Sleep Health: Journal of the National Sleep Foundation xxx (xxxx) xxx–xxx

Contents lists available at ScienceDirect

Sleep Health: Journal of the National Sleep Foundation

journal homepage: www.sleephealthjournal.org

Characterizing the sleep location, patterns, and maternally perceived sleep problems of the infants of Māori and non-Māori mothers in Aotearoa New Zealand

Mikaela L. Carter, ALM, BSc [a], Sarah-Jane Paine, PhD [b], Bronwyn M. Sweeney, PhD [a], Joanne E. Taylor, PhD [c], T. Leigh Signal, PhD [a,*]

[a] Sleep/Wake Research Centre, Massey University, Wellington, New Zealand
[b] Faculty of Medical and Health Sciences, University of Auckland, Auckland, New Zealand
[c] School of Psychology, Massey University, Palmerston North, New Zealand

A R T I C L E I N F O

Article history:
Received 5 March 2024
Received in revised form 15 October 2024
Accepted 23 October 2024

Keywords:
Ethnicity
Socio-ecological factors
Sleep health equity
Infant sleep development
Breastfeeding
Maternal depression

A B S T R A C T

Objectives: To investigate potential sleep inequities between the infants of Māori and non-Māori mothers in Aotearoa New Zealand, identify socio-ecological factors associated with infant sleep, and determine features of infant sleep that contribute to a mother-perceived infant sleep problem.
Design: Secondary analysis of longitudinal data from the Moe Kura: Mother and Child, Sleep and Well-being in Aotearoa New Zealand study when infants were approximately 12 weeks old.
Participants: 383 Māori and 702 non-Māori mother-infant dyads.
Methods: Chi-square and independent t-tests measured bivariate associations between maternal ethnicity and infant sleep characteristics. Multivariable and ordinal logistic regression models assessed the relative impact of different socio-ecological factors on infant sleep outcome variables.
Results: Key developmental markers of infant sleep did not differ by maternal ethnicity. There were some ethnicity-based differences in sleep location. Maternal ethnicity, maternal age, parity, maternal depression, maternal relationship status, life stress, breastfeeding, work status, and bedsharing were related to different dimensions of infant sleep, and to maternal perceptions of a sleep problem.
Conclusion: Sleep at 12 weeks is highly variable between infants and is associated with numerous socio-ecological factors. Findings support a social determinants explanation for sleep health inequities seen later in childhood.

Sleep predicts child development in myriad ways, including physical, cognitive, and emotional development,[1] and is recognized as essential to child health.[2] Additionally, both infant sleep and expectations around infant sleep impact maternal well-being.[3,4] Despite awareness of the importance of sleep for child health and family harmony,[5] it is difficult to determine what is normative vs. problematic sleep in young infants (e.g., ~12 weeks of age) because few studies have provided detailed descriptions of their sleep-wake characteristics.

In Aotearoa New Zealand (NZ), there are sleep health inequities between Māori, the Indigenous people of NZ, and non-Māori adults and in children as young as 3-4 years.[6] Health inequities are unjust, modifiable disparities in health between socially or economically disadvantaged groups and their more advantaged counterparts.[7] Early inequities in sleep health are thought to contribute to long-term inequities in well-being.[8,9] The primary aim of this study was to explore whether sleep health inequities between the children of Māori and non-Māori mothers are present as early as 12 weeks of age, as this can further our understanding of when and why they develop.

The development of organized sleep-wake patterns occurs as a function of two interacting biopsychosocial processes: consolidation and self-regulation.[10] Sleep consolidation describes the gradual development of a diurnal sleep pattern, with longer periods of sleep during the night, combined with longer periods of wakefulness during the day.[10] Sleep self-regulation refers to an infant's capacity to independently transition between wakefulness and sleep.[10] Emergence of the circadian timing system at 8-12 weeks helps to

* Corresponding author: T. Leigh Signal, Sleep Wake Research Centre, Massey University, Wellington, New Zealand.
E-mail address: t.l.signal@massey.ac.nz (T. Leigh Signal).

https://doi.org/10.1016/j.sleh.2024.10.010

initiate these processes,[11] facilitating changes to sleep-wake patterns that are especially rapid in the first year of life and which continue throughout childhood.[12] Their maturation is marked by fewer signaled night wakings, less reliance on caregivers to initiate or resume sleep, and a greater longest self-regulated sleep period (LSRSP) – the longest period of "uninterrupted" sleep (as experienced by the caregiver) the infant obtains.[13]

Socio-ecological models of sleep health propose several nested layers of factors relevant to infant sleep development.[14] At the most proximal, microsystem-level are factors intrinsic to the infant, such as age. The mesosystem includes parent-child interaction factors, including breastfeeding, bedsharing and family routines, which have bi-directional relationships with parent well-being such as mental health, life stress, and partner relationship satisfaction. More distally, socio-economic position (SEP) is associated with macrosystem factors including housing conditions. SEP has a strong association with health generally[15] and pediatric sleep health specifically.[6] A further aim of this study was to identify socio-ecological factors associated with infant sleep characteristics, with a focus on sleep location and markers of infant sleep development.

A final aim was to understand how infant sleep and socio-ecological factors relate to maternal perceptions of infant sleep problems. It is important to understand potential drivers of perceived problems, as they index one of the most common reasons for presentation to pediatric services and can be distressing for parents.[10,16] Though consolidation and regulation are important processes, it is normal to see large between-child variability in the speed and linearity of these processes.[3,12] Historically, pediatric sleep research, at least in western psycho-medical contexts, has been predicated on "sooner the better" assumptions regarding sleep consolidation and regulation.[3,10,16] Several studies have found night waking and shorter LSRSP commonly characterize parent-identified sleep problems.[17-19] This contrasts with anthropologically informed perspectives that consider signaled night wakings throughout infancy to be functional, particularly for nutrition and attachment.[3,16,20]

Irrespective of perspective, previous research indicates one third to one half of parents view their infant's sleep as problematic.[19,21,22] This points to possible widespread distress given how central sleep is to family well-being.[5] Understanding how mother-identified sleep problems are characterized for 12-week-old infants may assist in ameliorating that distress, whether by identifying and addressing potential contributing contextual factors, targeting infant sleep behaviors, or helping parents to understand infant sleep, in order to modify expectations and perceptions.

In summary, we know infant sleep health is important and that sleep health inequities are present among NZ adults and children as young as 3-4 years. We do not yet know if these inequities are present in infancy. We also have limited knowledge of the socio-ecological factors associated with infant sleep, and which infant sleep variables characterize a perceived sleep problem. This study aims to (1) characterize and compare the sleep of 12-week-old infants of Māori and non-Māori NZ women; (2) identify socio-ecological factors associated with infant sleep characteristics; and (3) determine features of infant sleep that contribute to a mother-perceived infant sleep problem.

Methods

Moe Kura: Mother and Child Sleep and Well-being in Aotearoa New Zealand (*Moe Kura*) is a longitudinal study investigating the role of sleep in the health and well-being of mothers and their children in NZ.[23] The study followed mothers from late pregnancy to 3 years post birth and collected self-report questionnaire data at four points. The current research involved cross-sectional, secondary analyses of a subset of survey data collected at 12 weeks postpartum from 2010-2012.

All aspects of the study are informed by Kaupapa Māori research principles described in detail elsewhere[23] but briefly include: (1) Māori participation and control at all levels and stages of the research; (2) appropriate collection of ethnicity data to identify and monitor health disparities; and (3) equal explanatory and analytical power for Māori and non-Māori. This research is covered by the study's ethical approval (HDEC; CEN 09/09/070). All women provided informed consent for themselves and their children.

Variables

Sleep measures

Infant sleep variables were developed from multi-choice questionnaire items based on the original Brief Infant Sleep Questionnaire[24] (see Supplementary Materials for sleep variable development details). Questions on night waking used the 10 PM – 6 AM timeframe proposed by Henderson and colleagues.[13] Based on response distributions, most outcome variables were subsequently dichotomized *(Bedsharing, Room-sharing and Independent sleeping all Yes/No; Night LSRSP:* ≤4hours vs. > 4 hours; *Night sleeplocation change:* ≥1 times/week vs. never; *Opportunity for maternal daytime breaks:* 0-3 vs. 4-7 days/week; opportunities for reasonable maternal sleep *(Reasonable mat. sleep):* 0-3 vs. 4-7 days/week; Infant has help from others to initiate sleep*(Help to sleep):* often/always vs. rarely/never; *Day to Day Change* or *Consistency* in infant sleep patterns: always different/frequent change vs. occasional change/always the same; *Sleep Problem:* Yes (serious or small) vs. No (not a problem at all). Due to their response distributions, two variables were coded into 4 categories: *Night Waking* (0, 1, 2, ≥3 wakings) and *Daytime LSRSP* (< 1, 1-2, 2-3, > 3 hours).

Maternal sleep duration was measured by a single item asking mothers to provide a past week estimate: "How many hours sleep, including naps, do you usually get in 24 h?" Maternal sleep quality was measured with the Sleep Quality Subscale of the General Sleep Disturbance Scale,[25] with the total score prepared as a continuous variable.

Maternal ethnicity

Participating mothers self-identified their own ethnicity based on responses to the 2001 New Zealand Census question: *"Which ethnic group do you belong to? Mark the space or spaces which apply to you."* Participants were categorized as Māori if they identified as Māori alone or in combination with another ethnic group(s), with all others categorized as non-Māori.[26]

Covariates

SEP was measured at 12 weeks postpartum using the New Zealand Index of Deprivation (NZDep2006).[27] This is a widely used area-based measure of relative socioeconomic deprivation in NZ based on nine census variables, with higher deciles indicating greater deprivation. Consistent with other research,[28] these deciles were collapsed into three levels of socioeconomic deprivation: low (deciles 1-3), medium (deciles 4-7), and high (deciles 8-10). Other covariates included maternal age (years), parity (primiparous or multiparous), infant age (weeks), infant ethnicity (Māori or non-Māori, as identified by the mother), breastfeeding status (exclusive breastfeeding, i.e., infants who had only ever received breastmilk vs. all others). The Edinburgh Postnatal Depression Scale (EPDS)[29] was used to measure current symptoms of maternal depression, with the total score prepared as a continuous variable. Life stress was measured with the Life Stress scale from the Pregnancy Risk Assessment Monitoring System (PRAMS).[30] High stress was defined as ≥2 stressors, in line with prior studies.[31,32] Partner relationship satisfaction was measured on an 8-point Likert-type scale (range 0-7; where, consistent with Ladyman et al,[31] < 3 indicated greater satisfaction and ≥3 indicated less satisfaction or not applicable). Work status was measured with a single item asking if the participant currently

Table 1
Sample demographic and descriptive data on infant sleep location and patterns by maternal ethnicity

	Māori	Non-Māori	*p*
Demographic characteristics			
Sample n (%)	383 (35.3)	702 (64.7)	
Maternal age *years*, mean (SD, range)[a]	28.41 (6.32, 16-43)	32.08 (5.21, 16-46)	**<.001**
Infant age *weeks*, mean (SD, range)[a]	12.09 (1.3, 6-22)	12.17 (0.97, 9-21)	.345
Infant ethnicity, % (95% CI)			**<.001**
Māori	96.6 (94.4-98.1)	8.3 (6.4-10.5)	
Non-Māori	3.4 (1.9-5.6)	91.7 (89.5-93.6)	
NZDep level, % (95% CI)			**<.001**
Low (1-3)	15.2 (11.9-19.1)	39.7 (36.1-43.3)	
Medium (4-7)	38.8 (34.1-43.8)	42.7 (39.0-46.3)	
High (8-10)	45.9 (41.0-51.0)	17.7 (15.0-20.6)	
Infant sleep characteristics, % (95% CI)			
Night sleep location			
Room-sharing	66.1 (61.2-70.7)	48.3 (44.6-52.0)	**<.001**
Bedsharing	14.4 (11.1-18.1)	5.4 (3.9-7.3)	**<.001**
Independent sleep (own room)	19.8 (16.1-24.1)	42.2 (38.6-45.8)	**<.001**
In sibling or other room, in cot or bassinet	2.1 (1.0-3.9)	0.9 (0.4-1.8)	.085
Other	1 (0.4-2.5)	0.9 (0.4-1.8)	.755
Day sleep location (room)			
Parent room	47.9 (42.9-52.9)	32.5 (29.1-36.0)	**<.001**
Own room	21.7 (17.8-26.1)	39.6 (36.0-43.3)	**<.001**
Sibling or other's room	0.5 (0.1-1.7)	0.4 (0.1-1.1)	.814
Another room of the house	18.0 (14.4-22.1)	9.3 (7.3-11.6)	**<.001**
With mum or another person (e.g., Being held, sling)	13.2 (10.1-16.9)	9.0 (7.0-11.3)	**.029**
Moving around with mum (e.g., In pram or basket)	18.0 (14.4-22.1)	17.5 (14.8-20.5)	.848
Day sleep location (sleep surface)			
Bassinet or cot	72.6 (68.0-76.9)	73.6 (70.3-76.8)	.706
Parent bed	11.3 (8.4-14.8)	3.1 (2.0-4.6)	**<.001**
Infant seat	5.8 (3.8-8.5)	4.8 (3.4-6.6)	.502
Held	8.7 (6.2-11.8)	8.8 (6.9-11.1)	.935
Pram	8.2 (5.7-11.2)	12.7 (10.4-15.3)	**.024**
Other	13.6 (10.4-17.3)	11.4 (9.2-13.9)	.294
Night sleep location change (nights/week)			**<.001**
0 (never)	63.7 (58.8-68.4)	77.6 (74.4-80.6)	
1-3 nights	20.4 (16.6-24.6)	12.1 (9.9-14.7)	
4-6 nights	8.6 (6.1-11.7)	3.3 (2.1-4.8)	
7 (every night)	7.5 (5.0-10.2)	7.0 (5.3-9.0)	
Help to sleep			**.002**
Never	6.0 (4.0-8.8)	12.2 (9.9-14.7)	
Rarely	38.6 (33.8-43.5)	41.6 (38.0-45.3)	
Often	41.5 (36.6-46.5)	33.0 (29.6-36.6)	
Always	13.9 (10.7-17.7)	13.2 (10.8-15.8)	
Night waking (wakings/night)			.703
0	16.4 (13.0-20.4)	16.4 (13.8-19.3)	
1	46.5 (41.5-51.5)	45.9 (42.2-49.6)	
2	26.9 (22.6-31.5)	29.3 (26.1-32.8)	
≥3	10.2 (7.5-13.5)	8.4 (6.5-10.6)	
Night LSRSP			.227
<2 h	0.8 (0.2-2.1)	0.1 (0.0-0.7)	
2-4 h	13.3 (10.2-17.0)	12.4 (10.1-15.0)	
>4 h	85.9 (82.2-89.1)	87.4 (84.8-89.7)	
Day LSRSP			**<.001**
<1 h	5.7 (3.7-8.4)	11.3 (9.1-13.7)	
1-2 h	26.6 (22.4-31.2)	35.0 (31.6-38.6)	
2-3 h	34.5 (29.8-39.3)	34.5 (31.0-38.0)	
>3 h	33.2 (28.6-38.0)	19.2 (16.4-22.3)	
Reasonable mat. sleep (days/week)			.084
0 (never)	3.7 (2.1-5.9)	4.3 (3.0-6.0)	
1-3 d	19.6 (15.8-23.8)	13.8 (11.4-16.5)	
4-6 d	45.2 (40.2-50.2)	46.2 (42.6-49.9)	
7 (always)	31.6 (27.1-36.4)	35.7 (32.2-39.3)	
Opportunity for mat. daytime breaks (days/week)			**.022**
0 (never)	2.9 (1.5-4.9)	7.0 (5.4-9.2)	
1-3 d	24.6 (20.5-29.1)	24.5 (21.5-27.8)	
4-6 d	33.0 (28.4-37.8)	33.7 (30.2-37.2)	
7 (always)	39.5 (34.7-44.5)	34.7 (31.2-38.2)	
Day-to-day change/Consistency			**.001**
Always the same	10.2 (7.5-13.5)	5.7 (4.2-7.6)	
Change occasionally	62.6 (57.6-67.3)	54.0 (50.3-57.7)	
Change often	18.8 (15.2-23.0)	29.3 (26.0-32.7)	
Every day is different	8.4 (5.9-11.5)	11.0 (8.8-13.5)	
Perceived problem, *n* (%)	18.0 (14.4-22.1)	26.1 (22.9-29.4)	**.003**

Abbreviations: LSRSP, longest self-regulated sleep period; Mat., maternal; NZDep, New Zealand Deprivation Index.

[a] Analyzed with independent t-test, all others with Chi-Square tests.

Table 2
Socio-ecological factors associated with infant night sleep location and patterns

	Bedsharing	Room-sharing	Independent sleep	Night waking[a]	Night LSRSP ≤4 h	Night loc. change
	OR (95% CI)	OR (95% CI)	OR (95% CI)	OR (95% CI)	OR (95% CI)	OR (95% CI)
Mat. ethnicity (Māori)	**1.945 (1.186-3.190)****	**1.591 (1.176-2.153)****	**0.472 (0.336-0.662)*****	1.004 (0.763-1.322)	0.943 (0.600-1.483)	1.386 (0.998-1.925)
Mat. age	0.987 (0.946-1.030)	0.993 (0.968-1.018)	0.999 (0.972-1.026)	**1.036 (1.013-1.060)****	1.007 (0.970-1.045)	0.990 (0.963-1.0170)
Infant age	**1.178 (1.025-1.355)***	0.937 (0.848-1.035)	1.025 (0.921-1.141)	0.988 (0.904-1.081)	0.962 (0.829-1.116)	1.031 (0.927-1.147)
NZDep (ref: Low, 0-3)						
Med (4-7)	1.721 (0.916-3.234)	1.136 (0.841-1.534)	0.927 (0.679-1.265)	0.904 (0.687-1.189)	0.839 (0.524-1.343)	0.890 (0.622-1.273)
High (8-10)	**2.433 (1.255-4.715)****	**1.719 (1.193-2.477)****	**0.477 (0.318-0.715)*****	1.243 (0.890-1.736)	1.105 (0.650-1.877)	1.099 (0.731-1.652)
Parity (Multip.)	1.086 (0.679-1.736)	**1.394 (1.070-1.815)***	**0.691 (0.521-0.916)***	0.803 (0.632-1.019)	0.944 (0.632-1.410)	**1.456 (1.077-1.969)***
EPDS	**1.059 (1.008-1.112)***	0.995 (0.965-1.027)	0.968 (0.935-1.002)	**1.053 (1.024-1.083)*****	**1.064 (1.019-1.111)****	1.011 (0.977-1.046)
Relationship (greater satisfaction)	0.850 (0.520-1.388)	**0.637 (0.474-0.856)****	**1.609 (1.162-2.228)****	1.024 (0.787-1.332)	0.966 (0.625-1.491)	**0.715 (0.519-0.983)***
Life stress	1.187 (0.727-1.937)	0.967 (0.729-1.283)	0.894 (0.660-1.211)	1.063 (0.823-1.374)	0.971 (0.633-1.491)	**1.442 (1.051-1.978)***
Breastfed (excl.)	**1.821 (1.141-2.906)***	1.143 (0.882-1.480)	**0.659 (0.500-0.869)****	**1.396 (1.102-1.768)****	1.106 (0.747-1.637)	0.832 (0.620-1.115)
Working	1.585 (0.821-3.062)	0.891 (0.578-1.375)	0.859 (0.532-1.387)	**1.635 (1.096-2.438)***	1.107 (0.592-2.070)	**1.800 (1.145-2.831)***
Bedsharing				**3.562 (2.331-5.444)*****	**3.299 (1.956-5.562)*****	**2.383 (1.502-3.782)*****

Abbreviations: EDPS, Edinburgh Postnatal Depression Scale; excl., exclusive; LSRSP, longest self-regulated sleep period; Mat., maternal; multip, multiparous; NZDep, New Zealand Deprivation Index.

*** $p < .001$.

** $p < .01$.

* $p < .05$.

[a] Night Waking analyzed with ordinal logistic regression, all other others with binary logistic regression.

works for *pay, profit or income.* Responses were *No; Yes, one paid job;* or *Yes, more than one paid job;* dichotomized to No/Yes.

Data analysis

Analyses were conducted using IBM SPSS (Version 28).

Descriptive analyses: Bivariate associations with infant and maternal age were analyzed using independent t-Tests; Chi-square tests were used for all other categorical variables.

Multivariable analyses: The relative impact of different socio-ecological factors on sleep outcome variables were assessed with multivariable logistic regression models. Ordinal logistic regression was used for *Night Waking* and *Daytime LSRSP. Bedsharing* (nighttime bedsharing vs. all other night sleep locations) was examined as both an outcome variable (what factors are associated with bedsharing?) and a covariate (is bedsharing associated with other sleep outcomes?). Independent variables were consistent across all models, except for the "Sleep Problem" model, which included infant sleep outcomes as independent variables and additional variables pertaining to maternal sleep (duration and quality).

Results

Table 1 details sample demographics and infant sleep characteristics by maternal ethnicity.

Sample demographics

Māori mothers were younger, with a greater proportion living in more deprived areas, compared to non-Māori mothers. Infant age ranged from 6-22 weeks; however, the standard deviation was relatively small (1.3 and 0.97 weeks for Māori and non-Māori, respectively), indicating more than 90% of mothers completed the survey within the requested timeframe (when infants were 11-13 weeks old). There was no difference in infant age based on maternal ethnicity. Most infants belonged to the same ethnic group as their mothers, however, 3.4% of Māori mothers had non-Māori infants, and 8.3% of non-Māori mothers had Māori infants.

Sleep location

At night, both room-sharing and bedsharing was more common among Māori than non-Māori mothers. Non-Māori mothers were more likely to report independent (i.e., own room) infant sleep, and they were also more likely to report never changing their infant's sleep location overnight. During the day, approximately three quarters of infants slept in a cot or bassinet, this did not differ by ethnicity. Conversely, ethnic differences were seen in other day sleep locations and surfaces.

Infant sleep patterns

Nearly half of mothers reported their infants woke once between 10 PM and 6 AM (Māori (M) 46.5%, non-Māori (nM) 45.9%), around one quarter reported waking twice, 16% reported no wakings, and 8%-10% reported ≥3 wakings. Most mothers reported nighttime LSRSP greater than 4 hours (M 85.9%, nM 87.4%). There were no differences in number of night wakings or night LSRSP by ethnicity. However, Māori mothers were more likely to report longer (> 3 hours) daytime LSRSP, and non-Māori mothers were more likely to report shorter daytime LSRSPs (< 1 and 1-2 hours).

Mothers' experiences of infant sleep

Most mothers reported their infants' sleep allowed them a reasonable amount of sleep on 4 or more days/week, which did not differ by ethnicity. However, non-Māori mothers were more likely to report their infants' daytime sleep patterns never allowed them to take a break (M 2.9% vs. nM 7.0%,). A large majority (> 90%) of mothers reported at least occasional day-to-day change in their infants' sleep patterns, though Māori mothers were more likely to report day-to-day consistency. Māori mothers were also more likely to report their infants "often" went to sleep with help from others and were less likely to rate their infants' sleep as problematic (M 18.0% vs. nM 26.1%).

Factors associated with infant sleep characteristics

Tables 2 and 3 present results from multivariable logistic models on the factors associated with infant sleep characteristics. After controlling for covariates, maternal ethnicity remained associated with infant sleep location. Ethnicity was not independently associated with key measures of infant sleep development, including night waking, nighttime LSRSP, night sleep location change, or the infant having help from others to go to sleep. Higher deprivation was associated with higher odds of bedsharing and room-sharing, and

Table 3
Socio-ecological factors associated with infant day sleep location and patterns, and the maternal experience of infant sleep

	Shorter daytime LSRSP[a]	Mat. daytime breaks	Reasonable mat. sleep	Help to sleep	Consistency
	OR (95% CI)	OR (95% CI)	OR (95% CI)	OR (95% CI)	OR (95% CI)
Mat. ethnicity (Māori)	**0.588 (0.448-0.773)*****	0.747 (0.536-1.040)	1.251 (0.862-1.817)	1.201 (0.892-1.617)	**0.637 (0.463-0.876)****
Mat. age	1.020 (0.998-1.042)	0.995 (0.969-1.022)	1.026 (0.995-1.059)	0.990 (0.966-1.015)	**1.040 (1.013-1.067)****
Infant age	1.061 (0.974-1.155)	0.944 (0.846-1.052)	0.990 (0.876-1.120)	0.959 (0.871-1.056)	0.945 (0.850-1.050)
NZDep (ref: Low, 0-3)					
Med (4-7)	1.02 (0.780-1.334)	0.907 (0.655-1.256)	0.769 (0.521-1.137)	1.050 (0.778-1.417)	1.011 (0.741-1.379)
High (8-10)	0.802 (0.58-1.108)	0.753 (0.506-1.121)	1.031 (0.660-1.611)	1.362 (0.951-1.952)	0.964 (0.661-1.406)
Parity (multip)	**0.585 (0.462-0.741)*****	1.112 (0.836-1.480)	1.304 (0.933-1.824)	0.835 (0.643-1.083)	0.912 (0.695-1.199)
EPDS	**1.032 (1.004-1.061)***	**1.084 (1.049-1.120)*****	**1.117 (1.077-1.158)*****	1.024 (0.993-1.056)	1.031 (0.998-1.064)
Relationship (greater satisfaction)	1.128 (0.869-1.464)	0.886 (0.648-1.210)	0.903 (0.633-1.289)	1.25 (0.935-1.671)	**0.674 (0.498-0.910)***
Life stress	1.24 (0.965-1.593)	1.027 (0.756-1.395)	1.115 (0.782-1.591)	1.254 (0.950-1.656)	1.055 (0.787-1.413)
Breastfed (excl.)	0.971 (0.773-1.220)	0.969 (0.733-1.281)	1.050 (0.757-1.456)	1.024 (0.794-1.322)	1.23 (0.941-1.608)
Working	1.141 (0.782-1.665)	0.826 (0.510-1.338)	1.142 (0.679-1.921)	1.193 (0.776-1.832)	0.769 (0.483-1.224)
Bedsharing	1.073 (0.709-1.623)	**2.169 (1.369-3.435)****	1.396 (0.832-2.343)	1.807 (1.138-2.872)*	1.012 (0.629-1.627)

Abbreviations: EDPS, Edinburgh Postnatal Depression Scale; excl., exclusive; LSRSP, longest self-regulated sleep period; Mat., maternal; multip, multiparous; NZDep, New Zealand Deprivation Index.
*** $p < .001$.
** $p < .01$.
* $p < .05$.
[a] Night Wakings and Daytime LSRSP analysed with ordinal logistic regression, all other others with binary logistic regression.

lower odds of independent sleep, but was not associated with developmental markers of sleep.

Factors associated with increased odds of night waking were older maternal age, more maternal depression symptoms, exclusive breastfeeding, having returned to work, and bedsharing. Factors associated with shorter nighttime LSRSP were maternal depression symptoms, and bedsharing.

The relationship between sleep location and breastfeeding status appeared to change with changes to nighttime mother-infant proximity, with a positive association between bedsharing and breastfeeding (OR 1.82, p = .012), no association between roomsharing and breastfeeding, and a negative association between independent infant sleep and breastfeeding (OR 0.66, p = .003).

Characterizing perceived sleep problems

As presented in Table 4, factors associated with decreased odds of a perceived sleep problem were multiparity, greater relationship satisfaction, higher life stress, being in paid employment, and bedsharing. Conversely, factors associated with increased odds of perceived problematic sleep included more maternal depression symptoms and fewer maternal opportunities for sleep and rest.

There was a dose-response relationship between night waking and perceived problem sleep; compared to mothers whose infants did not wake between 10 PM and 6 AM, mothers whose infants woke once were no more likely to rate their infant's sleep as problematic, while mothers whose infants woke twice had approximately 2x increased odds, and those whose infants woke three or more times had more than 4.5x increased odds. Daytime LSRSP < 1 hour was associated with a perceived sleep problem, but night LSRSP was not.

Neither maternal sleep duration nor quality were associated with a perceived infant sleep problem, however measures that aimed to capture the maternal experience of infant sleep (Fewer *maternal opportunities for daytime breaks*; infant receives *help to sleep*; *day to day change* in infant sleep patterns) were each associated with more than 2x increased odds of a perceived sleep problem.

Table 4
Infant sleep and socio-ecological factors associated with perceived infant sleep problem

	p	OR (95% CI)
Maternal ethnicity (Māori)	.538	0.873 (0.566-1.345)
Maternal age	.398	1.016 (0.980-1.053)
Infant age	.287	0.917 (0.782-1.076)
NZDep (ref: Low, 0-3)		
Med (4-7)	.676	0.915 (0.605-1.386)
High (8-10)	.218	0.723 (0.431-1.212)
Parity (multip.)	**<.001**	**0.461 (0.314-0.677)**
EPDS	**.001**	**1.077 (1.030-1.126)**
Relationship (greater satisfaction)	**.015**	**0.599 (0.397-0.904)**
Life stress	**.019**	**0.615 (0.410-0.922)**
Breastfed (excl.)	.381	0.850 (0.591-1.222)
Working	**.012**	**0.419 (0.213-0.824)**
Bedsharing	**.010**	**0.420 (0.217-0.812)**
Maternal sleep duration	.853	0.987 (0.856-1.137)
Maternal sleep quality	.305	1.082 (0.931-1.257)
Night wakings *(ref: 0 Wakings)*		
1 waking	.968	0.988 (0.538-1.815)
2 wakings	**.029**	**2.067 (1.078-3.965)**
≥3 wakings	**.001**	**4.460 (1.894-10.503)**
Night LSRSP ≤4 h	.470	0.807 (0.450-1.445)
Night location change	.599	1.116 (0.742-1.679)
Day LSRSP *(ref: > 3 h)*		
2-3 h	.760	0.920 (0.538-1.572)
1-2 h	.165	1.450 (0.858-2.450)
<1 h	**.045**	**1.986 (1.015-3.884)**
Opportunity for mat. daytime breaks (<half the week)	**<.001**	**2.640 (1.806-3.860)**
Reasonable maternal sleep (<half the week)	**.001**	**2.226 (1.414-3.505)**
Infant has help to sleep (often/always)	**<.001**	**2.290 (1.581-3.315)**
Day to day change (always/frequent)	**<.001**	**2.477 (1.725-3.557)**

Abbreviations: EDPS, Edinburgh Postnatal Depression Scale; excl., exclusive; LSRSP, longest self-regulated sleep period; multip, multiparous; NZDep, New Zealand Deprivation Index; Mat, maternal.

Discussion

This study described and compared the sleep of infants of Māori and non-Māori NZ mothers at approximately 12 weeks of age. It also drew on socio-ecological models of sleep health to explore factors associated with different sleep locations and patterns, and characterized maternal perceived infant sleep problems at this young age. Consistent with established literature, we found sleep at 12-week to be highly variable.[12,33] The infants of Māori and non-Māori mothers differed somewhat in *where* but less in *how* they were sleeping. A variety of factors were associated with perceived problems, and these did not always align with commonly accepted markers of sleep development.

A review of normal sleep patterns in infants and children found infants woke on average 0.8 times per night at 3-6 months and exhibited a mean longest sleep period of 5.7 hours at 0-5 months, though data varied widely – particularly for night waking.[12] Broadly in line with this, our findings showed almost half of Māori and non-Māori mothers reported one night waking, more than one quarter reported two wakings, and approximately 9% reported their infants woke three or more times, while approximately 16% reported their infants slept through the night. More than 85% of both groups reported night LSRSPs longer than 4 hours. We found no evidence of ethnic inequities in key developmental aspects of sleep at 12 weeks; night waking and night LSRSP. These findings add to prior research to suggest sleep health inequities emerge somewhere between 3 months and 3 years as a result of exposure to ethnic inequities in social determinants of health.[6,12]

According to both the American Academy of Pediatrics and the NZ Ministry of Health, room-sharing on a separate, flat sleep surface is recommended as the safest sleep location for infants under 6 months, to avoid sleep-related infant deaths.[34,35] Māori mothers were more likely to report room-sharing, in line with recommendations. Both groups also reported sleep practices inconsistent with recommendations; Māori mothers were more likely to report bedsharing, and non-Māori mothers were more likely to report their infants slept independently, in their own bedrooms. These findings were broadly consistent with prior work on infant sleep practices in NZ.[36,37] This study was novel in the level of detail it provided on day sleep location and patterns at 12 weeks, which were found to be particularly variable.

Our rates of room-sharing are ostensibly positive, and yet should be considered in light of a range of potential drivers. In addition to higher rates of room-sharing among Māori, room-sharing was more common among dyads in the high deprivation category. Research indicates people who live in more deprived areas are more likely to live in overcrowded, underheated homes; factors that might contribute to both room- and bedsharing rates.[38-40] It is well known that Māori are over-represented in the most deprived neighborhoods of NZ, and so our findings may reflect, at least in part, the inequitable distribution of SEP by ethnicity. Marginalized groups have fewer structural opportunities for sleep-supporting practices,[9,41] and the recommended practice of room-sharing may not always confer the intended safety benefits in this context. For example, one study found room-sharing was associated both with lower SEP, and higher rates of overnight transitions to bedsharing, against recommendations.[42] Conversely, other studies report no relationship between SEP and sleep location, and find bedsharing to be an increasingly common practice returning to Western culture, largely to facilitate the recommended practice of breastfeeding.[40,43] Together these findings[40,42,43] highlight the need for nuanced explorations of infant sleep practices in future research. Findings from such work could help to address structural barriers to safe sleep while supporting families to navigate their unique sleep preferences alongside risk-reduction recommendations and available resources.

Consistent with current literature, mother-infant proximity at nighttime was also associated with breastfeeding.[40,43,44] We found bedsharing infants had increased odds of breastfeeding and, conversely, independent sleeping infants had decreased odds. Also in line with socio-ecological models, maternal depressive symptoms were associated with more night waking, shorter night- and day LSRSP, and fewer opportunities for reasonable maternal sleep. Directionality cannot be determined in this cross-sectional study, but research suggests the relationship between maternal depression and infant sleep is bi-directional.[45]

We found a dose-response relationship between night waking and a perceived infant sleep problem, underscoring the salience of night waking in parents' perceptions of infant sleep.[17-19] One waking (vs. none) showed no effect, suggesting some night waking is expected in early infancy.[3,20] Conversely, two wakings was associated with a two-fold increase in a perceived problem, and three plus with a more than four-fold increase. These results are striking given we found that at 12 weeks, infants are more likely wake twice than not at all. They point to a tension between what is normative for infants and what is expected and/or manageable for caregivers. Eagerness among mothers to ease this tension is evident in participant feedback from intervention studies aimed at supporting sleep in early infancy.[46,47] In addition to night waking, the association between a perceived sleep problem and infants receiving more help settling to sleep is consistent with prior research.[21,48] Contrary to established findings,[17-19] night LSRSP was not associated with a perceived problem in the current study, perhaps due to a ceiling effect in our LSRSP variable.

Our study highlights the pertinence of day sleep, with short daytime LSRSP, more day-to-day change in sleep patterns, and fewer opportunities for daytime breaks all associated with a perceived sleep problem. This aligns with research that indicates issues with napping is the most frequently reported sleep concern by caregivers of infants.[18] Our somewhat surprising finding that mothers who had returned to work were less likely to perceive a sleep problem might be explained by a reduced sensitivity to nap difficulties in this group. Consistent with this idea, one study showed that while mothers reported similar levels of stress regardless of work status, stress levels were more tightly linked to infant sleep disturbances among mothers on parental leave, compared to those working outside the home.[49]

Research suggests infant sleep patterns that cause more parental sleep disturbance are more likely to be perceived as problematic, particularly in Western culture.[50] We found an association between a perceived problem and mothers' subjective judgments of whether their infants' sleep patterns afforded mothers reasonable sleep, but not with self-reported maternal sleep duration, nor quality. Individual differences in sleep needs and adaptability may affect how mothers experience infant-related sleep disturbances.[51,52]

Several socio-ecological variables were associated with a perceived infant sleep problem, including maternal depression symptoms, life stress, and relationship satisfaction. These findings support a recently proposed model by D'Souza and colleagues[16] that emphasizes the role of contextual factors in parents' perceptions of their children's sleep. Similar to other findings,[48] bedsharing was not associated with a perceived sleep problem, despite its association with common Western indices of poorer sleep development.[17-19] Some authors suggest that mothers who choose to bedshare might have more realistic expectations of infant sleep.[3,16,20] Others offer culture-based explanations; Latz and colleagues[53] found bedsharing was associated with sleep problems among American but not Japanese infants. Alternatively, in the context of high deprivation, infant sleep might be evaluated less negatively relative to concurrent challenges.[54] Indeed, we found high life stress was associated with decreased odds of a perceived sleep problem. Reasons for bedsharing were not assessed in the current study, and these tentative interpretations require empirical investigation.

Our findings have important clinical and public health implications. Large intra- and inter-infant variability in sleep patterns is expected in early infancy, and parents should be supported to anticipate and manage the significant challenge this brings. Support should include the provision of perinatal services that are fit for purpose. Research indicates fear of judgment from health providers prevents many mothers from disclosing their sleep practices and concerns.[55] This leads to the provision of insufficient or unsuitable care that ultimately perpetuates perceived problems and maternal distress.[55] It is critical that services are open and responsive to families' unique needs.

A key strength of this study lies in the Kaupapa Māori methodological approach of *Moe Kura*,[23] which provided a sample broadly representative of the NZ mother-infant population with sufficient analytical power to explore Māori/non-Māori differences. Another strength was its inclusion of detailed day sleep data. Where most studies have focused primarily on night sleep, our findings indicate day sleep is more variable than night sleep and highly relevant to maternal perceptions of infant sleep. Finally, our study provides a strong basis for future research. The misalignment of normative sleep patterns with the characteristics of perceived problems requires further exploration. The relationship between maternal depression and child sleep also warrants further research. We found symptoms of maternal depression were associated with multiple domains of infant sleep, and perceived sleep problems. Elucidating potential mechanisms of transmission might point to interventions that can benefit maternal mental health and child sleep.

Study limitations include the cross-sectional design, which precludes causal inference, and the exclusive reliance on maternal self-reports during a challenging life stage. However, since parental experiences of infant sleep often drive presentations to health services, our measures had good ecological validity. A related limitation is our exclusive focus on maternal experiences. This fits with the broader aims of the *Moe Kura* study but means our findings cannot be generalized to other caregiver-infant dyads. There were also limitations to some measures. Our sleep-surface multichoice options did not include wahakura (Indigenous flax basket) or Pēpi Pod (plastic bassinet); two in-bed, bassinet-like sleep devices often used in NZ, particularly among Māori.[38] Bedsharing rates might have been overestimated if mothers selected the "parent-bed" option for wahakura or Pēpi Pod bassinets. However, it is reassuring that our bedsharing rates align with other NZ research.[56] We did not assess reasons for bedsharing, which appear highly relevant to parental perceptions of infant sleep.[57] We also had no suitable measure of infant temperament, so could not account for this aspect of infant regulation. Some studies have found infant temperament is related to infant sleep,[58] while others have not.[59] Our measure of night LSRSP prevented analysis of LSRSP beyond the maximum response option of >4 hours; including longer durations might have revealed more and/or stronger associations.[12]

Conclusion

In line with prior research, we found infant sleep at ~12 weeks of age to be highly variable, particularly during the day. Infants of Māori and non-Māori mothers differed somewhat in *where* but less in *how* they were sleeping. No ethnic differences were found in key measures of sleep development: night waking and night LSRSP, indicating sleep-health inequities evident in prior research emerge somewhere between 3 months and 3 years, likely resulting from exposure to ethnic inequities in social determinants of health. Māori mothers were more likely to room- or bedshare with their infants, the infants of non-Māori mothers were more likely to sleep independently. This study drew on socio-ecological models of infant sleep and found several factors were related to different dimensions of infant sleep at ~12 weeks, and to maternal perceptions of an infant sleep problem. It finds several important associations that provide a strong basis for future research.

Funding

This study was conducted with funding from the Health Research Council of New Zealand (HRC 08/547 and 09/255) and Massey University. M. L. Carter was supported during this project by a Vice Chancellor's Doctoral Scholarship from Massey University.

Author contributions

Mikaela Carter: Conceptualization, Methodology, Formal analysis, Writing - original draft, Writing - review & editing, Visualization. **Leigh Signal**: Conceptualization, Methodology, Writing - review & editing, Investigation, Resources, Data curation, Supervision, Project administration, Funding acquisition. **Sarah-Jane Paine**: Writing - review & editing, Supervision, Project administration, Funding acquisition. **Bronwyn M. Sweeney**: Writing - review & editing, Supervision. **Joanne E. Taylor**: Writing - review & editing, Supervision.

Declaration of conflicts of interest

No potential conflict of interest was reported by the author(s).

Acknowledgments

We gratefully acknowledge the contribution of the participating women and children. We also thank individuals and organizations who assisted in promoting the study during participant recruitment, the research assistants who helped with data entry, and the study advisory group for their guidance and support.

Appendix A. Supporting information

Supplementary data associated with this article can be found in the online version at doi:10.1016/j.sleh.2024.10.010.

References

1. El-Sheikh M, Sadeh A. Sleep and development: introduction to the monograph. *Monogr Soc Res Child Dev*. 2015;80(1):1–14.
2. Marsh S, Maddison R, Choi YC, Pillai A, Morton S. Development of resilience to overweight and obesity in vulnerable children: evidence from Growing Up in New Zealand. *J Child Obes*. 2019;4(2:2):1–9.
3. Barry ES. Sleep consolidation, sleep problems, and co-sleeping: rethinking normal infant sleep as species-typical. *J Genet Psychol*. 2021;182(4):183–204.
4. Tikotzky L, Volkovich E, Meiri G. Maternal emotional distress and infant sleep: a longitudinal study from pregnancy through 18 months. *Dev Psychol*. 2021;57(7):1111–1123.
5. Muller D, Paine SJ, Wu LJ, Signal TL. "Their sleep means more harmony": maternal perspectives and experiences of preschoolers' sleep in ethnically and socio-economically diverse families in Aotearoa/New Zealand. *Qual Health Res*. 2019;29(14):2023–2034.
6. Paine SJ, Muller DP. A methodological approach to understanding ethnic inequities in sleep health. In: Kushida CA, Hoban T, Leibowit S, Wise M, eds. *Encyclopedia of Sleep and Circadian Rhythms*. Amsterdam, Netherland; Oxford, UK; Cambridge, USA: Elsevier; 2023:769–777. ; 5.
7. Braveman P. What is health equity: and how does a life-course approach take us further toward it? *Matern Child Health J*. 2014;18(2):366–372.
8. Billings ME, Cohen RT, Baldwin CM, et al. Disparities in sleep health and potential intervention models: a focused review. *Chest*. 2021;159(3):1232–1240.
9. Muller D, Paine S-J, Signal TL. The role of sleep in health and health inequities in early childhood in Aotearoa New Zealand. *J R Soc N Z*. 2022;53(5):570–586.
10. Goodlin-Jones BL, Burnham MM, Anders TF. Night waking, sleep-wake organization, and self-soothing in the first year of life. *J Dev Behav Pediatr*. 2001;22(4):226–233.
11. Oskar JG, Carskadon MA. Life cycles: infants to adolescents. In: Amlaner CJ, Fuller PM, eds. *Basics of Sleep Guide*. 2nd ed Westchester, IL: Sleep Research Society; 2009.
12. Galland BC, Taylor BJ, Elder DE, Herbison P. Normal sleep patterns in infants and children: a systematic review of observational studies. *Sleep Med Rev*. 2012;16(3):213–222.
13. Henderson JM, France KG, Blampied NM. The consolidation of infants' nocturnal sleep across the first year of life. *Sleep Med Rev*. 2011;15(4):211–220.
14. Meltzer LJ, Williamson AA, Mindell JA. Pediatric sleep health: it matters, and so does how we define it. *Sleep Med Rev*. 2021;57:101425.
15. Harris R, Tobias M, Jeffreys M, Waldegrave K, Karlsen S, Nazroo J. Racism and health: the relationship between experience of racial discrimination and health in New Zealand. *Soc Sci Med*. 2006;63(6):1428–1441.
16. D'Souza L, Cassels T. Contextual considerations in infant sleep: offering alternative interventions to families. *Sleep Health*. 2022;9(5):618–625.
17. Henderson JMT, Motoi G, Blampied NM. Sleeping through the night: a community survey of parents' opinions about and expectations of infant sleep consolidation. *J Paediatr Child Health*. 2013;49(7):535–540.
18. Mindell JA, Collins M, Leichman ES, et al. Caregiver perceptions of sleep problems and desired areas of change in young children. *Sleep Med*. 2022;92:67–72.
19. Sadeh A, Mindell J, Rivera L. "My child has a sleep problem": a cross-cultural comparison of parental definitions. *Sleep Med*. 2011;12(5):478–482.
20. Ball HL. Supporting parents who are worried about their newborn's sleep. *BMJ*. 2013;346:f2344.
21. Bayer JK, Hiscock H, Hampton A, Wake M. Sleep problems in young infants and maternal mental and physical health. *J Paediatr Child Health*. 2007;43(1-2):66–73.

22. Mindell JA, Leichman ES, Walters RM. Sleep location and parent-perceived sleep outcomes in older infants. *Sleep Med*. 2017;39:1–7.
23. Signal TL, Sweeney BM, Muller DP, Ladyman CI, Wu L, Paine SJ. Moe Kura: a longitudinal study of mother and child sleep and well-being in Aotearoa New Zealand. *J R Soc N Z*. 2022;52(3):283–300.
24. Sadeh A. A brief screening questionnaire for infant sleep problems: validation and findings for an internet sample. *Pediatrics*. 2004;113(6):e570–e577.
25. Lee KA. Self-reported sleep disturbances in employed women. *Sleep*. 1992;15(6):493–498.
26. Stats NZ. Ethnicity standard classification: consultation, Stats NZ; 2019.
27. Salmond C, Crampton P, Atkinson J. NZDep2006 Index of deprivation. Department of Public Health, University of Otago, Wellington; 2007.
28. Vaipuna TFW, Williams SM, Farmer VL, et al. Sleep patterns in children differ by ethnicity: cross-sectional and longitudinal analyses using actigraphy. *Sleep Health*. 2018;4(1):81–86.
29. Cox JL, Holden JM, Sagovsky R. Detection of postnatal depression. Development of the 10-item Edinburgh Postnatal Depression Scale. *Br J Psychiatry*. 1987;150:782–786.
30. Shulman HB, D'Angelo DV, Harrison L, Smith RA, Warner L. The Pregnancy Risk Assessment Monitoring System (PRAMS): overview of design and methodology. *Am J Public Health*. 2018;108(10):1305–1313.
31. Ladyman C, Signal TL, Sweeney B, et al. Multiple dimensions of sleep are consistently associated with chronically elevated depressive symptoms from late pregnancy to 3 years postnatal in Indigenous and non-Indigenous New Zealand women. *Aust N Z J Psychiatry*. 2021;55(7):687–698.
32. Signal TL, Paine SJ, Sweeney B, et al. The prevalence of symptoms of depression and anxiety, and the level of life stress and worry in New Zealand Māori and non-Māori women in late pregnancy. *Aust N Z J Psychiatry*. 2017;51(2):168–176.
33. Jenni OG, Carskadon MA. Sleep behavior and sleep regulation from infancy through adolescence: normative aspects. *Sleep Med Clin*. 2012;7(3):529–538.
34. Ministry of Health NZ. Sudden Unexpected Death in Infancy: an analysis of coronial SUDI Liaison Reports from September 2018 to June 2020 with subsequent recommendations. New Zealand Government; 2022.
35. Moon RY, Carlin RF, Hand I. Evidence base for 2022 updated recommendations for a safe infant sleeping environment to reduce the risk of sleep-related infant deaths. *Pediatrics*. 2022;150(1):1–47.
36. Tipene-Leach D, Hutchison L, Tangiora A, et al. SIDS-related knowledge and infant care practices among Māori mothers. *N Z Med J*. 2010;123(1326):88–96.
37. Scragg RKR, Mitchell EA, Stewart AW, et al. Infant room-sharing and prone sleep position in sudden infant death syndrome. *Lancet*. 1996;347:7–12.
38. Tipene-Leach D, Fidow JF. Sudden Unexpected Death in Infancy Prevention in New Zealand: The Case for Hauora - A Wellbeing Approach. Wellington: Ministry of Health; 2022. 9781991100528.
39. Wilson KE, Miller AL, Lumeng JC, Chervin RD. Sleep environments and sleep durations in a sample of low-income preschool children. *J Clin Sleep Med*. 2014;10(3):299–305.
40. Wennergren G, Stromberg Celind F, Goksor E, Alm B. Swedish survey of infant sleep practices showed increased bed-sharing and positive associations with breastfeeding. *Acta Paediatr*. 2021;110(6):1835–1841.
41. Reid P, Cormack D, Paine SJ. Colonial histories, racism and health-the experience of Maori and Indigenous peoples. *Public Health*. 2019;172:119–124.
42. Paul I, Hohman E, Loken E, et al. Mother-infant room-sharing and sleep outcomes in the INSIGHT study. *Pediatrics*. 2017;140(1) e20170122-e20170122.
43. Blair PS, Ball HL. The prevalence and characteristics associated with parent-infant bed-sharing in England. *Arch Dis Child*. 2004;89(12):1106–1110.
44. Baddock SA, Purnell MT, Blair PS, Pease AS, Elder DE, Galland BC. The influence of bed-sharing on infant physiology, breastfeeding and behaviour: a systematic review. *Sleep Med Rev*. 2019;43:106–117.
45. Sadeh A, Tikotzky L, Scher A. Parenting and infant sleep. *Sleep Med Rev*. 2010;14(2):89–96.
46. Ball HL, Douglas PS, Kulasinghe K, Whittingham K, Hill P. The Possums Infant Sleep Program: parents' perspectives on a novel parent-infant sleep intervention in Australia. *Sleep Health*. 2018;4(6):519–526.
47. Sweeney BM, Leigh Signal T, Babbage DR. Effect of a behavioral-educational sleep intervention for first-time mothers and their infants: pilot of a controlled trial. *J Clin Sleep Med*. 2020;16(8):1265–1274.
48. Loutzenhiser L, Ahlquist A, Hoffman J. Infant and maternal factors associated with maternal perceptions of infant sleep problems. *J Reprod Infant Psychol*. 2011;29(5):460–471.
49. Sinai D, Tikotzky L. Infant sleep, parental sleep and parenting stress in families of mothers on maternity leave and in families of working mothers. *Infant Behav Dev*. 2012;35(2):179–186.
50. Mindell JA, Sadeh A, Kwon R, Goh DY. Relationship between child and maternal sleep: a developmental and cross-cultural comparison. *J Pediatr Psychol*. 2015;40(7):689–696.
51. Dongen HPAV, Baynard MD, Maislin G, Dinges DF. Systematic interindividual differences in neurobehavioral impairment from sleep loss: evidence of trait-like differential vulnerability. *Sleep*. 2004;27(3):423–433.
52. Fjell AM, Walhovd KB. Individual sleep need is flexible and dynamically related to cognitive function. *Nat Hum Behav*. 2024;8(3):422–430.
53. Latz S, Wolf AW, Lozoff B. Cosleeping in context: sleep practices and problems in young children in Japan and the United States. *Arch Pediatr Adolesc Med*. 1999;153(4):339–346.
54. Barry ES, McKenna JJ. Reasons mothers bedshare: a review of its effects on infant behavior and development. *Infant Behav Dev*. 2022;66:101684.
55. Clapham B, Breheny M, Reweti A, Severinsen C, Ware F, Aydin M. Missed opportunities for addressing maternal mental health: a thematic analysis of mothers' experiences of using the Well Child Tamariki Ora Service in Aotearoa NZ. *Health Soc Care Community*. 2024;2024:1–10.
56. Galland BC, Gray A, Sayers RM, et al. Safe sleep practices in a New Zealand community and development of a sudden unexpected death in Infancy (SUDI) risk assessment instrument. *BMC Pediatr*. 2014;14(1):1–9.
57. D'Souza L, Morris ZA, Borgkvist A, Blunden S. Understanding motivations and satisfaction with sleep location among co-sleeping (including bed-sharing) parents. *Fam Relat*. 2023;73:661–682.
58. Sorondo BM, Reeb-Sutherland BC. Associations between infant temperament, maternal stress, and infants' sleep across the first year of life. *Infant Behav Dev*. 2015;39:131–135.
59. Martini J, Petzoldt J, Knappe S, Garthus-Niegel S, Asselmann E, Wittchen HU. Infant, maternal, and familial predictors and correlates of regulatory problems in early infancy: the differential role of infant temperament and maternal anxiety and depression. *Early Hum Dev*. 2017;115:23–31.