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Are maternal and paternal bonding problems associated with child sleep problems at 8 and 24 months?

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ABSTRACT

Both parental bonding and infant's sleep are important for healthy child psychosocial development. This study investigates how maternal and paternal bonding with their infant is associated with child sleep problems at the ages of 8 and 24 months. The data is based on a representative birth cohort. The independent variables assessed were maternal (N = 1299) and paternal (N = 1211) bonding at 8 months, using the Postpartum Bonding Questionnaire (PBQ). Infant sleep problems were measured using the Infant Sleep Questionnaire (ISQ) at 8 months (N = 1301) and at 24 months of age (N = 950). Numerous covariates, measured either prenatally or postnatally at the 3, 8, or 24-month time points, were included in the analyses. Using linear regression analyses, we found that maternal bonding problems at 8 months were associated with child sleep problems at the age of 8 and 24 months. Furthermore, maternal bonding problems at 8 months mediated the effects of maternal depression at both timepoints. In contrast, paternal postnatal bonding problems at 8 months were not associated with infant sleep problems at either time point. Our findings highlight the role of the primary caregiver in infant sleep problems. Accordingly, it is vital to screen for and provide early support for both infant sleep problems and parent-infant relationship difficulties, as these two are highly interconnected and one may pose reciprocal risks.

1. Introduction

Young children often experience various sleep difficulties, such as trouble falling asleep and night awakenings, which are often accompanied by a need for parental assistance in falling back asleep (Morrell, 1999). In addition, young children often show sleep

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association insomnia, which indicates both the tendency to wake up at night and the child's inability to fall asleep independently. It is the most common form of insomnia in infants aged 8–24 months.

This study investigates how maternal and paternal bonding with their infant is associated with child sleep problems at the ages of 8 and 24 months. Bonding refers to the parent's affective-behavioural state towards the infant (Kinsey and Hupcey, 2013). At the behavioural level, it entails the ways parents look at, touch, and take care for their infant (Kinsey and Hupcey, 2013). According to Condon and Corkindale (Condon and Corkindale, 1998), the affective side of parental bonding refers to the parent's affection for the child, manifesting as a desire for close interaction and provision of care and support. This also includes willingness to protect the child from harm, pain, and discomfort. Additionally, parents with strong affective bond can be more patient towards the child and may strive to understand the child's inner world. While maternal affective bond towards the infant, which starts to gradually develop during pregnancy, is already widely understood (Rusanen et al., 2018; 2021), also fathers are assumed to develop a comparable affective-behavioural state towards the infant.

Both parental bonding and infant's sleep are important for a child's healthy psychosocial development (Alhusen et al., 2013; Le Bas et al., 2020; Le Bas et al., 2021; Pudasainee-Kapri et al., 2025; Rusanen et al., 2024). Previous research has shown that environmental factors (e.g., bed-time interaction), along with developmental, maturational, and biological factors (e.g., circadian rhythm of sleep), are important for the development of infant's sleep (Sadeh et al., 2010). To date, studies are almost completely lacking on the interrelations between parental bonding and infant sleep problems although there are studies linking the infant's own secure attachment to a parent to their better sleep quality (Perpétuo et al., 2021).

Only a handful of studies have examined the association between maternal bonding and infant sleep. Hairston and colleagues (2016) reported that infant sleep difficulties were associated with poor maternal bonding. Similarly, Lux and colleagues (2023) showed that maternal bonding problems were associated with infant sleep problems. The developmental stage of the child can also play a significant role in the process of how parental bonding affects the infant's sleep problems. For example, according to the theory of Margaret Mahler and colleagues (1975/2002), eight months is when infants develop rudimentary consciousness of being separate from their parents, leading to separation anxiety, very often also accompanied by sleep problems. At two years, infants are developmentally undergoing a period of rapprochement (Mahler et al., 1975/2002), which may again make them more dependent on parental help and regulation, also regarding sleep. For these reasons, an 8-month-old and even a 24-month-old may have difficulties in separating from their mother, which is often the issue during bedtime. We therefore chose to examine these two age periods in relation to parental bonding. It is also noteworthy that at least in normative parents, a negative but, paradoxically, also a positive relationship between the parent and the child has been shown to be associated with the child's sleep problems. This is considered to be a result of the parent's higher tolerance for the child's night awakenings (Sadeh et al., 2010).

We could not find any research on the association between fathers' bonding and infant sleep, but Bordeleau and colleagues (2012) noted in their longitudinal study that the quality of both mothers' and fathers' interactions with their 12- to 18-month-old infants (i.e., sensitivity, autonomy support) was related to the percentage of infant night-time sleep (i.e., length of sleep) at the child age of 3–4 years. The strength and quality of parental bonding influence how parents interpret and respond to their infant's signals (Perpétuo et al., 2021). However, according to a systematic review, mothers and fathers have been found to respond differently to these signals, fathers being less attuned to infant distress or having a higher tolerance for it (Ragni et al., 2020). Parental bed-time behaviours – both mothers' and fathers' – can also be relevant in the development of child's sleep problems (Philbrook and Teti, 2016; Ragni et al., 2020). For example, Schlarb and colleagues (2020) found that parents of children with sleep problems use more physical comfort techniques with their children, while parents of well-sleeping children encourage them to be more autonomous in falling asleep. Finally, several other studies show indirect support for the role of fathers in infant sleep. The father's greater involvement in the infant's day- and night-time care was associated with fewer night awakenings, more consolidated infant sleep at 6 months (Tikotzky et al., 2010; Tikotzky et al., 2015; Ragni et al., 2020), and less difficulties in falling asleep at 8–12 months (Ragni et al., 2020). Another study found that the father's involvement in childcare can protect parents with child sleep problems from stress (Millikovsky-Ayalon et al., 2014). It is thus important to include paternal bonding as part of infant sleep research. For developmental reasons, distinct types of child sleep problems can be related to parental bonding in different ways. For a young child, falling asleep indicates the threat of being separated from parents or other primary caregivers (Bowlby, 1969). It is thus possible that specifically this type of sleep problem may be the most related to parental bonding issues, as compared with other sleep problems (i.e., night awakenings or sleep association disturbance).

In addition to bonding, the role of parental depression may also be vital. Some studies indicate that infant sleep problems are associated with mother-infant bonding problems only when the mother is depressed (Hairston et al., 2016; Sadeh et al., 2010), while others indicate mediating mechanisms between maternal mental health, bonding, and infant sleep problems. Lux and colleagues (2023) showed that maternal bonding mediated the effects of maternal depression on infant sleep problems. However, not all studies have found significant linkages between maternal depression and child sleep problems, possibly due to differences in samples (i.e., clinical vs. normative), the timing of depression measurements (i.e., pre- or postnatal), or the age of the children (Sadeh et al., 2010). It is therefore important to consider the role of parental depression when examining the link between bonding and infant sleep problems also in a cohort of normative mothers who may not display high levels of depressive symptoms. Further, no previous studies have examined paternal depression, bonding, and infant sleep problems together.

It is important to note that although the association between bonding and infant sleep is likely to be bidirectional, several studies have shown that parental bonding begins to develop even before the infant is born and is influenced by several parental psychosocial factors (Canella, 2005; Rusanen et al., 2018; Vedova et al., 2008). Bonding is therefore at least partially independent of the infant's sleep, and it is thus reasonable to study, especially regarding its longitudinal relation to child sleep problems. Our study adds to the previous literature by providing new information about the importance of both maternal and paternal bonding problems to infant sleep issues while also considering depression and other psychosocial factors of both parents.

The aim of this study was to examine how maternal and paternal bonding at 8 months is associated with infant's 1) perceived sleep problems, 2) night awakenings, 3) problems falling asleep, and 4) sleep association disturbance at the infant age of 8 and 24 months. In addition, we examine whether parental bonding is differently related to the various above-mentioned sleep problems. We control for numerous covariates, such as depressive symptoms, which have not been taken into account in previous longitudinal research. Referring to previous research, our first hypothesis was that maternal bonding problems are related to more severe child sleep problems. Our second hypothesis, based on Bowlby's and Mahler's theories, was that the relation of the maternal bonding problems to the infant's problems falling asleep are more obvious than to night awakenings. Regarding fathers, due to insufficient research, we did not make any hypotheses.

2. Methods

2.1. Participants and procedure

This study is based on a nationally representative birth cohort (Paavonen et al., 2017), which is a longitudinal study to follow children's sleep and development. The sample was collected systematically during 2011–2013, when all maternity clinics (N = 63) in Pirkanmaa Hospital District, southern Finland, belonged to the target study population. The first questionnaires were filled in during pregnancy (gestational week 32) and then at child ages of 3, 8, 18, and 24 months and again at 5 and 10 years. In our study, the dependent variables (infant sleep problems) were assessed at 8 and 24 months postnatal time points, and the independent variables (maternal and paternal bonding) were assessed at the 8-month postnatal time point. Numerous covariates were assessed at prenatal, 3-month, 8-month, or 24-month time points.

The parents were recruited from participating maternity clinics during their normal pregnancy follow-up visits. All Finnish-speaking families were eligible for the study. If the family agreed to participate, they gave informed consent and answered the first set of questionnaires. Participants received no monetary compensation, and they were informed that participation was voluntary and they could discontinue their participation at any time. The study protocol was approved by the Ethics Committee of the Pirkanmaa Hospital district (R11032/9.3.2011).

There were three separate questionnaires at each time point after child's birth. One was to be filled in by the mothers and it considered the mother's wellbeing and their bond to the child, one for the fathers concerning the father's wellbeing and their bond to the child. The questionnaires administered for mothers' and fathers' were nearly identical. In addition, there was a third questionnaire that concerned the child and it comprised questions related to child's health, development and sleep. The original prenatal data comprised 1667 mothers and 1598 fathers. Of these, 1421 mothers (85 %) and 1343 fathers (84 %) returned the three-month postnatal questionnaires, 1299 mothers (78 %) and 1211 fathers (76 %) returned the eight-month postnatal questionnaires, and 1038 mothers (62 %) and 776 fathers (49 %) returned the 24-month postnatal questionnaires.

We conducted an attrition analysis concerning sleeping problems, bonding, depression, education and age for both parents. Attrition at 24 months was not related to maternal and paternal depression [mothers: $t = -.695(1267)$, $p = .487$; fathers: $t = .979(1169)$, $p = .328$] and infant's sleep problems [mothers: $t = -.639(1267)$, $p = .523$; fathers: $t = -.622(1267)$, $p = .534$] at 8 months, or parental age at baseline [attrition at 8 month mothers: $t = .689(1451)$, $p = .491$; attrition at 8 months fathers: $t = .845(283.246)$, $p = .439$, fathers at 24 months: $t = 1.892$, (1179.379), $p = .059$] with the exception that younger mothers at baseline experienced higher attrition rates at 24 months ($t = 3.870(787.754)$, $p < .001$). Even those mothers and fathers who had less bonding problems at 8 months had more attrition at 24 months [mothers: $t = 3.204(656.519)$, $p = .001$; fathers: $t = 2.247(1159)$, $p = .025$]. Attrition at 8 and 24 months was also related to maternal and paternal education so that those at 8 and 24 months with lower education level had more attrition than those with higher education level at baseline [mothers at 8 months $\chi2 = 9.596(2)$, $p = .008$, mothers at 24 months $\chi2 = 18.864(2)$, $p < .001$, fathers at 8 months $\chi2 = 13.754(2)$, $p = .001$, fathers at 24 months $\chi2 = 16.906(2)$, $p < .001$].

The infant questionnaire could be completed by either the mother or the father at 3, 8, and 24 months postpartum. At 3 months of age 1427 questionnaires were returned, at 8 months, 1301 questionnaires were returned, and at 24 months, 950 questionnaires were returned. According to parental reports, infants' questionnaires were completed by mothers (N = 889, 70.6 %), fathers (N = 12, 1.0 %) or both parents together (N = 359, 28.4 %) at 8 months and at 24 months the respective percentages were 68.7 % (N = 633), 1.0 % (N = 9) and 30.3 % (N = 280). The number of missing responses at 8 months was 41 (3.2 %) and at 24 months 28 (2.9 %). At 24 months 33 % of the families of 3 months did not return the infants questionnaires. A total of 17 children with various chronic illnesses and their parents, based on two pediatrician's evaluations, were excluded from the analyses. The chronic illnesses were for example Down syndrome, Crouzon syndrome, Hischsprung disease, hereditary blindness or several congenital heart anomalies. According to ANOVA, as well as Tukey's and Bonferroni post hoc -tests, children's sleep problems at 8 months and at 24 months did not differ depending on whether the respondent was the mother, the father, or both parents together ($p > 0.05$).

2.2. Measures

2.2.1. Child-related measurements

Child's total sleep problems (total score) at 8 and 24 months of age were measured using the *Infant Sleep Questionnaire* (ISQ, (Morrell, 1999)**)**. The questionnaire comprises 12 questions, 6 of which are used to calculate the ISQ total score. These items are related to insomnia symptoms, such as settling problems, e.g. "How many times a week do you have problems settling him/her on average?" (0 =problems less than once a week, 1 =problems one night a week….7 =problems every night of the week), night awakenings, e.g. "How many nights a week does your baby wake on average?" (0 =none or less than once a week….7 =every night of week), and the child's difficulties to calm down at nights, e.g. "If your baby wakes, how long does it take for your baby to go back to sleep on average?" (0 =less than 10 min….6 =one hour or longer). The sum of the ISQ total was calculated; the higher the ISQ total score, the more problems the child has with sleeping. The range of ISQ total score was quite broad in relation to the entire scale, which is 0–38 (Table 1b). The reliability of ISQ total score was at 8 months α= 0.56 and at 24 months α= 0.64.

Because the reliability of the ISQ total score was quite low, Principal Component Analysis was performed, extracting two factors with eigenvalues > 1 and explaining 56.65 % of the total variance. The first factor represented difficulties in staying asleep and was named **Severity of night awakenings** (range 0–11). The second factor represented difficulties in initiating sleep and was named **Problems falling asleep** (range 0–13). Sums were calculated using the natural scores of items that loaded highly on the factor to maximize the sample size. The sum of Severity of night awakenings (Factor 1) included the items "How many nights a week does your baby wake on average?" and "How many times does your baby wake each night and need resettling on average?". The sum of Problems falling asleep (Factor 2) included the items "How long does it usually take to settle your baby to sleep on average?" and "How many times a week do you have problems settling him/her on average?". We excluded two other variables due to low communality: one variable from Severity of night awakenings and one from Problems falling asleep subscales, to achieve better international consistency. By excluding the item of "How often do you end up taking your baby into your bed because he/she is upset and won't sleep?" the reliability (Cronbach's alpha) of the subscale for the Severity of night awakenings increased from 0.55 to 0.66, and by excluding the item of "If your baby wakes, how long does it take for your baby to go back to sleep on average?", the reliability of the Problems falling asleep subscale increased from 0.59 to 0.65 (Supplementary Table 1).

Sleep-association disturbance indicator was created by combining the variable of "The child's ability to fall asleep by herself" and the item of ISQ "The number of night awakenings and resettling" (ISQ5, (Morrell, 1999). The new scale was 0 =can fall asleep on their own, 1 =cannot fall asleep on their own but does not wake up more than twice per night, 2 =cannot fall asleep on their own and wakes up at least two times per night. Sleep-association insomnia indicates that the child is unable to fall asleep without a certain set of circumstances at bed-time and wakes up frequently at night to get soothed back to sleep. The child's inability to fall asleep on his/her own is a risk factor for sleep association disturbance (Schlarb et al., 2020).

2.2.2. *Parent-related measurements*

Postpartum bonding problems among parents at 8 months of infant age were measured with the *Postpartum Bonding Questionnaire* (PBQ, (Brockington et al., 2006). This scale is widely used and has good psychometric properties (Brockington et al., 2006; Wittkowski et al., 2007). It comprises 12 items and has been found to be reliable and valid (Garcia-Esteve et al., 2016; Van Bussel et al., 2010; Wittkowski et al., 2007). The questionnaire has been used less frequently to study fathers' bonding but has nevertheless been found to be useful also among fathers, as it is not considered gender-specific (Edhborg et al., 2005; Kalfon-Hakhmigari et al., 2025). Furthermore, it has been recognized as a valuable clinical instrument (Nazaré et al., 2012).

In this study, we used one of the four PBQ subscales, the general factor. This subscale indicates 'some kind of problem in the parent–infant relationship' (Brockington et al., 2006). We recoded the items as 0–5, in accordance with Brockington et al. (Brockington et al., 2006) and calculated a summary score. Higher scores indicate problems related to maternal or paternal bonding. The ranges of PBQ scores at 8 months in our study were relatively small compared with the potential range of PBQ of 0–60 (Brockington et al., 2006), indicating that our data comprised relatively few severe bonding problems (Table 1a). The reliability of summary score for mothers was α= 0.77 and for fathers α= 0.80.

Depressive symptoms were measured from both parents using the ten-item version of the *Center for Epidemiological Studies Depression Scale* (CES-D, (Irwin et al., 1999; Radloff, 1977) at 8 and 24 months of child age. The response options ranged from 0 =rarely

Table 1a
Description of parent's sample filtered by sick children.

Parental related categorical variables	Mothers			Fathers		
	N	%	Range	N	%	Range
Health of parent*						
- 0) generally healthy	1129	77.6	—	1152	83.5	—
- 1) any illness or injury	326	22.4	—	228	16.5	—
Education*						
- 1) no education or courses	87	6.1	—	141	10.3	—
- 2) vocational school or university of applied sciences	847	59.2	—	809	58.9	—
- 3) university degree	497	34.7	—	423	30.8	—
Parity*						
- 0) zero previous child	660	48.6	—	—	—	—
- 1) one previous child	463	34.1	—	—	—	—
- 2) two or more previous child	236	17.4	—	—	—	—
* measurement before infant's born						
Parental related continuous variables	**Mean**	**SD**	**Range**	**Mean**	**SD**	**Range**
Age of parent	30.74	4.51	18–48	32.63	5.21	18–57
Postpartum bonding at 8 months	3.92	3.41	0.00–42.00	4.72	4.10	0.00–36.00
Depression						
- at 8 months	5.44	4.04	0.00–26.00	4.08	3.55	0.00–27.00
- at 24 months	5.50	3.96	0.00–23.00	4.48	3.23	0.00–21.00

or not at all or less than once a week to 3 =all the time or 5–7 days per week. We calculated the total score. Higher values indicated more perceived symptoms of depression. The range of depressive symptoms was quite wide in relation to the entire scale of CES-D, which is 0–30 (Table 1a). The reliability of CESD-D for mothers and fathers at 8 months was α= 0.83 and α= 0.84 and at 24 months α= 0.82 and α= 0.77, respectively.

2.3. Statistical analyses

First, we analyzed the distributions of the variables and visually inspected the associations between explanatory and outcome variables. Then we performed correlation analysis to formally study associations between bonding, depression and infant sleep quality. We used linear regression to analyze whether parental postpartum bonding at 8 months of child age was associated with child's sleep problems at 8 and 24 months. We conducted the modelling in three stages. First, we analyzed the association between parental bonding and child total sleep problems (i.e., the ISQ total score). Second, we studied in more detail which sleep problems are related to the bonding problems by analyzing the association between parental bonding, severity of night awakenings, and problems falling asleep. Third, we analyzed the association of parental bonding with sleep association disturbance. Parental depressive symptoms, physical health, age, education, as well as parity, breast-feeding, and child's age and sex were used as covariates in all analyses. As a sensitivity analysis we replicated the modeling when the data was stratified according to depression level of the parent. Lastly, as an additional explorative analysis, we conducted mediation analyses based on the statistically significant results of the linear regression analyses. We used IBM SPSS Statistics 29 in all statistical analyses and Hayes's PROCESS macro extension, version 4.2 in SPSS in mediation analyses.

3. Results

3.1. Description of the sample

Mothers' mean age was 30.7 years and fathers' 32.6 years, which corresponds to the average age at delivery for women and men in Finland (Perinatal statistics – parturients, deliveries, and newborns 2022). Almost half of the mothers (48.6 %) were expecting their first child. About a third of mothers (34.7 %) and fathers (30.8 %) had a university degree, whereas in the Finnish general population with an age similar to that in our sample, (<47 years for mothers and <56 years for fathers), 14.83 % of women and 10.07 % of men has a university degree (Official Statistics Finland, 2013). In the sample, 47.5 % of the infants were girls and 52.5 % were boys, with 54.5 % of the infants being breastfed at 8 months (Tables 1a-1b).

Table 1b
Description of children's sample filtered by sick children.

Child related categorical variables	N	%	Range
Age of child			
- at 8 months	1273	76.4	7.73–13.10
- at 24 months	931	55.8	22.93–33.60
Sex of child (at 3 months)			
- 1) girl	698	47.5	—
- 2) boy	772	52.5	—
Breast feeding			
- 0) no breast-feeding at 8 months	687	54.4	—
- 1) breast-feeding at 8 months	575	45.6	—
Sleep-association disturbance at 8 months			
- 0) can fall asleep on their own	504	40.6	—
- 1) can not fall asleep on their own but does not wakes up more than twice per night.	278	22.4	—
- 2) can not fall asleep on their own and wakes up more than twice per night.	458	36.9	—
Sleep-association disturbance at 24 months			—
- 0) can fall asleep on their own	435	47.3	—
- 1) can not fall asleep on their own but does not wakes up more than twice per night.	387	42.1	—
- 2) can not fall asleep on their own and wakes up more than twice per night.	98	10.7	—
Child related continuous variables	**Mean**	**SD**	**Range**
Age of child at 8 months	8.86	0.39	7.73–13.10
Total sleep problems			
- at 8 months	12.04	6.24	0.00–36.00
- at 24 months	7.20	6.23	0.00–33.60
Severity of night awakenings			
- at 8 months	7.50	3.37	0.00–11.00
- at 24 months	3.46	3.27	0.00–11.00
Problems falling asleep			
- at 8 months	2.09	2.23	0.00–13.00
- at 24 months	2.52	3.06	0.00–13.00
Sleep association disturbance			
- at 8 months	0.96	0.88	0.00–2.00
- at 24 months	0.63	0.67	0.00–2.00

3.2. Maternal and paternal bonding and infant sleep problems at 8 and 24 months

Maternal and paternal bonding problems correlated with infant's sleep problems at 8 months (mothers $r = .167$, $p < .001$; fathers $r = .082$, $p = .005$) and maternal at 24 months ($r = .139$, $p < .001$). However, fathers bonding problems were not correlated with infant sleeping difficulties at 24 months ($r = .048$, $p = .172$). Moreover, both mothers' and fathers' depressiveness correlated with infant's sleep problems both at 8 and 24 months (mothers $r = .207/.187$ ($p< .001$); fathers $r=.074/.141$ ($p= .01$) at 8/24 months).

Next, we studied whether parental bonding at 8 months was associated with the child's sleep problems at the ages of 8 and 24 months, when controlling for covariates. As reported in Tables 2a-3a-b, we found that maternal postnatal bonding problems with a child at 8 months were associated with child sleep problems at the age of 8 and 24 months (ISQ total score, at 8 months: $\beta=.089$, $p = .006$; ISQ total score, at 24 months: $\beta=.090$, $p = .019$). However, paternal postnatal bonding problems at 8 months were not significantly associated with infant sleep problems at either time point (at 8 and at 24 months: ISQ total $p > 0.05$).

In further analysis, we explored which sleep problems, in particular, are related to maternal bonding problems. We found that maternal bonding problems at 8 months were significantly associated with the child's problems falling asleep ($\beta =.129$, $p < .001$) at the age of 8 months but not with severity of night awakenings. Moreover, at 24 months, maternal bonding problems were associated with both the severity of night awakenings ($\beta =.097$, $p = .013$) and the difficulties falling asleep ($\beta =.079$, $p = .042$) (Table 2a-b). Fathers' results were clearly different from those of mothers. No significant associations were found between paternal bonding problems at 8 months and severity of night awakenings (at 8 and 24 months) or difficulties falling asleep (at 8 and 24 months), or any other dimensions (Table 3a-b).

Maternal bonding problems were associated with sleep association disturbance at 24 months ($\beta =.084$, $p = .032$) but not at 8 months.

3.3. Background factors and infant sleep problems at 8 and 24 months

Several confounding factors that were included in the analysis were also significantly related to the child's sleep problems (Tables 2a-3a-b). At 8 months of age, maternal depressive symptoms and breastfeeding were related to infant total sleep problems, severity of night awakenings, problems falling asleep, and sleep association disturbance. Mother's higher education level and multiparity were related to severity of night awakenings. Multiparity was also negatively related to problems falling asleep. Finally, older children had more sleep association disturbances than younger children (Table 2a).

At 24 months of age, mother's depressive symptoms were significantly associated with total sleep problems and problems falling asleep (Table 2b). New connections also emerged at 24 months such as mother's health problems were related to child's total sleep problems and to problems falling asleep and mother's older age to sleep association disturbance. Additionally, girls had more total sleep problems and more problems falling asleep, and older children had more total sleep problems (Table 2a-b). In the sensitivity analysis, with the data stratified according to parental depression level, the results remained.

In fathers, there were fewer significant associations with child's sleep problems overall. Father's depressive symptoms were related to total sleep problems more clearly at 24 months ($p = .008$) than at 8 months ($p = .051$). Moreover, father's higher education was related to severity of night awakenings at 8 months. Breastfed infants at 8 months had more total sleep problems, more serious night awakenings, and more sleep association disturbances than infants fed other ways. Finally, older infants (at 8 months) had more sleep association disturbances than younger children and girls (at 24 months) more problems in falling asleep than boys. (Tables 3 a-b).

3.4. Mediation analysis regarding maternal depression, bonding and infant sleep

Due to the association between maternal bonding problems and depression with infant sleep issues at 8 and 24 months of age, and previous literature (Lux et al., 2023), we employed mediation analyses to explore both the indirect and direct relationships of depression through bonding on infant sleep problems. Total ($b=.31$, $p = .0000$, 95 % CI [.23,.40]) and direct ($b=.24$, $p = .0000$, 95 % [.15,.34] effects of mother's depression on infant's sleep problem were significant at 8 months. There was also indirect effect of the mother's depression at 8 months on the infant's sleep problems at 8 months through maternal bonding problems at 8 months ($b =.07$, $p = .0231$, 95 % CI [.02,.11] Fig. 1). At 24 months the total and directs effects of mother's depression on infant's sleep problem were also significant (total: $b=.26$, $p = .0000$ 95 % CI [.16,.36], direct ($b=.20$, $p = .0003$, 95 % CI [.09,.31]. Statistically significant results of indirect effect persisted from 8 to 24 months of age ($b=.06$, $p = .0223$, 95 % CI [.02,.11), (Fig. 2). The models were significant ($p = .0000$) and explained 4.8 % ($R^2=0.0481$) of variance in infant's sleep problems at 8 months and 4.2 % ($R^2=0.0418$) of variance in infant's sleep problems at 24 months.

3.5. Mediation analysis regarding breastfeeding, bonding and infant sleep

Since breastfeeding was associated with the infant's sleep problems alongside the mother's bonding issues, and a previous study has also shown breastfeeding problems to potentially impair maternal bonding (Ondrusova, 2023), we also investigated the indirect effects of breastfeeding on the infant's sleep problems at 8 months through maternal bonding problems. There was significant total ($b=3.37$, $p = .0000$, 95 % CI[2.69, 4.03]) and direct ($b=3.33$, $p = .0000$, 95 % CI [2.67, 3.99])) effects of breastfeeding on the infant's sleep problems, but no indirect effect through mother-infant bonding problems at 8 months ($b =.03$, $p = .0588$, 95 % CI [-.09,.15]), (Fig. 3). The model was significant ($p = .0000$) and explained 9.9 % ($R^2=0.0994$) of variance in infant's sleep problems at 8 months.

Table 2a
Linear regression analysis of ISQ total, severity of night wakings, problems falling asleep, and dream-association disturbance, of child at 8 months of age, with explanatory variables of the PBQ of **mother,** controlled by depression and demographics and filtered by sick children.

	ISQ total 8 months					**Severity of night awakenings**					**Problems falling asleep**					**Sleep-association disturbance** Inability fall asleep alone and night wakings				
Variables	B	S.E.	β	t	p	B	S.E.	β	t	p	B	S.E.	β	t	p	B	S.E.	β	t	p
Bonding problems of mother	.159	.058	.089	2.756	.006	.057	.032	.059	1.790	.074	.083	.022	.129	3.846	< .001	.014	.009	.053	1.562	.119
Depressed mother	.232	.049	.151	4.691	< .001	.086	.027	.104	3.160	.002	.074	.018	.134	3.991	< .001	.017	.007	.080	2.336	.020
Health problem of mother	−.086	.430	−.006	−.200	.841	.110	.237	.014	.464	.643	.033	.162	.006	.201	.840	−.003	.065	−.001	−.049	.961
Age of mother	.082	.044	.058	1.889	.059	−.006	.024	−.007	−.232	.817	.054	.016	.104	3.288	.001	.007	.007	.035	1.079	.281
High education of mother	.275	.323	.025	.851	.395	.502	.179	.086	2.814	.005	−.221	.121	−.056	−1.825	.068	−.063	.049	−.041	−1.302	.193
Multiparity	.357	.253	.042	1.414	.158	.368	.139	.082	2.640	.008	−.310	.095	−.102	−3.281	.001	−.010	.038	−.009	−.272	.786
Breastfed infant	3.348	.358	.268	9.343	< .001	1.693	.198	.253	8.567	< .001	.357	.134	.079	2.658	.008	.285	.054	.160	5.273	< .001
Sex (1 =girl, 2 =boy)	−.030	.352	−.002	−.086	.931	.310	.194	.046	1.595	.111	−.173	.132	−.039	−1.313	.190	−.040	.053	−.022	−.746	.456
Age of child	.022	.444	.001	.050	.960	−.283	.242	−.034	−1.168	.243	.004	.166	.001	.022	.983	.137	.066	.062	2.066	.039

Multicollinearity: VIF> 0.1; Tolerance < 10; Adjusted R^2= .13

Table 2b
Linear regression analysis of ISQ total, severity of night wakings, problems falling asleep, and sleep-association disturbance, of child at 24 months of age, with explanatory variables of the PBQ of **mother,** controlled by depression and demographics and filtered by sick children.

	ISQ total 24 months					**Severity of night awakenings**					**Problems falling asleep**					**Sleep-association disturbance** Inability fall asleep alone and night wakings				
Variables	B	S.E.	β	t	p	B	S.E.	β	t	p	B	S.E.	β	t	p	B	S.E.	β	t	p
Bonding problems of mother	.152	.065	.090	2.350	.019	.086	.035	.097	2.486	.013	.065	.032	.079	2.037	.042	.015	.007	.084	2.154	.032
Depressed mother	.164	.060	.104	2.734	.006	.038	.038	.046	1.191	.234	.070	.030	.090	2.340	.020	.000	.007	.001	.027	.979
Health problem of mother	1.267	.544	.084	2.329	.020	.530	.291	.067	1.823	.069	.552	.269	.075	2.050	.041	.046	.059	.029	.785	.432
Age of mother	.044	.056	.030	.779	.436	.033	.030	.043	1.099	.272	.003	.028	.004	.107	.915	.015	.006	.093	2.409	.016
High education of mother	.146	.412	.013	.355	.723	.179	.220	.031	.812	.417	.128	.203	.024	.631	.529	−.027	.045	−.023	−.599	.549
Multiparity	−.046	.315	−.005	−.146	.884	−.063	.170	−.014	−.372	.710	.077	.156	.019	.491	.624	.019	.034	.021	.546	.586
Breastfed infant	.429	.452	.035	.949	.343	−.016	.242	−.003	−.067	.946	.297	.223	.049	1.328	.185	.092	.049	.069	1.873	.062
Sex (1 =girl, 2 =boy)	−1.000	.446	−.080	−2.242	.025	−.246	.239	−.038	−1.027	.305	−.609	.220	−.100	−2.764	.006	.003	.048	.002	.052	.959
Age of child	2.058	.742	.100	2.774	.006	.706	.395	.066	1.788	.074	.679	.366	.067	1.853	.064	.154	.081	.070	1.912	.056

Multicollinearity: VIF> 0.1; Tolerance < 10; Adjusted R^2= .05

Table 3a

Linear regression analysis of ISQ total, severity of night awakenings, problems falling asleep, and sleep-association disturbance, of child at 8 months of age, with explanatory variables of the PBQ-score of **father**, controlled by depression and demographics and filtered by sick children.

	ISQ total 8 months					**Severity of night awakenings**					**Problems falling asleep**					**Sleep-association disturbance** Inability fall asleep alone and night wakings				
Variables	B	S.E.	β	t	p	B	S.E.	β	t	p	B	S.E.	β	t	p	B	S.E.	β	t	p
Bonding problems of father	.077	.810	.003	.095	.925	.014	.030	.017	.461	.645	.016	.020	.030	.800	.424	.051	.122	.014	.419	.675
Depressed father	.108	.055	.064	1.954	.051	.028	.033	.031	.844	.399	.024	.023	.039	1.047	.295	.003	.008	.012	.351	.726
Health problem of father	.470	.528	.028	.892	.373	.307	.290	.034	1.060	.290	.247	.196	.042	1.259	.208	.114	.079	.048	1.445	.149
Age of father	.033	.040	.027	.824	.410	.008	.022	.012	.355	.723	.012	.015	.028	.809	.419	.004	.006	.024	.709	.479
High education of father	.557	.323	.055	1.723	.085	.426	.179	.078	2.379	.018	−.031	.121	−.009	−.260	.795	−.022	.049	−.015	−.453	.651
Multiparity	.430	.271	.052	1.587	.113	.241	.149	.055	1.617	.106	−.227	.102	−.077	−2.236	.026	−.002	.041	−.002	−.056	.955
Breastfed infant	3.082	.391	.251	7.882	< .001	1.530	.216	.232	7.071	< .001	.269	.147	.061	1.833	.067	.250	.058	.142	4.272	< .001
Sex (1 =girl, 2 =boy)	−.080	.385	−.007	−.208	.835	.380	.212	.058	1.792	.073	−.123	.144	−.028	−.850	.396	−.070	.058	−.040	−1.214	.225
Age of child	.883	.510	.054	1.731	.084	.048	.278	.006	.175	.861	.259	.190	.045	1.365	.173	.202	.076	.088	2.672	.008

Multicollinearity: VIF> 0.1; Tolerance < 10; Adjusted R^2= .08

Table 3b

Linear regression analysis of ISQ total, severity of night awakenings, problems falling asleep, and sleep-association disturbance, of child at 24 months of age, with explanatory variables of the PBQ-score of **father**, controlled by depression and demographics and filtered by sick children.

	ISQ total 24 months					**Severity of night awakenings**					**Problems falling asleep**					**Sleep-association disturbance** Inability fall asleep alone and night wakings				
Variables of fathers	B	S.E.	β	t	p	B	S.E.	β	t	p	B	S.E.	β	t	p	B	S.E.	β	t	p
Bonding problems of father	−1.100	.979	−.049	−1.124	.262	−.033	.036	−.043	−.904	.366	.004	.032	.005	.111	.911	−.119	.112	−.047	−1.066	.287
Depressed father	.223	.083	.120	2.677	.008	.073	.049	.072	1.488	.137	.081	.043	.090	1.880	.061	.008	.009	.039	.859	.391
Health problem of father	.033	.721	.002	.046	.964	−.124	.404	−.014	−.307	.759	.114	.350	.014	.325	.746	−.044	.082	−.024	−.539	.590
Age of father	.032	.056	.026	.571	.568	.037	.031	.054	1.177	.240	−.017	.027	−.029	−.638	.524	.010	.006	.069	1.518	.130
High education of father	−.141	.411	−.015	−.343	.732	−.087	.229	−.017	−.382	.703	.090	.200	.019	.451	.652	.002	.047	.002	.045	.964
Multiparity	−.102	.379	−.012	−.268	.788	−.006	.213	−.001	−.030	.976	.023	.186	.006	.125	.901	.011	.043	.012	.257	.797
Breastfed infant	.220	.513	.019	.428	.669	−.197	.285	−.031	−.689	.491	.354	.251	.062	1.414	.158	.058	.058	.043	.989	.323
Sex (1 =girl, 2 =boy)	−1.124	.505	−.095	−2.225	.027	−.309	.280	−.048	−1.102	.271	−.701	.247	−.122	−2.843	.005	−.043	.058	−.033	−.751	.453
Age of child	1.445	.920	.068	1.570	.117	.124	.509	.011	.244	.807	1.017	.451	.097	2.256	.024	.183	.105	.076	1.748	.081

Multicollinearity: VIF> 0.1; Tolerance < 10; Adjusted R^2= .014

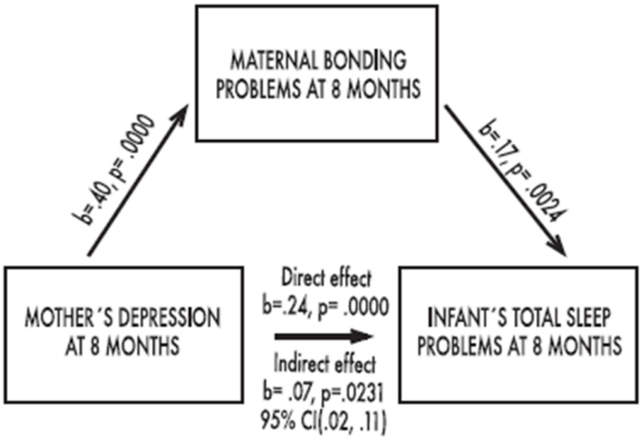

Fig. 1. Mediation model of the statistical effects (p = .0231) of mother's depression on infant's total sleep problems at 8 months through bonding problems.

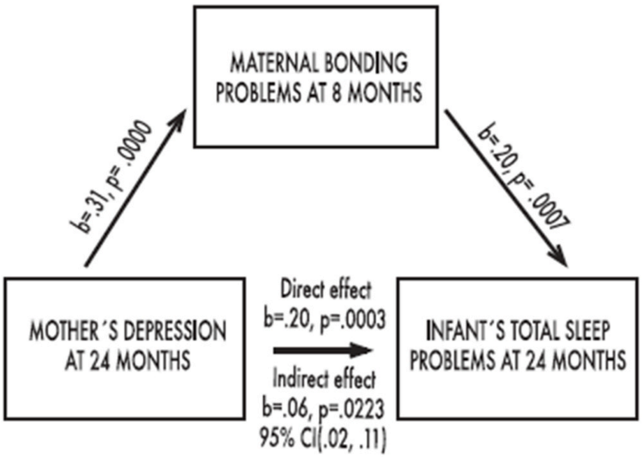

Fig. 2. Mediation model of the statistical effects (p = .0223) of mother's depression on infant's total sleep problems at 24 months through bonding problems.

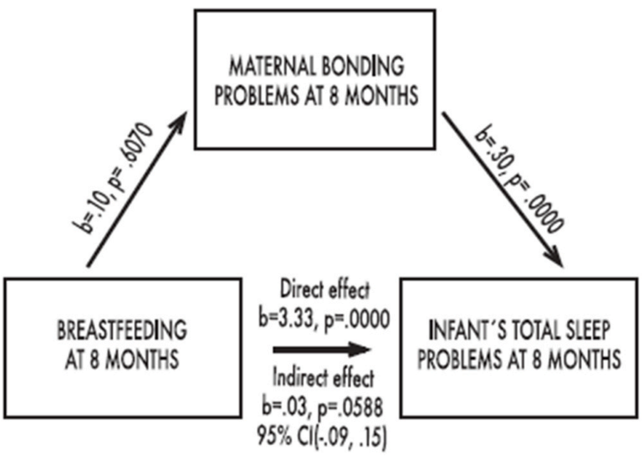

Fig. 3. Mediation model of the statistical effects (p = .0588) of breastfeeding on infant's total sleep problems at 8 months through maternal bonding problems at 8 months.

4. Discussion

Our aim was to evaluate the association between maternal and paternal postpartum bonding problems at 8 months and child sleep problems at 8 and 24 months. We found that maternal bonding problems were associated with the child's sleep problems, particularly trouble falling asleep and night wakings at both 8 and 24 months of age. Furthermore, maternal bonding problems were associated with sleep association disturbance at 24 months of age. Paternal bonding problems were not related to infant sleep problems at either time point. Moreover, the maternal and paternal depression, higher education, breastfeeding of the child, and a larger number of siblings were related to sleep problems at 8 months. Among fathers, the associations between these confounding factors and sleep problems were weaker, but at 24 months girls had more sleep problems than boys.

4.1. Bonding and infant sleep

Our findings that maternal bonding problems are linked to infant sleep problems support our first hypothesis and are consistent with earlier studies (Hairston et al., 2016; Lux et al., 2023). Previous reports on paternal bonding and infant sleep are lacking, but other studies with related study questions have indicated that the father-infant relationship is important for infant sleep. According to Bordeleau, Bernier, and Carrier (Bordeleau et al., 2012), the quality of the mother's and father's interaction with the child at 12–18 months of age is related to the percentage of the child's night sleep (i.e., length of sleep) at 3–4 years of age. Although bonding is a different concept from observed parent-infant interaction, measurement of bonding includes also interactional elements such as confidence, satisfaction, pleasure in interaction with the infant, and desire for physical closeness (Le Bas et al., 2021). It was thus somewhat surprising that we found no association between paternal bonding problems and infant sleep problems at 8 and 24 months.

The discrepant findings regarding mothers and fathers are interesting and raise further considerations. Maternity and parental leaves are well organized in Finland, which supports the development of maternal-infant and paternal-infant relationships (Clark et al., 1997; Plotka and Busch-Rossnagel, 2018). However, mothers use 88 % of parental allowance days while fathers use only 12 % (Keskinen, 2023). During the data collection period (2011–2013), the proportion of fathers' usage was even lower than that of the mothers' (Kelan lapsiperhe-etuustilasto, 2010; Kelan Lapsiperhe-etuustilasto, 2022). At the time that this sample was collected, mothers used 93 % of the parental allowance days and were on maternity leave for about 11 months after the birth of the infant (Kelan lapsiperhe-etuustilasto, 2010; Kelan Lapsiperhe-etuustilasto, 2022). Family leave was renewed after the data collection in a more egalitarian direction in 2022 (Kelan Lapsiperhe-etuustilasto, 2022).

Due to parents' family leave choices, mothers are typically more often in charge of the bedtime routines and night awakenings of young infants than fathers (Ragni et al., 2020). In our data set, 50.3 % of mothers vs. only 6.8 % of fathers usually put the child to sleep (and both parents in the rest of cases) which probably explains the findings related to father's bonding and child sleep. Given that mothers were generally more involved in caregiving and more frequently responded to the infant questionnaire, this may help explain why paternal factors were less strongly related to child outcomes — both are based on subjective perspectives on the child's situation.

The results may also be influenced by the developmental stage at the time of measurement, as 8 months is typically the age when separation anxiety from the primary caregiver begins to emerge (Bowlby, 1980/1991; Sadeh et al., 2010). It could be that infants' growing understanding of themselves as separate individuals plays a role in the different types of bonding with their mother and father. Because mothers usually take care of their babies in the first few months more than fathers, mothers are more often the primary attachment figures for the baby. This different kind of attachment with parents is important in certain sensitive situations, such as bedtime, when the child often prefers, if possible, to have the primary caregiver present. For example, in our study, mothers mostly decided their children's bedtime while fathers did it rarely, reflecting the greater role of mothers in infant's sleep routines.

Nonetheless, our findings do not support the conclusion that fathers play an insignificant role in their child's life or their sleep-related behaviours. Tikotzky and colleagues (2010) reported that although mothers are more involved in infant care than fathers, paternal involvement is associated with fewer infant night awakenings. They emphasize that while a father's participation does not replace that of the mother, his participation in caregiving responsibilities can significantly improve maternal wellbeing and infant sleep quality.

Our findings offer only partial support for our second hypothesis, grounded by Bowlby's and Mahler's theories which suggest that maternal bonding problems could be more clearly linked to problems falling asleep than to night awakenings. However, our results showed that mother's bonding problems were associated not only with difficulties falling asleep at 24 months, but also with the severity of night awakenings and sleep association disturbance. This suggests that maternal bonding is particularly important for a child's sleep during the rapprochement period described by (Mahler et al., 1975/2002) around the age of two.

4.2. Background factors and infant sleep

Interestingly, our findings are consistent with earlier research suggesting that the factors influencing infant sleep are quite complex. We tested a large number of covariates and found, similar to previous studies (e.g. (Hairston et al., 2016); (Lux et al., 2023), that mother's depressive symptoms, alongside bonding difficulties, were associated with more infant sleep problems at 8 months of age. These included total sleep problems, severity of night awakenings, problems falling asleep, and sleep association disturbance. At 24 months of age, the association between maternal depressive symptoms and both total sleep problems and problems falling asleep remained. Although the link between maternal depression and infant sleep problems is more commonly observed in samples with clinically significant symptom levels (Sadeh et al., 2010), our study provides additional evidence that parental mood is an important predictor of infant sleep even in a normative, non-clinical sample. It is possible that even non-clinical but slightly heightened levels of depression may affect infant sleep.

According to the mediation analysis, in addition to the direct association between maternal depression and the infant sleep problems, maternal depression was also indirectly associated with sleep problems at 8 and 24 months of age through maternal bonding difficulties. This is consistent with earlier research suggesting that maternal depression is associated with infant sleep problems both directly and indirectly via bonding difficulties (Lux et al., 2023). Thus, bonding problems may represent one important mechanism through which the adverse effects of maternal depression are mediated to the infant. Importantly, bonding only partially mediated the observed associations, suggesting that other pathways may also link maternal depression to infant sleep problems.

Regarding fathers, the association between depressive symptoms and infant sleep problems appeared to depend on age. While paternal depressive symptoms were not associated with infant sleep problems at 8 months, they were related to total sleep problems at 24 months. As it is common in Finland for mothers of 24-month-old children to have returned to full-time work, it is likely that fathers take on a more active role in childcare during this period, possibly including participation in bedtime routines. However, it is also noteworthy that already at 8 months, the association between paternal depressive symptoms and infant total sleep problems approached statistical significance ($p = .051$).

Regarding other variables examined, we found that breastfed infants had more sleep problems, such as higher ISQ total scores, greater severity of night awakenings, more difficulties in falling asleep, and sleep association disturbance compared to non-breastfed infants at 8 months of age. This is consistent with several other studies (Jafar et al., 2021; Lux et al., 2023; Nakagawa et al., 2021). According to the mediation analysis, breastfeeding is directly associated with sleep problems in 8-month-old infants, but this association is not mediated by maternal bonding. Hence, even though breastfeeding difficulties have been associated with bonding problems in some studies (Ondrusova, 2023), our findings suggest that breastfeeding and bonding influence infant sleep quality through separate pathways. We are not aware of any other studies that that could confirm or refute our findings. However, breastfed infants tend to wake up more (Ramamurthy et al., 2012) and they are more likely co-sleepers, which may contribute to sleep problems (Vogiatzoglou et al., 2024).

One possible interpretation of the increased sleep problems among breastfed infants relates to the framework of co-regulation: breastfed infants may be more likely to rely on their caregiver to fall asleep and to resume sleep during the night. At the same time, this finding may also reflect maternal perceptions and reporting practices. Mothers who breastfeed are typically more involved in nighttime caregiving and may therefore be more aware of, or affected by, their infant's awakenings. This increased involvement may influence how they report sleep disturbances in questionnaires or interviews, potentially leading to higher rates of reported problems, even when objective sleep patterns might be similar across feeding groups. However, it is also be taken into consideration that night wakings are not necessarily problematic from a developmental perspective, but may also reflect an ongoing co-regulatory partnership process between the infant and the caregiver.

We also found an association between higher parental education and sleep problems, specifically the severity of night awakenings, at 8 months, consistent with previous findings (Lux et al., 2023). In contrast to their results, we observed that having more siblings and being slightly older were also associated with sleep problems; a greater number of siblings was linked to severity of night awakenings while older infant age was associated with sleep association disturbance. Interestingly, in our study, the number of siblings was negatively associated with difficulties in falling asleep at 8 months, indicating that having more children in the family was related to fewer problems in initiating sleep. This finding is consistent with Lux et al. (Lux et al., 2023), who reported that both the number of siblings and child's age were negatively associated with sleep problems, indicating that older children and those with more siblings tended to experience less sleep problems. At 24 months, the associations of parental education, breastfeeding, and parity and infant sleep problems were no longer statistically significant. However, at 24 months, maternal (but not paternal) health problems, and infant's female sex were significantly associated with sleep problems.

4.3. Future research

Due to the study design, we cannot establish causality between bonding issues and sleep problems, which underscores the need for future studies to investigate the underlying mechanisms more thoroughly. It is possible that other parent- or child related factors not included in our study may also contribute to a child's sleep quality. These may include the parent's own sleep (Hairston et al., 2016; Jiao et al., 2024; Kalmbach et al., 2022), parental personality and cognition (Sadeh et al., 2010), greater paternal involvement in infant care (Tikotzky et al., 2010), the child's temperament (Hairston et al., 2016), parental social isolation (Lux et al., 2023), bedtime parenting behaviours (Philbrook and Teti, 2016; Schlarb et al., 2020; Ragni et al., 2020), and the overall quality of child-parent interactions (Bordeleau et al., 2012). Regarding the latter two factors, the co-regulatory relationship between parent and child may be particularly important. It can be assumed that parents who struggle to help their child regulate emotions may also experience a reduced sense of connection with their child. Finally, we did not examine marital quality or indirect support fathers may provide in helping mothers put their infants to sleep, both of which may play a significant role in shaping infant sleep development. Therefore, more complex study settings are needed to better clarify the mechanisms through which parental bonding may influence a child's sleep.

Moreover, combining subjective and objective sleep measures in future research, (e.g., actigraphy, video monitoring) could help distinguish actual sleep disruptions from caregiver perceptions, and reduce bias caused by potential over- or underreporting by parents. Additionally, it may be valuable to investigate whether the association between breastfeeding and sleep varies is influenced by concurrent sleep-related practices (e.g., co-sleeping). Finally, it is important to note that in our sample, mothers' and fathers' bonding problems at 8 months were significantly correlated ($r = .348$, $p < .001$), suggesting an interconnection in parental bonding to the baby that should be taken into account in further research.

4.4. Strengths and limitations of the study

The sample in this study was large and nationally representative of Finnish-speaking parents in Finland, comprising longitudinal data collected from 8 to 24 months. The dropout rates from the original prenatal sample (N = 1667) were relatively high by 24 months (38 % for mothers and 51 % for fathers), which may limit generalizability of the findings to the entire target population. Due to educational attrition, the results may be less generalizable to families in which parents have lower levels of education. Additionally, attrition at 24 months was associated to age, meaning that the mothers who remained in the study at the point were on average older than those in the original sample. Attrition at 24 months was not associated with maternal or paternal depression nor with infants' sleep problems. However, it was related to maternal and paternal bonding problems: mothers and fathers who reported less bonding problems at 8 months were more likely to drop out at 24 months. Since the primary focus of our research was the relationship between bonding and infant sleep, it was important that participants who reported bonding problems at 8 months remained in the study at 24 months.

The data were collected from a normative, non-clinical population, and therefore, the sample may not include the mothers and fathers with the most severe bonding problems or depression nor children with the most difficult sleep problems. However, there was a considerable number of mothers and fathers in the dataset with elevated levels of depression. In our data, 14.6 % of mothers scored 10 or more on the CESD depression scale at age months and 14.5 % at 24 months. For fathers, the corresponding figures were 6.9 % and 7.7 %. A score of 10 or above has been used in previous studies to indicate high levels of depression (Pietikainen et al., 2020).

Another potential limitation is that only a small proportion (1 %) of respondents to the infant sleep questionnaires were fathers, which may limit the generalizability of the findings to paternal experiences and partially explain the lack of association between (mostly mother-reported) infant sleep-problems and paternal bonding. However, the prevalence of children's sleep problems was not dependent on whether the respondent was the mother, the father, or both parents together.

Finally, although the reliabilities for the ISQ total scale were quite low, we also reported results based on factor analyses to address this limitation.

4.5. Clinical implications

As some sleep problems in children are highly persistent (Cortesi et al., 2008) and can be distressing for parents, there is a clear need to improve the effectiveness of treatments for children's severe sleep problems. There are effective intervention and prevention programs to support children's sleep (Park et al., 2022). For example, parental guidance on establishing consistent bedtime routines has been shown to improve children's sleep (Mindell and Williamson, 2018). Additionally, the bedtime pass program, for children aged 3–6 years can be an effective method in reducing bedtime resistance (Moore et al., 2006). When planning interventions for infants with persistent sleep problems, it is important to also support the parent-child relationship, because there are likely bidirectional effects between bonding and sleep problems, that may reinforce each other and lead to vicious cycles.

In some cases, parent-infant psychotherapy has been identified as an effective approach for addressing both infant sleep problems and parent-infant relational problems (Mihelic et al., 2017). In such cases, working with families (Yokoyama et al., 2017), and providing early support for parental bonding and mental health is very important, because persistent infant sleep problems can strain the parent-child relationship and negatively impact parental well-being. However, infant sleep problems are multifactorial and not necessarily linked to parenting issues. In our study, several factors influenced infant sleep and the magnitude of the association between bonding and infant sleep was relatively small. Both maternal and paternal depressive symptoms were associated with infant sleep problems; among mothers, this relationship was mediated through bonding difficulties. These findings highlight the complex and multifaceted pathways linking parental mental health to infant sleep, and underscore the importance of early identification and treatment of parental perinatal depression. Finally, it is crucial to identify families in which parents are simultaneously experiencing bonding difficulties and depressive symptoms at an early stage, and to provide support tailored to their specific circumstances. Research has shown that these challenges can often be detected even before the baby is born (Canella, 2005; Rusanen et al., 2018; blinded for review).

4.6. Conclusions

Our study is the first longitudinal investigation to report an association between maternal bonding problems and persistent infant sleep problems. By including fathers, we were also able to highlight the significant role of the primary caregiver in infant sleep development. Moreover, we found that both maternal and paternal depression were associated with infant sleep problems, and that the effects of maternal depression were partly mediated through bonding difficulties.

In health care services, it is important to screen for infant sleep problems and provide parents with psychoeducation on how to support their infant's sleep through sensitive interactions and establishment of consistent and developmentally appropriate bedtime routines. According to our results, caregivers experiencing bonding difficulties or depression should be supported as early as possible, given that bonding begins to develop already during pregnancy and perinatal depression is common. It is possible that early support for the parent-infant relationship may help prevent persistent sleep problems in infants (Sadeh et al., 2010).

CRediT authorship contribution statement

E. Rusanen: Writing – review & editing, Writing – original draft, Validation, Methodology, Formal analysis, Data curation, Conceptualization. **M. Flykt**: Writing – review & editing, Validation, Supervision, Methodology, Conceptualization. **A. Kylliäinen:** Writing – review & editing, Supervision, Conceptualization. **O. Saarenpää-Heikkilä:** Writing – review & editing, Supervision, Conceptualization. **E.J. Paavonen:** Writing – review & editing, Validation, Supervision, Resources, Project administration, Methodology, Investigation, Conceptualization.

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Declaration of Generative AI and AI-assisted technologies in the writing process

During the preparation of this work the author(s) used ChatGPT in order to check the grammar and enhance the readability of the text. After using this tool/service, the author(s) reviewed and edited the content as needed and take(s) full responsibility for the content of the publication.

Conflict of Interest

The authors have no conflicts of interest to disclose.

Appendix A. Supporting information

Supplementary data associated with this article can be found in the online version at doi:10.1016/j.infbeh.2025.102123.

Data Availability

The authors do not have permission to share data. If necessary, you can request more information about the material from the director of the Child-Sleep project (E.J. Paavonen).

References

Alhusen, J. L., Hayat, M. J., & Gross, D. (2013). A longitudinal study of maternal attachment and infant developmental outcomes. *Archive Womens Mental Health, 16*(6), 521–529. https://doi.org/10.1007/s00737-013-0357-8

Bordeleau, S., Bernier, A., & Carrier, J. (2012). Longitudinal associations between the quality of Parent–Child interactions and children's sleep at preschool age. *Journal of Family Psychology, 26*(2), 254–262. https://doi.org/10.1037/a0027366

Bowlby, J. (1969). *attachment. attachment and loss: volume 1. attachment.* Penguin Books.

Bowlby, J. (1980/1991). *Attachment and loss: volume 2. Separation. anxiety and anger*. Penguin Books.

Brockington, I. F., Fraser, C., & Wilson, D. (2006). The postpartum bonding questionnaire: a validation. *Archives of Women'States Mental Health, 9*(5), 233–242. https://doi.org/10.1007/s00737-006-0132-1

Canella, B. L. (2005). Maternal-fetal attachment: An integrative review. *Journal of Advanced Nursing, 50*(1), 60–68. https://doi.org/10.1111/j.1365-2648.2004.03349.x

Clark, R., Hyde, J. S., Essex, M. J., & Klein, M. H. (1997). Length of maternity leave and quality of Mother-Infant interactions. *Child Development, 68*(2), 364–383. https://doi.org/10.1111/j.1467-8624.1997.tb01945.x

Condon, J. T., & Corkindale, C. J. (1998). The assessment of parent-to-infant attachment: development of a self-report questionnaire instrument. *Journal of Reproductive and Infant Psychology, 16*(1), 57–76. https://doi.org/10.1080/02646839808404558

Cortesi, F., Giannotti, F., Sebastiani, T., Vagnoni, C., & Marioni, P. (2008). Cosleeping versus solitary sleeping in children with bedtime problems: child emotional problems and parental distress. *Behavioral Sleeping Medicine, 6*(2), 89–105. https://doi.org/10.1080/15402000801952922

Edhborg, M., Matthiesen, A.-S., Lundh, W., & Widström, A.-M. (2005). Some early indicators for depressive symptoms and bonding 2 months postpartum – A study of new mothers and fathers. *Arch Womens Ment Health*, (8), 221–231. https://doi.org/10.1007/s00737-005-0097-5

Garcia-Esteve, L., Torres, A., Lasheras, G., Palacios-Hrnández, B., Farré-Sender, B., Subirà, S., Valdés, M., & Brockington, I. F. (2016). Assessment of psychometric properties of the postpartum bonding questionnaire (PBQ) in spanish mothers. *Archives of Women'States Mental Health, 19*(2), 385–394. https://doi.org/10.1007/s00737-015-0589-x

Hairston, I. S., Solnik-Menilo, T., Deviri, D., & Handelzalts, J. E. (2016). Maternal depressed mood moderates the impact of infant sleep on mother–infant bonding. *Arch Womens Ment Health, 19*, 1029–1039. https://doi.org/10.1007/s00737-016-0652-2

Irwin, M., Haydari, K., & Oxman, M. (1999). Screening for depression in the older adult. *Archives of International Medicine, 159*(15), 1701–1704. https://doi.org/10.1001/archinte.159.15.1701

Jafar, N. K. A., Tham, E. K. H., Pang, W. W., Fok, D., Chua, M. C., Teoh, O.-H., Goh, D. Y. T., Shek, L. P.-C., Yap, F., Tan, K. H., Gluckman, P. D., Chong, Y.-S., Meaney, M. J., Broekman, B. F. P., & Cai, S. (2021). Association between breastfeeding and sleep patterns in infants and preschool children. *American Journal of Nutrition, 114*(6), 1986–1996. https://doi.org/10.1093/ajcn/nqab297

Jiao, N., Pituch, K., Whisner, C., & Petrov, M. (2024). Early postpartum maternal stress and Mother-Infant bonding predicted infant nighttime wakefulness at six months. *Sleep, 47*(1), A86–A87. https://doi.org/10.1093/sleep/zsae067.0201

Kalfon-Hakhmigari, M., Segal, H., & Peled, Y. (2025). Hebrew validation of the postpartum bonding questionnaire: A study of mothers and fathers. *Journal of Reproductive Infant Psychology, 43*(2), 459–471.

Kalmbach, D. A., O'Brien, L. M., Pitts, D. S., Sagong, C., Arnett, L. K., Harb, N. C., Cheng, P., & Drake, C. L. (2022). Mother-to-Infant bonding is associated with maternal insomnia, snoring, cognitive arousal, and infant sleep problems and colic. *Behav Sleeping Med, 20*(4), 393–409. https://doi.org/10.1080/15402002.2021.1926249

Kelan lapsiperhe-etuustilasto (2010). ⟨http://hdl.handle.net/10138/159415⟩.

Kelan Lapsiperhe-etuustilasto, (2022). ⟨https://helda.helsinki.fi/items/2239e150-fce4-48aa-abb1-72592daf3e35⟩.

Keskinen, S. (2023). *Kelan lapsiperhe-etuustilasto 2022*. Tilastokeskus. Helsinki: Finland. ⟨http://hdl.handle.net/10138/358139⟩.

Kinsey, C. B., & Hupcey, J. E. (2013). State of the science of maternal–infant bonding: A principle-based concept analysis. *Midwifery, 29*(12), 1314–1320. https://doi.org/10.1016/j.midw.2012.12.019

Le Bas, G. A., Youssef, G. J., Macdonald, J. A., Rossen, L., Teague, S. J., Kothe, E. J., & Hutchinson, D. M. (2020). The role of antenatal and postnatal maternal bonding in infant development: A systematic review and Meta-Analysis. *Social Development, 29, 3–20*. https://doi.org/10.1111/sode.12392

Le Bas, G., Youssef, G., Macdonald, J. A., Teague, S., Mattick, R., Honan, I., & Hutchinson, D. (2021). The role of antenatal and postnatal maternal bonding in infant development. *Journal of the American Academy of Child Adolescent Psychiatry, 61*(6), 820–829. https://doi.org/10.1016/j.jaac.2021.08.024

Lux, U., Müller, M., Reck, C., Liel, C., & Walper, S. (2023). Linking maternal psychopathology to children's excessive crying and sleeping problems in a large representative German sample—The mediating role of social isolation and bonding difficulties. *Infancy, 28*, 435–453. https://doi.org/10.1111/infa.12514

Mahler, M., Pine, F., & Berman, A. (1975/2002). *Psychological birth of the human infant. Symbiosis and individuation*. Karnac.

Mihelic, M., Morawska, A., & Filus, A. (2017). Effects of early parenting interventions on parents and infants: A meta-analytic review. *Journal of Child and Family Studies, 26*(6), 1507–1526. https://doi.org/10.1007/s10826-017-0675-y

Millikovsky-Ayalon, M., Atzaba-Poria, N., & Meiri, G. (2014). The role of the father in child sleep disturbance: Child, parent, and parent–child relationship. *Infant Mental Health Journal, 36*(1), 114–127. https://doi.org/10.1002/imhj.21491

Mindell, J. A., & Williamson, A. A. (2018). Benefits of a bedtime routine in young children: sleep, development, and beyond. *Sleeping Medicine Reviews, 40*, 93–108. https://doi.org/10.1016/j.smrv.2017.10.007

Moore, B. A., Friman, P. C., Fruzzetti, A. E., & MacAleese, K. (2006). Brief report: Evaluating the bedtime pass program for child resistance to Bedtime—A randomized, controlled trial. *Journal of Pediatric Psychology, 32*(3), 283–287. https://doi.org/10.1093/jpepsy/jsl025

Morrell, J. M. B. (1999). The infant sleep questionnaire: a new tool to assess infant sleep problems for clinical and research purposes. *Child Psychology Psychiatry Review, 4*(1), 20–26. https://doi.org/10.1017/S1360641798001816

Nakagawa, M., Ohta, H., Shimabukuro, R., Asaka, Y.,T., Nakazawa, T., Oishi, Y., Hirata, M., Ando, A., Ikeda, T., Yoshimura, Y., Mitani, Y., Kaneshi, Y., Morioka, K., Fukutomi, R., Kobayashi, K., Ozawa, M., Takeshima, M., Mishima, K., Kikuchi, M., Cho, K., Yoda, H., & Kusakawa, I. (2021). Daytime nap and nighttime breastfeeding are associated with toddlers' nighttime sleep. *Scientific Reports, 11*(3028). ⟨https://www.nature.com/articles/s41598-021-81970-6⟩.

Nazaré, B., Fonseca, A., & Canavarro, M. C. (2012). Avaliação da ligação parental ao bebé após o nascimento: Análise fatorial confirmatória da versão portuguesa do postpartum bonding questionnaire (PBQ). *Laboratório Délelőtt Psicologia, 10*(1), 47-61.

Official Statistics Finland, Suomen virallinen tilasto, SVT (2018). Educational structure of the population [online publication]. ⟨https://www.stat.fi/til/vkour/2018/vkour_2018_2019-11-05_tie_001_fi.html⟩.

Ondrusova, S. (2023). Breastfeeding and bonding: A surprising role of breastfeeding difficulties. *Breastfeeding Med, 18*(7), 514–521. https://doi.org/10.1089/bfm.2023.0021

Paavonen, E. J., Saarenpää-Heikkilä, O., Pölkki, P., Kylliäinen, A., Porkka-Heiskanen, T., & Paunio, T. (2017). Maternal and paternal sleep during pregnancy in the Child-sleep birth cohort. *Sleep Medicine*, (29), 47–56. https://doi.org/10.1016/j.sleep.2016.09.011

Park, J., Kim, S. Y., & Lee, K. (2022). Effectiveness of behavioral sleep interventions on children's and mothers' sleep quality and maternal depression: A systematic review and meta-analysis. *Scientific Reports, 12*(4172). https://doi.org/10.1038/s41598-022-07762-8

Perpétuo, C., Diniz, E., & Verissimo, M. (2021). A systematic review on attachment and sleep at preschool age. *Children, 8*(10), 895. https://doi.org/10.3390/children8100895

Philbrook, L., & Teti, M. D. (2016). Bidirectional associations between bedtime parenting and infant sleep: parenting quality, parenting practices, and their interaction. *J of Family Psychology, 30*(4), 431–441. https://doi.org/10.1037/fam0000198

Pietikainen, J. T., Kiviruusu, O., Kylliainen, A., Pölkki, P., Saarenpää-Heikkilä, O., Paunio, T., & Paavonen, E. J. (2020). Maternal and paternal depressive symptoms and children's emotional problems at the age of 2 and 5 years: a longitudinal stud. *Journal of Child Psychology and Psychiatry, 61*(2), 195–204. https://doi.org/10.1111/jcpp.13126

Plotka, R., & Busch-Rossnagel, N. (2018). The role of length of maternity leave in supporting mother-child interactions and attachment security among American mothers and their infants. *International Journal of Child Care Education Policy, 12*(2). https://doi.org/10.1186/s40723-018-0041-6

Pudasainee-Kapri, S., Zhang, Y., & Razza, R. A. (2025). Early bedtime routines and behavioral outcomes among children from low-income families: Mediating role of emotion regulation. *Infant Behavior and Development*. https://doi.org/10.1016/j.infbeh.2025.102027

Radloff, L. S. (1977). The CES-D scale: a self report depression scale for research in the general population. *Applied Psychological Measurement, 1*(3), 385–401. https://doi.org/10.1177/014662167700100306

Ragni, B., De Stasio, S., & Barni, D. (2020). Fathers and sleep: A systematic literature review of bidirectional links between paternal factors and Children's sleep in the first three years of life. *Clin Neuropsychiatry, 17*(6), 349–360. https://doi.org/10.36131/cnfioritieditore20200604

Ramamurthy, M. B., Sekartini, R., Ruangdaraganon, R., Huynh, D. H. T., Sadeh, A., & Mindell, J. A. (2012). Effect of current breastfeeding on sleep patterns in infants from Asia-Pacific region. *J Paediatr Child Health, 48*(8), 669–674. https://doi.org/10.1111/j.1440-1754.2012.02453

Rusanen, E., Lahikainen, A. R., Pölkki, P., Saarenpää-Heikkilä, O., & Paavonen, E. J. (2018). The significance of supportive and undermining elements in the maternal representations of an unborn baby. *Journal of Reproductive and Infant Psychology, 36*(3), 261–275. https://doi.org/10.1080/02646838.2018.1462476

Rusanen, E., Vierikko, E., Kojo, T., Lahikainen, A. R., Pölkki, P., & Paavonen, E. J. (2021). Prenatal expectations and other psycho-social factors as risk factors of postnatal bonding disturbance. *Infant Mental Health Journal, 42*(5), 655–671. https://doi.org/10.1002/imhj.21941

Rusanen, E., Lahikainen, A. R., Vierikko, E., Pölkki, P., & Paavonen, E. J. (2024). A Longitudinal Study of Maternal Postnatal Bonding and Psychosocial Factors that Contribute to Social-Emotional Development. *Child Psychiatry & Human Development, 55*(1), 274–286. https://doi.org/10.1007/s10578-022-01398-5

Sadeh, A., Tikotzky, L., & Scher, A. (2010). Parenting and infant sleep. *Sleeping Medicine Reviews, 14*(2), 89–96.

Schlarb, A. A., Seiler, D., Werner, A., & Kater, M.-J. (2020). Modern strategies for settling infants to sleep: A comparison between sleep-disturbed and non-sleep-disturbed infants. *Somnologie, 24*(4), 237–244.

Tikotzky, L., Sadeh, A., & Glickman-Gavrieli, T. (2010). 2 infant sleep and paternal involvement in infant caregiving during the first 6 months of life. *Journal of Pediatric Psychology, 36*(1), 36–46. https://doi.org/10.1093/jpepsy/jsq036

Tikotzky, L., Sadeh, A., Volkovich, E., Manber, R., Meiri, G., & Shahar, G. (2015). Infant sleep development from 3 to 6 months postpartum: Links with maternal sleep and paternal invovement. *Monographs of the Society for Research in Child Development, 80*(1), 107–124.

Van Bussel, J. C. H., Spitz, B., & Demyttenaere, K. (2010). Three self-report questionnaires of the early mother-to-infant bond: Reliability and validity of the Dutch version of the MPAS, PBQ and MIBS. *Archives of Women'States Mental Health, 13*(5), 373–384. https://doi.org/10.1007/s00737-009-0140-z

Vedova, A. M., Dabrassi, F., & Imbasciati, A. (2008). Assessing prenatal attachmnet in a sample of Italian women. *Journal of Reproductive and Infant Psychology, 26*(2), 86–98. https://doi.org/10.1080/02646830701805349

Vogiatzoglou, M., Iliadou, M., Antoniou, E., Dagla, M., et al. (2024). Exploring the relationship between Co-Sleeping, maternal mental health and expression of complaints during infancy, and breastfeeding. *Healthcare (Basel), 12*(13), 1278. https://doi.org/10.3390/healthcare12131278

Wittkowski, A., Wieck, A., & Mann, S. (2007). Original contribution an evaluation of two bonding questionnaires: A comparison of the Mother-to-Infant bonding scale with the postpartum bonding questionnaire in a sample of primiparous mothers. *Archives of Women'States Mental Health, 10*(4), 171–175. https://doi.org/10.1007/s00737-007-0191-y

Yokoyama, Y., Hakulinen, T., Sugimoto, M., Silventoinen, K., & Kalland, M. (2017). Maternal subjective well-being and preventive health care system in Japan and Finland. *The European Journal of Public Health, 28*(4), 652–657. https://doi.org/10.1093/eurpub/ckx211