the best fitting models predicting the number of infant night wakings from sampling period, caregiver anxious-depressive symptoms (between- and within-person effects), history of

caregiver depression, infant term status, infant biological sex, and caregiver demographics (age, education, race, and household income). Likelihood ratio tests indicated that neither history of caregiver depression [$\chi^2(1) = 1.41$, $p = .23$], nor term status [$\chi^2(1) = 1.29$, $p = .26$] significantly moderated the longitudinal change in night wakings and, therefore, were not presented in the table. Given the number of demographic differences by site, Table 3 includes parameter estimates for the biological sex and demographic covariates, though none were significant predictors nor did their inclusion improve model fit, $\chi^2(6) = 5.64$, $p = .46$.

Results indicated that night wakings declined from twice per night estimated for the newborn sampling period (Table 3 intercept) to approximately once per night by the 9-month sampling period. There were between-person differences for caregiver anxious-depressive symptoms and term status such that caregivers with higher average anxious-depressive symptoms and infants born full term reported more night wakings. The within-person effects of caregiver anxious-depressive symptoms were not significant. Thus, changes in a particular caregiver's anxious-depressive symptoms were not systematically, concurrently associated with reported night wakings for their infant. The intraclass correlation coefficient indicated that 40% of the variance in night waking was attributed to within-person differences whereas the fixed effects (i.e., marginal R^2) explained 7% of the between-person differences.

4 | DISCUSSION

Using a prospective, longitudinal design with a socio-demographically diverse sample, this study provides insight into an understudied area of caregiver emotional

TABLE 3 Parameter estimates from nested multilevel models predicting infant night wakings from maternal depressive symptoms, infant term status, and demographic covariates

Predictors	Model 1			Model 2		
	<i>b</i>	β	CI _{<i>b</i>}	<i>b</i>	β	CI _{<i>b</i>}
(Intercept)	2.09 ***	.05	1.97–2.21	1.84 ***	.01	1.40–2.28
Sampling period	–.09 ***	–.21	–.11 to –.08	–.10 ***	–.22	–.11 to –.08
Depressive Symptoms: within-person	.07	.02	–.02–.17	.08	.03	–.02–.19
Depressive Symptoms: between-person	.19 **	.11	.08–.30	.20 **	.11	.07–.32
History of depression: yes	.08	.07	–.09–.25	.10	.09	–.09–.29
Term status: preterm	–.20 **	–.17	–.34 to –.06	–.22 **	–.19	–.37 to –.06
Infant sex: male				.12	.11	–.03–.27
Maternal age (years)				.01	.05	–.01–.03
Maternal education				.04	.03	–.07–.14
Race: multiracial/other				–.03	–.02	–.31–.26
Race: White				–.01	.00	–.21–.20
Household income				–.04	–.09	–.08–.01
Random effects						
σ^2	.72			.73		
τ_{00}	.48 _{id}			.47 _{id}		
ICC	.4			.39		
<i>N</i>	552 _d			482 _{id}		
Observations	2060			1811		
Marginal <i>R</i> ² /Conditional <i>R</i> ²	.067/.438			.077/.440		

History of depression was coded as 0 = no, 1 = yes. Infant term status was coded as 0 = full term, 1 = preterm. Infant sex was coded as 0 = female, 1 = male. Maternal education ranged from 0 = some high school/high school to 3 = post-graduate/professional degree. Household income ranged from 1 = under \$10,000 to 9 = over \$150,000.

p* < .05. *p* < .01. ****p* < .001.

functioning–anxious-depression–following the birth of a child and its impact on infant night wakings. Between-person differences were found, such that caregivers who on average reported more symptoms of anxious-depression also reported that their infants generally experienced more night wakings. This is in contrast to Tikotzky et al. (2021), who found that maternal depression was unrelated to either reported or actigraphically assessed night wakings. To our knowledge, this is the first study to demonstrate that this association is unrelated to within-person change in anxious-depression symptoms and changes in infant night wakings. Furthermore, the relation between more caregiver anxious-depressive symptoms and more frequent infant night wakings was unaffected by sociodemographic factors or infant biological sex.

Findings that between-caregiver differences in anxious-depressive symptoms are associated with reports of more frequent infant night wakings may have several possible explanations. It may be that infants do truly experience more night wakings when their caregivers experience increased psychological distress. An increase in infant night wakings may be due, at least in part, to differences in emotional availability and responsiveness to infant signals that are seen in caregivers experiencing anxious-

depressive symptoms. For example, caregivers experiencing increased psychological distress have reported more infant distress at bedtime (i.e., excessive crying) and more nighttime issues (i.e., night wakings) (Goldberg et al., 2013). Caregivers who are experiencing increased distress also tend to display more negative affect toward their infants and may be less emotionally available; research indicates that when caregivers are less emotionally available at bedtime, their infants are more likely to struggle with night wakings and difficulty falling asleep (Boyd et al., 2006; Teti et al., 2010). Anxious-depressive symptoms may also influence the way caregivers respond to their infants during the night. These caregivers may be more hyper-vigilant and responsive to their infants during the night, attending to them when they move or vocalize even if they are not distressed. This increased caregiver presence during periods of wakefulness may decrease the infant’s ability to self-soothe, leading to more frequent signaled night wakings (Teti & Crosby, 2012).

While it is conceivable that infants of caregivers experiencing more anxious-depressive symptoms do truly experience more night wakings, this has not been found in studies using objective measures of infant sleep (cf. Tikotzky et al., 2021). These findings, along with prior

research, suggest that caregivers with more severe symptoms may perceive their child's night wakings differently than caregivers who are experiencing fewer symptoms. For example, the possible hypervigilance exhibited by caregivers experiencing higher levels of anxious-depressive symptoms may lead them to perceive infant night wakings as more negative and stressful, which may in turn affect their reporting of infant night wakings. This conjecture is supported by several studies demonstrating that caregivers who were experiencing more psychological distress were more likely to characterize their infants' sleep behaviors as problematic (Goldberg et al., 2013; Teti & Crosby, 2012; Tikotzky et al., 2021). Furthermore, some caregivers may report night wakings that are qualitatively different from others depending on the immediacy with which they respond to their infant during the night. If a caregiver immediately attends to slight vocalizations from their infant at night, they may count this as a 'night waking' even if the infant could have returned to sleep on their own. Conversely, if a caregiver is able to tolerate several minutes of infant signaled distress at night before intervening, they may only report 'night waking' based on times when their infant failed to soothe themselves back to sleep. The threshold for a night waking may be set at a different level for caregivers who are experiencing more anxious-depressive symptoms, which could affect their reporting. If these caregivers experience disrupted sleep due to repeated infant night wakings, they may have a further exacerbation of their symptoms of depression and anxiety (Kahn-Greene et al., 2007; Stremler et al., 2020). This reciprocal association highlights the importance of considering dyadic and family approaches within infant mental health.

Determining whether the observed differences lie in the actual number of signaled night wakings, non-signaled wakings, or in caregiver perception of night wakings would provide information about maturational changes in infant sleep. However, pediatric primary care providers will generally not have the means to distinguish between these possibilities, especially if their practice includes only one or two parent report questions about infant sleep. Instead, understanding how caregiver anxious-depression is associated with information from screener questions about infant sleep may be used to cue primary care providers to further assess these constructs. For instance, when treating a family in which the caregiver experiences consistent anxious-depressive symptoms, understanding between-person differences may prompt the provider to more thoroughly assess infant night wakings. Similarly, reports of persistent frequent night wakings may prompt a primary care provider to screen the caregiver for anxious-depressive symptoms. Understanding that these two constructs vary together, at least in the current

sample, can alert providers to the type of monitoring that is needed and the interventions that might be warranted.

Though the current findings provide valuable information about the association between caregiver anxious-depressive symptoms and infant night wakings, they must be interpreted in the context of certain limitations. While pediatric primary care providers will gather information about infant night wakings exclusively from caregiver report, a more objective measure of sleep would provide additional information. Further research comparing the current results with data obtained from actigraphy or videosomnography could provide more nuanced information about whether the number of night wakings, ability to self-soothe, or caregiver perception of infant wakings is truly what is affected by caregiver anxious-depressive symptoms. Despite the extra information that may come from an alternative method, gathering information about infant sleep via caregiver report is clinically useful, as it is standard practice during well-child visits. It is not feasible for pediatric primary care providers to use actigraphy in general clinical practice to track sleep development. Therefore, understanding the relation between caregiver anxious-depressive symptoms and infant night wakings using caregiver report is directly relevant to current pediatric practice. Second, since our study utilized a community sample, findings cannot be generalized to caregivers with clinical levels of anxious-depressive symptoms. Understanding whether similar relations are found in dyads in which the caregiver is experiencing clinically significant anxious-depressive symptoms will be an important target of future research. Furthermore, broadening the focus of this work to include additional aspects of caregiver psychological distress (e.g., traumatic stress, distress related to caregiving, relational conflict) will be critical in future research. Lastly, while the relation between caregiver anxious-depression and infant night wakings was unaffected by sociodemographic factors (e.g., race, income, caregiver age, educational attainment), the potential impact of these considerations on the caregiver-child relationship should not be overlooked in other investigations.

5 | CONCLUSIONS AND IMPLICATIONS

Despite the above limitations, our findings provide important insight into the ways in which caregiver anxious-depressive symptoms and infant night wakings are intertwined. The inclusion of a large sample of caregiver-infant dyads representing a socioeconomically diverse population allows for generalization of these findings to many different families. Identifying the association between infant night wakings and caregiver anxious-depressive symptoms in a community sample

highlights the importance of screening both caregiver and infant during well-child visits regardless of sociodemographic background or prior diagnosis of caregiver depression. By using information from the current study, healthcare providers can gather information from any caregiver about their baseline level of anxious-depressive symptoms and use this to help understand reported infant sleep difficulties. Being aware of the relation between caregiver-reported anxious-depressive symptoms and infant night wakings—irrespective of sociodemographic background—can assist providers in planning prevention and intervention strategies focused on improving infant sleep and enhancing caregiver mental health.

Further research should continue to explore the association between caregiver anxious-depressive symptoms and infant night wakings as children progress through toddlerhood and enter preschool. By working toward a more nuanced understanding of how between-person differences and individual fluctuations in caregiver anxious-depressive symptoms affect an infant's sleep development, interventions can be targeted and implemented earlier, and before infant sleep problems become a chronic issue that may be more difficult to modify. Future research could expand upon these ideas by considering whether interventions to improve infant sleep may also have a positive impact on caregiver anxious-depressive symptoms, or vice versa.

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CONFLICT OF INTEREST

The authors have no conflicts of interest to disclose.

DATA AVAILABILITY STATEMENT

Data will be made available upon request.

ORCID

Michelle Lobermeier  <https://orcid.org/0000-0002-3240-7353>

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