Sleep, mental health and wellbeing among fathers of infants up to 1 year postpartum: A scoping review

Karen Wynter BScHons(Psych), MPhil (Education), PhD ^{1,2}

Lauren Francis ³ BPsych(Hons)

Richard Fletcher BSc, MMedSci, GDip IMH, PhD⁴

Nyanda McBride DipTeach, BEd, PGDHP, MPH, PhD⁵

Eileen Dowse RM, RN, DipCFHN, GDipHlthSc (Women's Health), MN, PhD⁶

Nathan Wilson BPD(P&C), BSc/BA(Hons), MEnvSus, D.Psych(Clinical)^{7,8}

Laura Di Manno DPsych (Clinical)³

Samantha Teague BBus/BPsych(Hons), PhD³

Jacqui A. Macdonald BA(Hons), GCertAdLearn&Leadership, GCertHigherEd, GDipProfWrit, PhD^{3,9,10}

and The Australian Fatherhood Research Consortium

Correspondence

Karen Wynter

1 Gheringhap Street, Geelong, Victoria, 3220, Australia,

Tel: +61 3 92468413

E-mail: k.wynter@deakin.edu.au

1. School of Nursing and Midwifery, Deakin University, Australia
2. Centre for Quality and Patient Safety Research - Western Health Partnership, Australia
3. Centre for Social and Early Emotional Development, School of Psychology, Faculty of Health, Deakin University, Australia
4. Family Action Centre, University of Newcastle, Australia
5. National Drug Research Institute, Faculty of Health Sciences, Curtin University, Australia
6. School of Nursing & Midwifery, University of Newcastle, Australia
7. Cognitive Behaviour Therapy Australia, Australia
8. Turner Institute for Brain and Mental Health, Monash University, Australia
9. Department of Paediatrics, University of Melbourne, Australia
10. Murdoch Children's Research Institute, Australia

Word count: 302

Sleep, mental health and wellbeing among fathers of infants up to 1 year postpartum: A scoping review

Abstract

Background

Sleep disturbance among adults has consequences for their health and functioning. Among mothers of infants, there is evidence that fatigue and sleep disturbance are significantly associated with depression, anxiety and impaired relationships with partners and infants. It is not known whether consistent evidence of such associations exists for fathers. The aim of this review was to describe what is known about fathers' sleep and its associations with mental health and wellbeing, in the first 12 months postpartum.

Methods

A scoping review was conducted, searching MEDLINE complete, Scopus, PsycINFO and CINAHL complete, from 1990 to 13 May 2019. Reference lists of relevant reviews were also searched. Articles were included if they were published in English, and reported on sleep among men cohabiting with their infants from birth to 12 months.

Results

Thirty-six papers reporting on 31 separate studies met inclusion criteria. Sleep constructs and assessment of these varied greatly. While some measures of fathers' sleep improved, fathers' fatigue increased significantly with increasing infant age. In adjusted analyses, fathers' sleep problems were associated with poorer mental health, relationships with infants and partners, and safety compliance at work.

22 Conclusions

23 Further research on fathers' sleep in the first postnatal year is recommended, including:
24 validation of brief self-report measures to assess sleep disturbance and fatigue; well-
25 designed longitudinal studies to clarify the causal direction of associations between infant
26 sleep, fathers' sleep and fathers' wellbeing; and development of interventions to improve
27 fathers' sleep, for example by supporting parents to address infant sleep problems.

28 Keywords:

29 Fathers, fatigue, mental health, sleep, wellbeing

30

31 Introduction

32 Sleep disturbance among new parents is common. Infant sleep tends toward short cycles
33 that are incongruent with typical adult diurnal patterns ¹. However, in up to a third of
34 parents, their infant's sleep is reported to be problematic ². Such problems are likely to be
35 associated with interrupted parental sleep.

36 Adult sleep disturbance is associated with increased risk for physical health conditions such
37 as diabetes, cardiovascular disease and cancer, as well as short- and long-term impacts on
38 individuals' motivation, emotions, and cognitive functioning ³⁻⁵. This is a particular concern
39 among new parents. Fatigue can lead to compromised executive control, suboptimal
40 performance and a higher degree of risk taken in everyday decisions ⁶, and may therefore
41 impact on the ability to care for infants ⁷.

42 Evidence for postnatal fatigue and sleep disturbance has mainly focused on mothers. Poor
43 maternal postnatal sleep quality is associated with anxiety and depressive symptoms ⁸⁻¹⁰,
44 and can interfere with relationships with intimate partners and infants ¹¹⁻¹⁵.

45 Less is known about fathers' sleep and fatigue, yet fathers' sleep disturbance may have far-
46 reaching implications for families. Many fathers return to work soon after the birth when
47 sleep deprivation may compromise safety in the workplace ¹⁶. At home, fathers' support and
48 engagement in infant care is protective of mothers' mental health ^{17,18}. However, sleep
49 disturbance increases risk of irritation and anger and decreases self-control, with potentially
50 adverse consequences for day-to-day interactions within the family ¹⁹. In addition, parents
51 report that infant crying, which can occur because infants are sleeping poorly, is a trigger for
52 angry or abusive behaviours towards their infants ²⁰.

A review of the associations between sleep and wellbeing in postpartum fathers is timely, given the changing role of fathers in family life. Prior reviews of parents with infants have been limited to sub-constructs of sleep and wellbeing, with few papers on fathers being eligible for inclusion. For example, a recent meta-analysis¹⁰ examined fatigue and depression among postpartum parents. Of the 35 included studies, only one reported data from fathers¹⁰. A review with a broader lens may provide a better understanding of the state of the literature, and help to guide future research to address areas of critical need. Therefore, we aimed to provide a concise snapshot of the literature investigating sleep in fathers of infants up to 12 months postpartum. Specifically, our objective was to map evidence and identify gaps in two areas:

(a) fathers' sleep (e.g., sleep disturbance, sleep quality, sleep quantity, sleepiness and fatigue); and

(b) associations between fathers' sleep functioning and their wellbeing. Given the likelihood that infant sleep disturbance is associated with reduced parental sleep quality¹, we also report on associations between infant sleep and fathers' wellbeing.

Methods

A scoping review was selected as the most appropriate methodology to identify key concepts and theories in an emerging topic of research²¹. Scoping reviews use the same systematic, rigorous methodologies as systematic reviews to search databases and extract data²². However, a formal evaluation of methodological quality of included studies is not performed because the aim is to provide a broad overview of the topic and types of evidence available irrespective of quality^{23,24}.

The Preferred Reporting of Systematic Reviews and Meta-Analysis (PRISMA) guidelines²⁵ were followed for conducting and reporting the results of this review. The review was pre-registered with PROSPERO, registration number CRD42017081737.

Search Strategy

Two search strategies were used. First, the literature databases MEDLINE complete, Scopus, PsycINFO and CINAHL complete were searched. In all searches, the keywords were organised into three key concepts and combined using the 'AND' Boolean operator: (fatigue or sleep) AND (postpartum) AND (father or man). Results were limited to English language, human populations and peer-reviewed academic journals. The search strategy in Cinahl complete is provided in Box 1. All searches were conducted on 13/05/2019, searching for literature from 1990.

Second, reference lists of identified relevant systematic reviews and meta-analyses were examined.

Screening was conducted in Covidence²⁶. All authors participated in double-screening of titles and abstracts. Double screening was also conducted for full text articles. Any discrepancies at either stage were subsequently resolved by two authors (KW & JM). A third reviewer was available to mediate disagreements, however this was not required.

Inclusion and exclusion criteria

Full-text qualitative and quantitative studies published in peer-reviewed academic journals were eligible if they: were published in English; reported on humans; included data from men with infants from birth to 12 months old who were cohabiting with their infants; and, reported data from men separately from women. The articles were required to assess sleep, fatigue, sleepiness, sleep quality or sleep disturbance among fathers OR associations

between these experiences and fathers' wellbeing OR associations between infant sleep or sleep disturbance and fathers' wellbeing. 'Wellbeing' was broadly defined to include fathers' mental health, general health and functioning in multiple contexts, as well as quality of relationships with intimate partners and infants, and perceived social support.

The limited timeframe (infant age 0 to 12 months) was based on longitudinal research which demonstrates that the number of night wakings and time awake during the night are highest when children are aged between 0-12 months ²⁷.

Case studies, opinion pieces, editorials, systematic reviews and meta-analyses were excluded, although reviews were scanned for references to additional eligible studies.

Results

Summary of included studies

The PRISMA Flowchart is presented in Figure 1.

Thirty-six papers reporting on 32 separate studies met inclusion criteria and are presented in Table 1.

PLEASE INCLUDE TABLE 1 ABOUT HERE

Of the 32 studies, twelve were North American (nine in the United States, three in Canada), seven Australasian (six in Australia, one in New Zealand), seven European (two in Finland, two in Germany, one each in Greece, the Netherlands and Sweden), four British, and two East Asian (one each in China and Japan). Thirty-two of the papers reported quantitative studies, three were qualitative and one was a mixed-method design.

Samples ranged from 6 to 22 participants in qualitative studies and 7 to 4553 in quantitative studies. Father mean age ranged from 27.1 to 37.6 years. In 22 studies, couples were

recruited; in 10 of these studies, couples had to be cohabiting or married. In 14 studies, the infant was a first child for the father, the mother or the couple. Substantial variation existed in the subjective sleep-related constructs reported (see Table 1), including self-reported: fatigue (n=6 papers), sleep quality (n=6), sleep quantity/duration (n=4), nocturnal awakenings/ interruptions (n=4), sleep difficulties (n=3), sleep disturbance (n=2), combined sleep quality and quantity (n=1), sleep satisfaction (n=1), vitality (n=1), wake after sleep onset (WASO, “time spent laying awake before falling asleep”) (n=1) and sleepiness (n=1). Within each of these constructs, there was also diversity in the measures used. For example, among the six studies that described fatigue, four different measures were used. Less frequently, objective measurement of fathers’ sleep was reported: Actigraphy was used to record sleep quantity (n=6), WASO (n=2), sleep efficiency (n=2), sleep fragmentation (n=1) and duration of nocturnal activity (n=1).

Infant sleep was assessed using parents’ assessment of infant sleep as a problem (n=4), infant sleep duration (n=4), number of awakenings overnight (n=1) and a sleep behaviour scale (n=1).

Details of the measures in each study are provided in Table 1. Many studies reported only descriptive results on measures of sleep. Our summary below focuses on key findings and on associations reported in multivariate rather than unadjusted analyses.

Describing fathers’ sleep

Disrupted and shortened sleep appears to be common among new fathers, not only in the immediate period after the birth but in the following months (Table 1). For example, 85.4% fathers reported sleep interruptions at 6 weeks postpartum ²⁸. At 7 weeks postpartum, only 5% of fathers were in the normative range for sleep onset latency, an indication of

sleepiness²⁹. In this same study, mean sleep quality and subjective sleepiness scores were in the clinical ranges²⁹. Mean sleep efficiency (time spent asleep as a percentage of time spent in bed) ranged from 71.5% at 3 weeks postpartum³⁰ to 80% at 6 weeks postpartum²⁹ and 84% at 12 weeks postpartum³⁰. In a community sample, sleep quantity was rated as “not enough” by 52% of fathers at 16 weeks postpartum and 46% at 24 weeks postpartum³⁰. Similarly, sleep quality was rated as “not good enough” by 45% and 41% of fathers at 16 and 24 weeks respectively³⁰. High levels of fatigue were reported up to 6 months postpartum³¹.

Four studies reported statistical analysis of changes in sleep or fatigue variables over more than one postpartum assessment point. Total sleep time increased, self-reported sleep quality and sleep efficiency improved and number of night awakenings decreased significantly as infant age increased^{28,32-34}. However, fathers’ experiences appeared to be worse when children in the sample were older: Fatigue increased significantly with infant age²⁸. Consistent with this, data from various studies indicated that mean “wake after sleep onset” (WASO), expressed as a percentage of minutes awake since sleep onset, was 17.4% at 3 weeks postpartum³⁵ and 54.4% at 6 weeks postpartum^{36,37}. The proportion of fathers who reported “laying awake for more than 30 minutes before falling asleep” was 51.7% at 16 weeks postpartum and 60.7% at 24 weeks postpartum³⁸.

Four papers reported statistical associations between infant and fathers’ sleep^{30,31,33,39}. Multivariate analysis confirmed an association between infant sleep problems and poor fathers’ sleep quantity and quality, controlling for infant age and gender, socio-economic status and fathers’ education³⁰. In a qualitative study, infants’ excessive crying was perceived by parents as a causal factor of sleep deprivation⁴⁰.

Associations between sleep and fathers’ mental wellbeing

Twelve quantitative studies reported associations with measures of fathers' wellbeing (Table 2) including symptoms of depression (n=5), perceived stress (n=1), trait anxiety (n=1), general mental health (n=1), wellbeing (n=1), worry about the infant (n=1), general health (n=1), partner relationship (n=6), relationship with infant (n=1) and safety behaviour at work (n=1).

PLEASE INCLUDE TABLE 2 ABOUT HERE

Eleven quantitative studies reported associations between infant sleep and measures of fathers' wellbeing (Table 3), including depressive symptoms or distress (n=9), psychological functioning (n=1), perceived stress (n=2), daily parenting hassles (n=1), general health (n=2), partner relationship (n=3) and perceived social support (n=2).

PLEASE INCLUDE TABLE 3 ABOUT HERE

Fathers' and infant sleep problems were linked to poorer outcomes for mental health, relationships and performance at work (see Tables 2 and 3). Poorer fathers' sleep quality and quantity were associated with increased depression symptoms between 2 months and 1 year postpartum even after controlling for demographic, birth, maternal, and infant factors^{41,42}. Mixed evidence emerged regarding associations between infant sleep and fathers' wellbeing: In adjusted analyses, compared to fathers who perceived that their infant's sleep was not a problem, fathers who perceived that their infant's sleep was a problem had higher mean depression scores postpartum³⁰ and were significantly more likely to screen positive for "minor" (but not "major") depression⁴³. In addition, longer infant night-time sleep duration was significantly associated with better fathers' psychological functioning⁴⁴. In contrast, in two other studies, after adjustment for potential

188 confounding factors, depressive symptoms ⁴⁵ and serious psychological distress ⁴⁶ did not
189 remain significantly correlated with poorer infant sleep behaviours.

190 Evidence also emerged of associations between fathers' sleep disruption and poorer
191 relationships with partners and infants, whereby fathers' objectively measured total sleep
192 time independently predicted relationship satisfaction ³⁶, while infant sleep problems were
193 associated with increases in fathers' doubt about parenting competence and anger at
194 infants' demands ³⁰.

195 Higher fatigue at both 6 and 12 weeks was associated with poorer safety compliance and
196 participation at work, adjusting for work hours, physical intensity, sleep interruption and
197 estimated duration of sleep ²⁸. Consistent with this, safety risks associated with exhaustion
198 were identified in two qualitative studies ^{40,47}. Another qualitative study reported that
199 because fathers were required to return to work earlier than mothers, they perceived that
200 they needed more sleep in order to function well in the workplace ⁴⁸.

201 Discussion

202 Fathers' postpartum sleep is an emerging area of research. No previous reviews were found
203 of evidence about sleep and fatigue among fathers of infants 0-12 months, in which the
204 search and extraction were conducted rigorously according to PRISMA guidelines.

205 The aims were to systematically map the literature on fathers' sleep functioning in the first
206 postnatal year, and to identify associations between fathers' sleep functioning and their
207 wellbeing. The available studies, predominantly from high-income populations and relying
208 on self-report, used a wide range of sleep-related constructs making key concepts difficult
209 to identify. However, across the studies using self-report and objectively measured sleep
210 parameters, the results suggest that poor sleep is a common experience among fathers in

the first postnatal year. For example, in one study, mean sleep quality and subjective sleepiness scores were in the clinical ranges²⁹, and sleep efficiency was below 85% at 3, 6 and 12 weeks postpartum^{29,30}. The latter is considered to represent a clinical level of insomnia⁴⁹ and is similar to healthy sleepers aged 75 years and older⁵⁰.

Of note, as infant age increased across samples, so too did duration of fathers' sleep and ratings of self-reported sleep quality, while sleep interruptions were fewer^{28,30,33,34}.

However, levels of fatigue remained high up to 6 months postpartum³¹ or actually increased with older infant age²⁸. This may reflect a cumulative effect of disrupted, inadequate sleep⁵¹ in combination with multiple new demands. Among new mothers, results from longitudinal data are inconsistent, some suggesting that high levels of fatigue persist^{34,51}, while others report decreases in fatigue⁵² beyond the early postnatal period. More research is needed to elucidate the trajectory of fathers' fatigue at this life stage.

No assumption is made that fathers' sleep is more disrupted than maternal sleep after the birth of an infant. Although changes in sleep satisfaction and duration from pregnancy to the postnatal period are statistically significant for both women and men, they are more pronounced among women³⁴. However, thus far much of the research focus has been on maternal sleep and co-existing poor mental health. This scoping review has presented sufficient evidence that substantial sleep disruption exists among fathers and that sleep complaints among fathers of infants should not automatically be dismissed as normative.

No quality assessment was conducted; however, only a few studies included adequate sample size and reported multivariate analysis (for fathers separately) controlling for theoretically plausible variables. The findings from these studies suggest that among fathers

in the first postnatal year, substantial sleep disruption co-exists with increased vulnerability to poor mental health including depressive symptoms^{30,41,42}. The significant impact of sleep deprivation and fatigue on fathers' physical and emotional wellbeing is consistent with research among fathers with children older than those included in this review^{53,54}. These associations are particularly important given that increased risk of depression among fathers has implications for subsequent development of their infants⁵⁵.

This review has also identified associations between fathers' sleep disruption and impaired relationships with partners³⁶ and infants³⁰. Poor self-control as a result of lack of sleep, and subsequent angry or threatening behaviours towards partners and infants, have adverse consequences for day-to-day interactions within the family¹⁹, and can trigger abusive behaviours towards infants²⁰.

Based on links between sleep problems and poor individual and family wellbeing, we recommend an increased research focus on assessment of fathers' sleep and fatigue in the first postnatal year and inclusion of fathers in parenting sleep interventions. The first aspect that requires attention is measurement of sleep. The gold-standard measurement of sleep is polysomnography (PSG)⁵⁶. One paper reported only limited results from PSG²⁹; the same study reported performance on a psychomotor vigilance task (PVT), a well-validated computerized measure of reaction times that is sensitive to sleep loss⁵⁷. Such measures are time-consuming, so less feasible for assessment of fathers who are often time-poor and focused on their partners and infants⁴⁷. Actigraphy, an objective proxy-measure of sleep based on wrist movement, is less time-consuming and was reported in five papers^{29,32,35,58,59}. Self-report scales are least burdensome for participants; however, amongst the

self-report scales reported, there was little consistency in measurement of fatigue and sleep variables, or indeed in constructs measured. Brief self-report measures of sleep disturbance validated in this population would allow rigorous assessment of sleep-related experiences among fathers, and benchmark levels of fatigue, sleepiness and poor sleep against other populations. Routine screening among fathers for clinically significant fatigue or poor sleep quality, may be in the interests of public health, given that poor sleep can impact on fathers' mental health, partner and infant relationships and workplace safety.

Secondly, more research is needed to disentangle the bidirectional association between sleep and depressive symptoms; these are related but distinct constructs among women in the postnatal period⁶⁰. Poor sleep may represent a mechanism via which infant sleep problems may impact on fathers and their families; however no paper investigated this pathway explicitly and there was mixed evidence on associations between poor infant sleep and fathers' depression^{30,43-46}. Further research is needed to investigate complex associations among infant sleep, fathers' sleep and fathers' mental health and functioning in key relationships, to elucidate causal pathways.

Thirdly, research into strategies for addressing poor sleep among fathers is needed. Early parenting services⁶¹ and community health nurse-led education⁶² have each been shown to improve sleep and mental health outcomes in mothers by focusing on infant sleep problems. Such services represent an opportunity to engage and screen fathers, as fathers are motivated to address infant sleep problems⁵³, but are not always admitted to these services⁶³. The effectiveness of work-family sleep interventions on improving sleep has been demonstrated⁶⁴ but such interventions are not specific to parents of young infants.

Addressing infant sleep problems has been shown to improve maternal quality of life through reduction in postnatal depression and is cost-effective compared to usual care⁶⁵. Similar research has yet to be carried out among fathers.

In conclusion, further research on assessment and resolution of fathers' sleep disruption is a priority. Improved sleep in the first postnatal year has the potential to positively impact fathers' mental health, relationships with partners and infants, and workplace safety.

References

1. Burnham MM, Goodlin-Jones BL, Gaylor EE, Anders TF. Nighttime sleep–wake patterns and self-soothing from birth to one year of age: a longitudinal intervention study. *J Child Psychol Psychiatry*. 2002;43:713-725.
2. Bayer J, Hiscock H, Hampton A, Wake M. Sleep problems in young infants and maternal mental health and physical health. *J Paediatr Child Health*. 2007;43(8):66-73.
3. Banks S, Dinges DF. Behavioral and physiological consequences of sleep restriction. *J Clin Sleep Med*. 2007;3(5):519-528.
4. Walker MP. The role of sleep in cognition and emotion. In: *Annals of the New York Academy of Sciences*. Vol 1156/2009:168-197.
5. Zaharna M, Guilleminault C. Sleep, noise and health: Review. *Noise and Health*. 2010;12(47):64-69.
6. van der Linden D, Frese M, Meijman TF. Mental fatigue and the control of cognitive processes: Effects on perseveration and planning. *Acta Psychol (Amst)*. 2003;113(1):45-65.
7. Kienhuis M, Rogers S, Giallo R, Matthews J, Treyvaud K. A proposed model for the impact of parental fatigue on parenting adaptability and child development. *J Reprod Infant Psychol*. 2010;28(4):392-402.
8. Parfitt Y, Ayers S. Transition to parenthood and mental health in first-time parents. *Infant Mental Health Journal*. 2014;35(3):263-273.
9. Taylor J, Johnson M. The role of anxiety and other factors in predicting postnatal fatigue: From birth to 6 months. In: Vol 29/2013:526-534.
10. Wilson N, Lee JJ, Bei B. Postpartum fatigue and depression: A systematic review and meta-analysis. *J Affect Disord*. 2019;246:224-233.
11. Countermine MS, Teti DM. Sleep arrangements and maternal adaptation in infancy. *Infant Mental Health Journal*. 2010;31(6):647-663.
12. Fischman SH, Rankin EA, Soeken KL, Lenz ER. Changes in sexual relationships in postpartum couples. *JOGNN: Journal of Obstetric, Gynecologic & Neonatal Nursing*. 1986;15(1):58-63.
13. McQueen A, Mander R. Tiredness and fatigue in the postnatal period. *J Adv Nurs*. 2003;42(5):463-469.
14. Tikotzky L. Postpartum Maternal Sleep, Maternal Depressive Symptoms and Self-Perceived Mother–Infant Emotional Relationship. *Behav Sleep Med*. 2016;14(1):5-22.
15. Giallo R, D'Esposito F, Christensen D, et al. Father mental health during the early parenting period: results of an Australian population based longitudinal study. *Social Psychiatry and Psychiatric Epidemiology*. 2012;47(12):1907-1916.

16. Czeisler CA. Duration, timing and quality of sleep are each vital for health, performance and safety. *Sleep Health*. 2015(1):5.
17. Dennis C-L, Letourneau N. Global and relationship-specific perceptions of support and the development of postpartum depressive symptomatology. In. Vol 422007:389-395.
18. Tikotzky Ilbai, Sadeh A, Glickman-Gavrieli T. Infant Sleep and Paternal Involvement in Infant Caregiving During the First 6 Months of Life. *J Pediatr Psychol*. 2011;36(1):36-46.
19. Ellett M, Appleton M, Sloan R. Out of the Abyss of Colic: A View Through the Fathers' Eyes. *MCN; American Journal of Maternal Child Nursing*. 2009;34(3):164-171.
20. Reijneveld Sa, Wal Mvd, Brugman E, Sing RaH, Verloove-Vanhorick SP. Infant Crying and Abuse. *Lancet*. 2004;364(9442):1340-1342.
21. Levac D, Colquhoun H, O'Brien KK. Scoping studies: advancing the methodology. *Implement Sci*. 2010;5:69.
22. Arksey H, O'Malley L. Scoping Studies: Towards a Methodological Framework. *International Journal of Social Research Methodology*. 2005;8(1):19-32.
23. Colquhoun HL, Levac D, O'Brien KK, et al. Scoping reviews: time for clarity in definition, methods, and reporting. *J Clin Epidemiol*. 2014;67(12):1291-1294.
24. Joanna Briggs Institute. Methodology for JBI scoping reviews. 2015; http://joannabriggs.org/assets/docs/sumari/Reviewers-Manual_Methodology-for-JBI-Scoping-Reviews_2015_v2.pdf. Accessed 7 April, 2019.
25. Moher D, Liberati A, Tetzlaff J, Altman DG. Preferred reporting items for systematic reviews and meta-analyses: the PRISMA statement. *BMJ: British Medical Journal*. 2009(7716):332.
26. *Covidence systematic review software* [computer program]. 2018.
27. Price AMH, Brown JE, Bittman M, Wake M, Quach J, Hiscock H. Children's sleep patterns from 0 to 9 years: Australian population longitudinal study. *Arch Dis Child*. 2014;99(2):119-125.
28. Mellor G, John St W. Fatigue and work safety behavior in men during early fatherhood. *American Journal of Men's Health*. 2012;6(1):80-88.
29. Insana SP, Montgomery-Downs HE. Sleep and sleepiness among first-time postpartum parents: A field- and laboratory-based multimethod assessment. *Dev Psychobiol*. 2012.
30. Cook F, Giallo R, Petrovic Z, et al. Depression and anger in fathers of unsettled infants: A community cohort study. *J Paediatr Child Health*. 2017;53(2):131-135.
31. Loutzenhiser L, Sharpe DP, McAuslan P. The trajectory of maternal and paternal fatigue and factors associated with fatigue across the transition to parenthood. *Clin Psychol*. 2015;19(1):15-27.
32. Damato EG, Burant C. Sleep Patterns and Fatigue in Parents of Twins. *Journal of Obstetric, Gynecologic, & Neonatal Nursing*. 2008(6):738.
33. McDaniel BT, Teti DM. Coparenting quality during the first three months after birth: The role of infant sleep quality. *Journal of Family Psychology*. 2012;26(6):886-895.
34. Richter D, Krämer MD, Tang NKY, Montgomery-Downs HE, Lemola S. Long-term effects of pregnancy and childbirth on sleep satisfaction and duration of first-time and experienced mothers and fathers. *Sleep*. 2019;42(4).
35. Gay CL, Lee KA, Lee S. Sleep patterns and fatigue in new mothers and fathers. *Biological research for nursing*. 2004;5(4):311-318.
36. Insana SP, Costello CR, Montgomery-Downs HE. Perception of partner sleep and mood: postpartum couples' relationship satisfaction. *J Sex Marital Ther*. 2011;37(5):428-440.
37. Insana SP, Garfield CF, Montgomery-Downs HE. A mixed-method examination of maternal and paternal nocturnal caregiving. *J Pediatr Health Care*. 2014;28(4):313-321.
38. Galland BC, Sayers RM, Cameron SL, et al. Anticipatory guidance to prevent infant sleep problems within a randomised controlled trial: Infant, maternal and partner outcomes at 6 months of age. *BMJ open*. 2017;7(5).

- 373 39. Meijer AM, van den Wittenboer GLH. Contribution of infants' sleep and crying to marital
374 relationship of first-time parent couples in the 1st year after childbirth. *J Fam Psychother.*
375 2007;21(1):49-57.
- 376 40. Long T, Johnson M. Living and coping with excessive infantile crying. *J Adv Nurs.*
377 2001;34(2):155-162.
- 378 41. Saxbe DE, Schetter CD, Guardino CM, et al. Sleep Quality Predicts Persistence of Parental
379 Postpartum Depressive Symptoms and Transmission of Depressive Symptoms from Mothers
380 to Fathers. *Ann Behav Med.* 2016;50(6):862-875.
- 381 42. Da Costa D, Danieli C, Abrahamowicz M, et al. A prospective study of postnatal depressive
382 symptoms and associated risk factors in first-time fathers. *Journal of affective disorders.*
383 2019;249:371-377.
- 384 43. Philpott LF, Corcoran P. Paternal postnatal depression in Ireland: Prevalence and associated
385 factors. *Midwifery.* 2018;56:121-127.
- 386 44. Loutzenhiser L, Seigny PR. Infant sleep and the quality of family life for first-time parents of
387 three month-old infants. *Fathering: A Journal of Theory, Research & Practice about Men as*
388 *Fathers.* 2008;6(1):2-19.
- 389 45. Cockshaw WD, Muscat T, Obst PL, Thorpe K. Differences in parent regulation beliefs and
390 maternal postnatal depressive symptoms in early weeks. *Psychiatry Res.* 2015;228(3):953-
391 955.
- 392 46. Martin J, Hiscock H, Hardy P, Davey B, Wake M. Adverse associations of infant and child
393 sleep problems and parent health: an Australian population study. In. *Pediatrics.* Vol 119. Elk
394 Grove Village; USA: American Academy of Pediatrics; 2007:947-955.
- 395 47. Darwin Z, Galdas P, Hinchliff S, et al. Fathers' views and experiences of their own mental
396 health during pregnancy and the first postnatal year: A qualitative interview study of men
397 participating in the UK Born and Bred in Yorkshire (BaBY) cohort. *BMC Pregnancy Childbirth.*
398 2017;17(1).
- 399 48. Miller T. Falling back into Gender? Men's Narratives and Practices around First-time
400 Fatherhood. *Sociology.* 2011;45(6):1094.
- 401 49. Lacks P, Morin CM. Recent advances in the assessment and treatment of insomnia. *J Consult*
402 *Clin Psychol.* 1992(4):586.
- 403 50. Ohayon MM, Carskadon MA, Guilleminault C, Vitiello MV. Meta-analysis of quantitative
404 sleep parameters from childhood to old age in healthy individuals: Developing normative
405 sleep values across the human lifespan. In. Vol 272004:1255-1273.
- 406 51. Giallo R, Seymour M, Dunning M, Cooklin A, Loutzenhiser L, McAuslan P. Factors associated
407 with the course of maternal fatigue across the early postpartum period. *J Reprod Infant*
408 *Psychol.* 2015;33(5):528-544.
- 409 52. Iwata H, Mori E, Sakajo A, Aoki K, Maehara K, Tamakoshi K. Course of maternal fatigue and
410 its associated factors during the first 6 months postpartum: a prospective cohort study.
411 *Nursing Open.* 2018;5(2):186-196.
- 412 53. Rominov H, Pilkington PD, Whelan TA, Giallo R. "Getting help for yourself is a way of helping
413 your baby:" Fathers' experiences of support for mental health and parenting in the perinatal
414 period. *Psychology of Men and Masculinity.* 2018;19(3):457-468.
- 415 54. Wynter K, Wilson N, Bei B, Thean P, Fisher J. Psychological distress, alcohol use, fatigue,
416 sleepiness and sleep quality: an exploratory study among men whose partners are admitted
417 to a residential early parenting service. *Aust Psychol.* 2018.
- 418 55. Ramchandani PG, Psychogiou L, Vlachos H, et al. Paternal depression: An examination of its
419 links with father, child and family functioning in the postnatal period. *Depress Anxiety.*
420 2011;4(2).
- 421 56. Carskadon MA, Dement WC. Normal Human Sleep: An Overview. In: Meir Kryger TR, William
422 C. Dement, ed. *Principles and Practice of Sleep Medicine (Sixth Edition).* Elsevier; 2017:15-24.

57. Basner M, Mollicone DJ, Dinges DF. Validation of a modified brief version of the psychomotor vigilance test (PVT). *Sleep*. 2011;34:A110-A110.
58. Doan T, Gardiner A, Gay CL, Lee KA. Breast-feeding increases sleep duration of new parents. *Journal of Perinatal & Neonatal Nursing*. 2007(3):200.
59. Wulff K, Siegmund R. Circadian and ultradian time patterns in human behaviour: Part 1: Activity monitoring of families from prepartum to postpartum. *Biological Rhythm Research*. 2000;31(5):581-602.
60. Wilson N, Wynter K, Fisher J, Bei B. Related but different: Distinguishing depression and fatigue among women seeking help for unsettled infant behaviours *BMC Psychiatry*. 2018;18(1).
61. Wilson N, Wynter K, Anderson C, Rajaratnam S, Fisher J, Bei B. Postpartum fatigue, daytime sleepiness, and psychomotor vigilance are modifiable through a brief residential early parenting program. *Sleep Med*. 2019;19(48).
62. Hall WA, Biletski J, Hunter DL, Lemay S, Ou C, Rempel L. Dissemination of evidence based interventions for pediatric sleep disorders – The Niagara project: process and outcomes. *Sleep Medicine: X*. 2019;1.
63. Fletcher R, Dowse E, St George J, Payling T. Mental health screening of fathers attending early parenting services in Australia. *Journal of Child Health Care*. 2017;21(4):498-508.
64. Crain TL, Hammer LB, Bodner T, et al. Sustaining sleep: Results from the randomized controlled work, family, and health study. *J Occup Health Psychol*. 2019;24(1):180-197.
65. Saing S, Parkinson B, Church J, Goodall S. Cost Effectiveness of a Community-Delivered Consultation to Improve Infant Sleep Problems and Maternal Well-Being. *Value in Health Regional Issues*. 2018.
66. Ahlborg T, Dahlöf L, Hallberg LR. Quality of the Intimate and Sexual Relationship in First-Time Parents Six Months after Delivery. *The Journal of Sex Research*. 2005;42(2):167.
67. Dragonas TG. Greek fathers' participation in labour and care of the infant. *Scandinavian journal of caring sciences*. 1992;6(3):151-159.
68. Elek SM, Hudson DB, Fleck MO. Expectant Parents' Experience with Fatigue and Sleep during Pregnancy. *Birth (Berkeley, Calif)*. 1997;24(1):49-54.
69. Feinberg ME, Jones DE, McDaniel BT, Liu S, Almeida D. Advancing research and measurement on fathering and child development: II New fathers' and mothers' daily stressors and resources influence parent adjustment and family relationships. *Monographs of the Society for Research in Child Development*. 2019;84(1):18-34.
70. Gjerdingen DK, Center BA. First-time parents' prenatal to postpartum changes in health, and the relation of postpartum health to work and partner characteristics. *Journal of the American Board of Family Practice*. 2003;16(4):304-311.
71. Gjerdingen DK, Center BA. The relationship of postpartum partner satisfaction to parents' work, health, and social characteristics. *Women and Health*. 2004;40(4):25-39.
72. Mao Q, Zhu LX, Su XY. A comparison of postnatal depression and related factors between Chinese new mothers and fathers. *Journal of clinical nursing*. 2011;20(5-6):645-652.
73. Muscat T, Thorpe K, Obst P. Disconfirmed expectations of infant behaviours and postnatal depressive symptoms among parents. In. Vol 302012:51-61.
74. Repokari L, Punamäki RL, Poikkeus P, et al. The impact of successful assisted reproduction treatment on female and male mental health during transition to parenthood: A prospective controlled study. *Human Reproduction*. 2005;20(11):3238-3247.
75. Sälevaara M, Punamäki RL, Unkila-Kallio L, Vänskä M, Tulppala M, Tiitinen A. The mental health of mothers and fathers during pregnancy and early parenthood after successful oocyte donation treatment: A nested case-control study. *Acta obstetrica et gynecologica Scandinavica*. 2018;97(12):1478-1485.

- 472 76. Smart J, Hiscock H. Early infant crying and sleeping problems: A pilot study of impact on
473 parental well-being and parent-endorsed strategies for management. *Journal of paediatrics*
474 *and child health*. 2007;43(4):293-299.
- 475 77. Vilska S, Unkila-Kallio L, Poikkeus P, et al. Mental health of mothers and fathers of twins
476 conceived via assisted reproduction treatment: A 1-year prospective study. *Human*
477 *Reproduction*. 2009;24(2):367-377.
- 478 78. Yamazaki A, Lee KA, Kennedy HP, Weiss SJ. Sleep-wake cycles, social rhythms, and sleeping
479 arrangement during Japanese childbearing family transition. *JOGNN: Journal of Obstetric,*
480 *Gynecologic & Neonatal Nursing*. 2005;34(3):342-348.

481

482 Table 1: Methodology of included studies, and descriptive findings about sleep among fathers

Paper number (study number) Author(s) (date) / country / study design	Sampling frame; inclusion Criteria (IC); Exclusion Criteria (EC); Assessment Time (AT: infant age, stated and actual)	N=number of fathers recruited (recruitment fraction); n= analytic sample; father age in years; other sample characteristics	Research question	Descriptive findings: paternal sleep
1 (1) Ahlborg, Dahlöf & Hallberg (2005) ⁶⁶ / Sweden / X	Couples recruited by primary care nurses at family health centres; IC: first child in common, cohabiting, Swedish speakers, healthy child; EC: NR; Stated AT: "about 6M old" (Actual AT: NR)	N=389 (65.3 NRS); n=388; Mean age (<i>SD</i> , range) =32.4 (5.4, 21-66); 91% employed outside the home, 7.5% of fathers multiparous, other demographics NRS	To describe the quality of the intimate relationship among parents 6M after the birth of their first child	150/384 (39%) fathers too tired for sexual activity (item from DAS)
2 (2) Cockshaw, Muscat, Obst & Thorpe (2014) ⁴⁵ / Australia / X	Recruited through mothers of infants at general medical practices, postnatal clinics at hospitals, & community-based child health clinics; IC: NR; EC: NR; Stated and actual AT: 0-24W pp, Median 7W)	N= 219 (NR); n= 205-212; Mean age (<i>SD</i>) =32.7 (5.3); 83.9% married; 14.7% living with partner; 44% university degree; 79.2% Australian cultural background. Compared to population aged 20-45, fathers more highly educated and higher proportion married.	To investigate whether infant feeding & sleeping problems are related to paternal postnatal depression	Father sleep not assessed

3 (3) Cook, Giallo, Petrovic, Coe, Symour, Cann & Hiscock (2017) ³⁰ / Australia / L	Fathers of newborn infants across four Local Government Areas in the north-west region of Melbourne. Control group of RCT; IC: NR; EC: Insufficient English; infant born < 32W gest, infant has a serious health concern; Stated AT: 4M & 6M pp (Actual AT: NR)	N: NR (NR, 150 fathers interested); n=102 at 4M, n=90 at 6M; Mean age (SD, range)=35.7 (5.3, 24.7-51.4); Slightly higher SES than average, 65.4% had tertiary degree. 60.6% of the infants were firstborns	To report infant sleep & crying & examine relationship between unsettled infant behaviour & fathers' depressive symptoms, cognitions surrounding infant sleep, sleep quality & quantity, & social support in a community cohort	Fathers reporting not good enough sleep quality in past two weeks* n(%): 46(45.1) at 4M; 37(41.1) at 6M Fathers reporting not enough sleep in past two weeks* n(%): 53(52.0) at 4M; 41(46.1) at 6M * Single items from PSQI
4 (4) Da Costa, Danieli, Abrahamovicz, Dasgupta, Seqitch, Lowensteyn & Zolkowitz (2019) ⁴² / Canada / L	Couples recruited in waiting rooms at obstetrics clinics at three teaching hospitals in Montreal & at local prenatal classes; IC: At least 18, functionally fluent in French / English, married / cohabiting & expecting first child; EC: NR; Stated AT: preg (third trim), 2M & 6M pp (Actual AT: NR)	N: NR (NR, 1176 men agreed to learn more about study); n=622 (preg), 487 (2M), 375 (6M); Mean age (SD) = 34.3 (5.0); 24.5% had non-white origin, 72% had completed university, 91.6% employed. Those retained to 2M pp more likely to be white, higher income & reported more social support during preg. Those retained to 6M pp had lower EPDS scores at 2M pp.	To identify independent socio-demographic & psychosocial risk factors for paternal depressive symptoms at 2 & 6M pp, in a large Canadian cohort.	Descriptives for sleep quality ^e NR

5 (5) Damato & Burant (2008) ³² / United States / L	Couples recruited from two hospital pp units / via advert at prenatal education class for expectant mothers of twins; IC: heterosexual couples, cohabiting, able to read & write English, >= 18 y, telephone access, twins delivered >= 33W gest; EC: either parent had a history of: sleep disorder, illicit drug use, alcohol abuse, depression, or worked night shift, Level 3 NICU stay > 7 days for either twin, either twin required unusual care-taking on discharge; Stated AT: 2W, 12W & 20W post discharge of both twins. (Actual AT (in W): Mean (SD, range): 2.8 (5.9, 2-4) at 2W, 12.7 (1.2, 12-15) at 12W, 19.9 (0.4, 19-20.5) at 20W)	N=10 couples (NR); n=8 couples; Mean age (SD, range) =32.3 (3.6, 28-39); All white, non-Hispanic, & married. All fathers employed at baseline, one unemployed at subsequent assessment points.	To describe or assess the following in mothers & fathers of twins: 24 hrs sleep quantity, number of nightly sleep interruptions, perceived fatigue, mother/father differences on these variables, change over time in patterns of sleep & fatigue.	Mean (SD): am fatigue ^b : 4.9 (1.8) at 2W, 4.6 (1.8) at 12W & 4.6 (1.3) at 20W after discharge pm fatigue: 5.6 (1.2) at 2W, 5.6 (1.3) at 12W & 5.7 (1.6) at 20W after discharge number of night sleep interruptions (sleep diary): 1.0 (0.8) at 2W, 0.8 (0.6) at 12W & 0.7 (0.7) at 20W after discharge night sleep time in mins (actigraphy): 322.9 (81.6) at 2W, 374.9 = (61.3) at 12W & 391.2 (77.8) at 20W after discharge 24 hour sleep time in mins (actigraphy): 347.2 (61.3) at 2W, 387.7 = (65.8) at 12W & 391.2 (77.8) at 20W after discharge sleep efficiency (%) (actigraphy): 71.5 (10.1) at 2W, 84 (9.5) at 12W & 82.2 (10.4) at 20W after discharge. Sleep efficiency increased between 2W & 12W, also between 2W & 20W after discharge (F=8.86, df=2, p<0.01) Changes in time for other variables NR
6 (6) Darwin, Galdas, Hinchliff, Littlewood, McMillan, McGowan, Gilbody, BaBY team (2017) ⁴⁷	Partners of women enrolled in Born & Bred in Yorkshire (BaBY) study. Mothers recruited via maternity services, partners invited via mothers; IC: Baby born in the past 12M at ≥37W gest; no serious health concern with mother or	N=42 (NR), 22 selected to reflect broad range of mental health and wellbeing scores; n=19; No differences between non participating and participating Mean age (SD, Range) = 33.1 (5.1, 25-44); All married, cohabiting, white.	To examine fathers' views & direct experiences of paternal perinatal mental health.	No qualitative findings relevant.

/ United Kingdom / Q	baby before discharge; EC: same sex parents; Stated AT: 5-10M pp (Actual AT: NR)	73.4% primiparous, 89.5% born in the UK, 89.5% employed full time, 84.2% had post-secondary education.		
7 (7) Doan, Gardiner, Gay & Lee (2007) ⁵⁸ / United States / X	Participants recruited during pregnancy into an RCT to improve new parents' sleep at 3M pp. Control & intervention groups reported together as difference NS; IC: expecting first child, both individuals > 18 y, willing to participate, able to read & write in English; EC: planned to hire a live in nanny, either parent worked night shift, or mother had a history of involuntary preg loss; Stated AT: 3M pp (Actual AT: Mean (SD)=11.3 (1) W)	N=152 couples (NR); n=133; Mean age (SD) =34.2 (5.6); 86% employed, other demographics NRS	To investigate whether supplementing with formula in the evening before bedtime, or during the night, increases nocturnal sleep time for new parents	Mean (SD): TST (actigraphy & sleep log) for fathers whose infants were fed between 6pm & 12am: 7 (1.2) hrs for exclusive breastmilk group & 6.3 (1.4) hrs for supplementation group, $t(116)=2.88$, $p=0.005$ TST for fathers whose infants were fed between 12am & 6am: 7 (1.3) hrs for exclusive breastmilk group & 6.3 (1.1) hrs for supplementation group, $t(104)=2.13$, $p=0.035$ Fathers who shared responsibility for night time feeding (n=17) slept less (6.0+/- 1.4 hrs) than fathers whose partners had sole responsibility for night-time feeding (7.0+/- 1.2 hrs, $t[102]=2.94$, $p=0.004$) Sleep disturbance ^c for fathers whose infants were fed between 6pm to 12am: 32 (13) for exclusive breastmilk group & 34 (10) for supplementation group. Difference NS (statistics NR) Sleep disturbance for fathers whose infants were fed between 6pm to 12am: 32 (13) for exclusive breastmilk group 38 (11) for supplementation group, $t(112)=2.38$, $p=0.019$

8 (8) Dragonas (1992) ⁶⁷ / Greece / X	Partners were recruited via the mothers who were randomly selected from one obstetric hospital & one private practice in Athens; IC: NR; EC: NR; Stated AT: 4-6W pp (Actual AT: NR)	N: NR (NR); n=157; Mean age (range)=28.3 (24-45); 100% married; 50% primiparous; 43.5% had post-secondary education. Compared to population data, teenage parents & those with low levels of education under-represented in this sample.	To explore fathers' reaction to participation in delivery, expectations about the baby & participation in childcare	50% of fathers reported that when they arrived home from work they were too tired to take the baby (Single item from Reaction to Fatherhood Scale)
9 (9) Elek, Hudson & Fleck (2002) ⁶⁸ / United States / L	Couples recruited via convenience sampling from rural & urban primary care practices during preg (last trim); IC: Both willing to participate, cohabiting, mothers 19 - 40 y, fathers 19 - 45 y, each expecting first child; EC: Mother, father, or infant had substantial health problems, either parent had a past or present sleep disorder, depression, alcohol / drug abuse, or working overnight; Stated AT: 9th M of preg & at 4W, 8W, 12W & 16W pp (Actual AT: NR)	N=48 couples (NR); n=44 couples; Mean age (SD, range) =28.6 (4.9, 19-41); 98% Caucasian. 79.6% had post-secondary education. 88.6% married.	To examine changes in & differences between mothers' & fathers' reports of morning & evening fatigue, & to determine if parents' morning or evening fatigue is related to their marital satisfaction during the first 4M after the birth of their first child.	Mean (SD) am fatigue ^b : 31.9 (12.7) in preg, 38.1 (17.4) at 4W, 40.1 (16.7) at 8W, 43.5 (22.2) at 12W & 38.3 (22.0) at 16W pp Mean (SD) pm fatigue: 49.2 (16.4) in preg, 59.5 (17.0) at 4W, 60.2 (17.2) at 8W, 61.8 (20.0) at 12W & 62.7 (19.3) at 16W pp pm higher than am fatigue, fatigue scores increased preg to pp (statistics NRS) Assoc between number of sleep cycles (sleep diary) & fatigue NS at all time points, statistics NR

10 (10) Feinberg, Jones, McDaniel, Liu & Almeida (2019) ⁶⁹ / United States / X	Recruited from couples participating in a RCT; IC: NR; EC: NR; Stated AT: 8 days of daily (pm) phone interviews at 10M pp (Actual AT: NR)	N=265 couples (76% NRS); n = 202 couples in preg, 143 fathers at 10M pp; Mean age (SD) = 31.0 (5.6); 87% non-Hispanic white, 93% married. Mean (SD) y of education=15.6 (1.9).	To understand parental daily experiences at 10M pp; specifically relationship between daily experiences & parent adjustment (parents' individual well-being; perceived quality of relationships with partner and child)	Mean (SD) sleep in hrs the night before (SR)=6.87 (1.28), ICC=0.24
11 (11) Galland, Sayers, Cameron, Gray, Heath, Lawrence, Newlands, Taylor & Taylor (2017) ³⁸ / New Zealand / L	All mothers booked in to maternity hospital in Dunedin. Used opt-out recruitment strategy. Randomised into 4 groups: 1 Control 2. Sleep, 3. Breastfeeding, 4. combined Sleep & Breastfeeding. Stratification based on parity & household deprivation; IC: First child for mother; EC: home not Dunedin, plan to move away in next 2 y, not booked with maternity centre or homebirth midwife before 34W gest, unable to communicate in English or Māori, infant congenital abnormality likely to affect feeding or growth, infant born < 36.5W gest; Stated AT: Preg (3rd trim), & 4M & 6M pp (Infant sleep at 6M pp only) (Actual AT: NR)	N=802 couples (58% NRS); n=209 couples in control group at baseline Mean father age (SD): Control 34.5 (6.1), Intervention groups 34.3 (6.2), 34.7 (6.1) & 34.2 (5.8) Other demographics NR	To evaluate the effectiveness of sleep education delivered antenatally & at 3W pp to prevent infant sleep problems at 6M of age.	Control group: Mean (SD) sleep duration in hrs: 6.9 (1.3) at 4M, 6.9 (1.3) at 6M; Sleep latency >=30 min n (%):62 (51.7%) at 4M, 68 (60.7%) at 6M; Mean (SD) sleep quantity score (from 1 not nearly enough to 8 more than enough): 5.5 (1.1) at 4M, 5.4 (1.1) at 6M; Mean (SD) sleep quality score (from 1 very bad to 8 very good): 8 (1.3) at 4M, 4.7(1.3) at 6M; Mean (SD) fatigue score (from 1 complete exhaustion to 5 well rested): 3.3 (0.8) at 4M, 3.2 (0.7) at 6M

12 (12) Gay, Lee & Lee (2004) ³⁵ / United States / X (unclear whether this is same study as paper 4)	Couples recruited from Childbirth education classes (control group of RCT); IC: Expecting first child, both parents at least 18 y, willing to participate, able to read & write English; EC: Planning to hire live-in nanny, either parent worked night shift, expectant mother had history of involuntary preg loss; Stated AT: during 1 st M pp (Actual AT: Mean (SD) infant age=19.6 (4.3) days)	N=77 (NR); n=72; Mean age (SD, range) =34.6 (6.3, 22-53); 79% in paid employment. Other demographics NRS	To describe sleep & fatigue for both parents in late preg, early pp using objective & subjective measures of sleep	Mean (SD): am fatigue ^d : 3.6 (1.6) in preg, 4.4 (1.9) at 6M pp pm fatigue: 5.8 (1.7) in preg, 6.8 (1.8) at 6M pp pm higher than am fatigue (statistics NRS) am sleep disturbance ^c : 28.3 (17.3) in preg, 42.8 (14.1) in 1 st M pp Statistics NR for increases preg to pp Sleep disturbance assoc with am fatigue, $r=0.52$, $p<0.001$ in preg & 0.34 , $p<0.01$ in 1 st M pp; Also assoc with pm fatigue $r=0.37$, $p<0.01$ in 1 st M but NS in preg Assessed using actigraphy & sleep log, Mean (SD): TST night (mins): 419 (52.9) in preg, 403.2 (64.5) in 1 st M pp TST day (mins): 18.6 (29.4) in preg, 15.5 (29.7) in 1 st M pp; TST total (mins): 441.9 (59.3) in preg, 424.2 (89.0) in 1 st M pp WASO (%): 9.3 (5.2) in preg, 17.4 (8.4) in 1 st M pp, $t[57]=9.60$, $p<0.001$ Fathers in paid employment less WASO than fathers in paid employment, $t(63)=3.08$, $p<0.001$. Other differences by work status or infant feeding type NS
13 (13) Gjerdingen & Center (2003) ⁷⁰ / United States / L	Recruited from prenatal classes at two hospitals. Originally RCT (intervention aimed to enhance partner support), data pooled between control & intervention as no treatment	N: NRS (NR); n(preg) 129 men; n(6M)= 99; Mean age (SD) =30.5 (4.5); 65.1% had post-secondary education, 91.5% married, 98.4% employed, 92.1% white	To evaluate preg to pp changes in primiparous parents' physical & mental health, & to describe social & health predictors of parents' pp health.	Mean (SD): Number of hrs of sleep for previous night (SR): 7.4 (1.0) in preg, 7.2 (1.3) at 6M pp, $p=0.681$ Vitality ^e scores: 17.1 (2.8) in preg, 16.0 (3.4) at 6M pp, $p<0.001$

14 (13) Gjerdingen & Center (2004) ⁷¹ / United States / L	effects on partner outcomes; IC: English literate, couple (married or unmarried) living together, expecting first child; EC: not living with a partner; Stated AT: preg (2 nd or 3 rd trim), 6M pp (Actual AT: NR)		To examine the relationship between pp partner satisfaction & parents' & their partners' work, health, & social characteristics. To determine whether partner satisfaction declines in the pp	
15 (14) Insana, Costello, Montgomery- Downs (2011) ³⁶ / United States / X	Couples recruited via community advertisements (as part of larger study of pp women); IC: Cohabiting, primiparous couples; EC: either parent receiving treatment for sleep disorder or history of or treatment for major depressive or anxiety disorder or scored ≥ 16 on CES-D; either partner had a diagnosed sleep disorder; if expecting multiples, had a preterm delivery, or if the infant was admitted to the NICU; Stated AT: Participation of 1 continuous week, between 3 - 8W pp (range: 3.6–8.6W). (Actual AT: Mean (SD) infant age 6.9 (1.3) W)	N: NR (NR); n=21; Mean age (SD) =29.1 (5.1); Mean gest age=39.6 (1.1) W 95.2% white. Mean (SD) y of education for fathers=15.7 (3.8)	To evaluate associations among objective sleep, subjective sleep, mood & relationship satisfaction among couples during the early pp period	Mean (SE): Sleep quality (rated from 1 not at all rested to 100 full rested): 57.09 (3.38) Number of night wakings: 2.08 (0.27) Subjective WASO in mins (how long were you awake last night?): 42.66 (9.13)
16 (14) Insana & Montgomery- Downs (2012) ²⁹ / United States / X (includes samples described in papers 14 & 16)			To compare sleep, sleepiness, fatigue, & neurobehavioral performance among primiparous mothers & fathers during their early pp period.	<u>Actigraphy & sleep diary</u> , Mean (SD): 24-hr sleep time in mins: 373.1 (34.4) Night sleep time in mins: 365.1 (37.0) Sleep fragmentation index (movement during night sleep): 14.3 (4.5) WASO (number of mins awake during night sleep): 54.4 (25.0) Sleep efficiency (mins of sleep as % of night sleep period): 80.0 (7.0) <u>Multiple Sleep Latency test</u> : Mean (SD) sleep onset latency (sleepiness) scores 8.0 (3.9), range: 3.6– 20.0 min).; 25% in pathological range, 50% moderate, 20% mild, & 5% normative <u>Subjective (SR)</u> , Mean (SD): Sleep quality ^a : 8.8 (3.7) Sleepiness ^f : 3.0 (1.0) Fatigue ^g : 48.8 (15.1) <u>Psychomotor vigilance test</u> : Mean (SD) number of lapses in attention: 6.7 (5.3)

			Differences by work status or infant feeding type all NS	
17 (14) Insana, Garfield & Montgomery-Downs (2014) ³⁷ / United States / X,Q			To describe & compare what happens during mothers' & fathers' nocturnal awakenings during the early pp period	Paternal nocturnal awakenings were primarily 'passive awakenings' (35.9%), for self-care (18.4%) & infant feeding (9.4%) (SR within 2 hrs of waking each morning)
18 (15) Long & Johnson (2001) ⁴⁰ / United Kingdom / Q	Recruited from West Yorkshire rural, urban & inner-city areas, including households from areas of relative affluence & poverty. Identified by health visitors from caseloads / & using posters at baby clinics; IC: In a couple with infant who cries/ cried excessively when <12M; EC: NR; Stated & actual AT: NR	N: NR (NR); n=6 fathers; Father age NR; Failed to recruit ethnic minorities.	To describe parents' experiences of excessive crying, consequences of the crying for individuals & family, experiences of support for excessive infant crying	Qualitative findings not relevant
19 (16) Loutzenhiser, McAuslan & Sharpe (2015) ³¹ / Canada / X	Couples recruited for L study in mid-Western Canadian city through prenatal classes, community baby showers/ exhibits, flyers in physicians' offices, & through local media; IC: Cohabiting couples expecting their first baby; EC: NR; Stated AT: 3rd trim, 1M, 3M & 6M pp (Actual AT: NR)	N=118 couples (NR, 161 couples interested); n=108 couples; Mean age (SD, range) =30.7 (5.7, 16-50); 100% employed, other demographics NRS Excluded participants (missing fatigue data ≥ 2 time points) had shorter relationship with partners than included	To examine the course/trajectory of fatigue & related factors (depression, infant characteristics, sleep quality & stress) across pp	Mean (SD): pm fatigue ^b : 32.4 (19.2) in preg, 50.8 (15.0) at 1M, 48.9 (18.4) at 3M & 50.6 (17.7) at 6M pp, statistics for change NR Sleep quality ^h : 22.0 (8.6) at 1M pp. Not assessed at other timepoints. Poor sleep quality assoc with fatigue in preg ($r=0.25$, $p<0.05$), at 1M ($r=0.27$, $p<0.01$), 3M ($r=0.24$, $p<0.05$) & at 6M pp ($r=0.27$, $p<0.01$)

20 (17) Loutzenhiser & Sevigny (2008) ⁴⁴ / Canada / X (unclear whether this is same study as paper 19)	Part of L study. Recruited from urban prenatal classes & community baby shower; IC: Expecting first child; EC: NR; Stated AT: 3M pp (Actual AT: NR)	N=78 couples (NR); n=72 (92%) completed data reported in this paper; Mean age (<i>SD</i> , range)=30.9 (6.3, 19-57) 100% of couples living together, 86% married. Other demographics NRS	To investigate relationships between infant sleep, parental psychological functioning, relationship functioning in non- clinical population of primiparous parents with 3M old infants	Father sleep not assessed
21 (18) Mao, Zhu & Su (2011) ⁷² / China / X	Couples recruited from outpatient postpartum clinics in two regional hospitals in Fujian Province, China; IC: Married, first child, normal healthy newborn; EC: Past depressive episode or deliberate self-harm; prolonged hypnotic use; family psychiatric history; Stated AT: 6 - 8W pp (Actual AT: NR)	N=420 (NR); n=376; Mean age (<i>SD</i> , range) =27.1 (4.5, 22-39); 48% had post-secondary education. Other demographics NRS	To identify differences in the prevalence of depression, perceived stress & social support between mothers & fathers during the postpartum period, & factors associated with mothers' & fathers' PND.	Father sleep not assessed
22 (19) Martin, Hiscock, Hardy, Davey & Wake (2007) ⁴⁶ / Australia / X	Baseline data from national study targeting 5000 infants; 2-stage cluster sampling design. Primary sampling units: postcodes (stratified by state of residence & urban versus rural), secondary sampling units: National healthcare database. One child per family; IC: NR EC: Families with very remote	N(Infant sample)=5107 families (64%) n=3434-4552; Mean age (<i>SD</i>)=33.7 (6.0); Parents who had completed high school were more likely to complete the assessment. 79.4% of fathers born in Australia/New Zealand, 28.9% had completed post- secondary education, 87.7% in skilled labour force. English	To investigate relationship between infant sleep problems & maternal & paternal mental health & well- being	Father sleep not assessed

	postcodes, postal address was a post office box, primary caregiver fathers because their questionnaire did ask about past depression; Stated AT: NR (Actual AT(mean)= 8.8M pp)	spoken at home 89.3%, 93.4% of infants born >36W gest, 41.3% first child. Compared to census data, families with lower incomes underrepresented.		
23 (20) McDaniel & Teti (2012) ³³ / United States / L	Participants recruited from local hospitals soon after infants born for Project SIESTA, a L study of parenting, infant sleep, & infant development. IC: cohabiting families; EC: single-parent families; Stated AT: 1M & 3M pp (Actual AT: NR)	N=167 families (NR); n=132 fathers provided complete data at both timepoints; Mean age (SD, range)=32.1 (5.6, 21-48); 87% white, 86% had completed post-secondary education, 95% employed. Those retained more likely to be married & higher income	To examine infant sleep & its potential indirect influence on parents' perceptions of co-parenting quality	Mean (SD): Number of night wakings* over 7 nights: 9.4 (7.1) at 1M & 6.7 (6.0) at 3M pp, $t=-4.2$, $p<0.001$, Cohen's $d=-0.34$ Sleep quality (range of possible scores NR)*: 26.2 (4.1) at 1M & 27.6 (4.4) at 3M pp, $t=3.9$, $p<0.001$, Cohen's $d=0.41$ *Items adapted from 24-hour sleep patterns interview Number of night wakings assoc with sleep quality at 1M ($r=-0.35$, $p<0.001$) & 3M ($r=0.37$, $p<0.001$)
24 (21) Meijer & van den Wittenboer (2007) ³⁹ / Netherlands / L	Couples recruited from 23 public obstetric practices; IC: Good comprehension of written Dutch, partners were pregnant women ≥ 35 W gest in the care of midwives (in the Netherlands, this implies unproblematic preg); EC: NR; Stated AT: 35-40W gest, 2W, 7W, 12M pp (Actual AT: NR)	N: NR (NR); n=127, 107, 86, 89 couples at each time point. For 73% of cases, complete data available from both partners; Father age: 45.8% were 36-30, 94.4% had a job, 38.3% had completed post-secondary education. Mean (SD) gest age of infants=40.4 (1.14) W. Differences between those retained versus not NS	To investigate the influence of infants' sleep & crying on marital relationship in primiparous parent couples during the 1st pp year	Descriptives for insomnia ⁱ NR
25 (22) Mellor & St John	From a larger study investigating working men during early fatherhood.	N=241 (37.7%); n=227 at 6W, n=224 at 3M, n=221 completed at both	To examine the relationship between fatigue & work safety	Mean (SD):

(2012) ²⁸ / Australia / L	Convenience sample recruited from antenatal & pp services in the Queensland Gold Coast & Northern New South Wales; IC: NR; EC: NR; Stated AT: 6W & 12W (Actual AT: NR)	timepoints; Father age: NR; 73.6% had post-secondary education, 24.7% in office work, 23.7% in trade, 12.6% in construction, 7.9% in education, 7% in retail, 3.7% in food services, 2.3% in manufacturing, 18.1% other	behaviour in men during early fatherhood	Fatigue ⁱ : 28.3 (6.3) at 6W & 31.5 (6.5) at 12W pp, $t(220)=-10.38$, $p<.001$ (65% experiencing fatigue "some of the time" at 6W, 76% at 12W) Number of interruptions: 2.4 (1.2) at 6W & 1.8 (1.1) at 12W, $t(217)=7.26$, $p<0.001$ (85.4% reported any interruptions at 6W (NR at 12W) Duration of sleep without interruptions (SR): 5.5 (1.2) at 6W & 5.9 (1.2) at 12W, $t(210)=-4.65$, $p<0.001$
26 (23) Miller (2011) ⁴⁸ / United Kingdom / Q	Recruited via adverts at work, shops, leisure, other premises; IC: Expecting first child; EC: NR; Stated AT: preg (7-8M), 6-12W, 9-12M & 2 y pp (Actual AT: NR)	N: NR (NR); n=17; Mean age (range): 33.7 (24-39); All white, employed, heterosexual & living in dual-earner households.	To investigate how gender roles influence primiparous fathers across the perinatal period	Qualitative findings not relevant
27 (24) Muscat, Thorpe & Obst (2012) ⁷³ / Australia / X	Parents attending community GP, antenatal classes, child health clinics & early parenting centre in defined geographical region of Brisbane during preg & postnatal period; IC: NR EC: NR; Reported AT: Up to 16W pp (Actual AT: mean (SD) 7 (4) (range 1-15) W)	N: NR (NR); n=24 fathers who responded to both questionnaires; Mean age (SD, range)=34.0 (7.1, 22-53); 93% married or cohabitating, 78% fathers had post-secondary education. 83% pregnancies planned. 100% healthy single born infants	To investigate whether disconfirmed expectations about infant & sleeping behaviours contribute to postnatal depressive symptoms.	Father sleep not assessed
28 (25) Philpott & Corcoran (2018) ⁴³ / Ireland / X	Recruited from primary care centre serving urban, suburban & rural southern region of Ireland, various SES levels. Mothers from large maternity hospital, fathers	N=100 (77%); n=100; Father age: 12% were <30, 36% were 30-34, 32% were 35-40; 20% were > 40; 71% Irish, 66% married, 31%	To investigate paternal PND, & to examine associations with a range of demographic & clinical factors	Father sleep not assessed

	from public health nurses' records, randomly selected; IC: > 18 y, infants < 12M; EC: NR; Stated AT: Up to 12M (Actual AT: NR)	cohabiting, 79% had completed post-secondary education, 84% employed. 47% lived in urban areas.		
29 (26) Repokari, Punamäki, Poikkeus, Vilksa, Unkila-Kallio, Sinkkonene, Almqvist, Tiitinen, Tulppala (2005) ⁷⁴ / Finland / L	Study group: couples recruited from 5 infertility clinics in Helsinki; Control group: couples recruited by consecutive sampling from the patient list for screening ultrasound scans at 16–18W gest at Helsinki University Central Hospital; IC: Study group: Finnish speaking, achieved viable singleton preg via ART using own gametes; Control group: Finnish speakers, no history of infertility, mother >25 y; EC: NR; Stated AT: 18-20W gest, 2M & 12M pp (Actual AT: NR)	N(study group)=367 couples (73.6%), N(control group)=379 couples (66.2%); n(study group)=352, n(control group)=358;; Men in the ART group were older than men in the control group (35.2 ± 5.8 versus 34.1 ± 5.4, p< 0.01); 74.7% of men in ART group were primiparous versus 45.5% in control group. Men in ART group had lower SES than control group. Compared to non-participants, participants had higher SES & fewer marriages/cohabiting partnerships	To investigate differences in mental health during transition to parenthood between parents undergoing treatment with assisted reproduction techniques & those who conceive spontaneously	Sleeping difficulties ^k increased from preg to 2M pp among the men who conceived spontaneously (p<0.05), not among men in the ART group. Scores NR
30 (27) Richter, Krämer, Tang, Montgomery-Downs & Lemola (2019) ³⁴ / Germany/ L	Data drawn from the German Socio-Economic Panel, a, nationally representative, longitudinal study in Germany. Annual interviews. Households selected using multistage random sampling technique with regional clustering.	N=2118 men who reported birth of first, second or third child during the study period (NR); n=2097 for sleep satisfaction, n=1864 for sleep duration; Mean age (SD) 36.2 (6.4); 94.9% cohabiting with partners, 37.9% had "high"	To examine the changes in mothers' & fathers' sleep satisfaction & sleep duration across pre-pregnancy, pregnancy, & pp period of up to 6 y after birth; also to determine potential protective &	Sleep satisfaction (on 10-point scale) decreased from preg to pp after: 1 st child: d=0.18 (0.41 scale points, B (SE) = -0.414 (0.095), p<0.001) 2 nd child d=0.09 (0.20 scale points, B (SE) = -0.198 (0.099), p<0.05). NS after 3 rd child (B (SE) = - 0.190 (0.129)) Mean sleep duration (weighted composite score based on SR number of hrs slept during working

	<p>IC: ≥18 y, living in Germany, contributed to at least 2 data points; EC: NR; Stated AT: 2 & 1 year before 1st childbirth, then 1, 2, 3, 4-6, >6 y after 1st, 2nd, 3rd childbirth Also for 1st childbirth: each trim of preg & each quarter pp (Actual AT: NR)</p>	<p>educational attainment, 42.4% were home owners.</p>	<p>risk factors for sleep during that time.</p>	<p>week and on weekend) decreased from preg to pp after: 1st child: $d=0.21$ (14 mins, $B (SE) = -0.240$ (0.051), $p<0.001$) 2nd child: $d=0.13$ (9 mins, $B (SE) = -0.143$ (0.054), $p<0.01$) 3rd child: $d=0.18$ (12 mins, $B (SE) = -0.203$ (0.071), $p<0.01$). Between 3rd trim preg & first 3M pp after 1st child: Decrease in sleep satisfaction $d=0.42$ (0.96 scale points) Decrease in sleep duration, $d=0.40$ (27 minutes), Improvement between 3M & 6M pp, $p<0.001$ Assoc between changes in sleep satisfaction or duration in 1st year after birth and age, household income & breastfeeding NS.</p>
<p>31 (28) Sälevaara, Punamäki, Unkila-Kallio, Vänskä, Tulppala & Tiitinen (2018) ⁷⁵ / Finland / L</p>	<p>Nested matched cohort study within a larger L study of psychosocial & mental health post IVF/ICSI. Couples recruited from Finnish fertility clinics. 1) conceived using oocyte donation (OD); 2) matched with couples who conceived through IVF/ICSI using own gametes; & 3) conceived naturally (NC) recruited at Helsinki University Hospital at 2nd trim ultrasound; IC: NR; EC: NR; Stated AT: 18 - 20W gest, 2M & 12M pp (Actual AT: NR)</p>	<p>N: NR (OD 69%, IVF/ICSI 80.1%, NC 80.5%); n(couples who conceived with OD)=26, n(matched controls IVF/ICSI)=52, n(NC)=52. Groups matched based on maternal age, parity, plurality & number of completed questionnaires completed by mother; Mean age (SD): OD=37.6 (6.3), IVF/ICSI=35.6 (4.7), NC=35.2 (5.4); Fathers in "high professional occupation": OD=25%, IVF/ICSI=40%, NC=50%.</p>	<p>To examine whether mothers & fathers after successful OD differ in their mental health problems from mothers & fathers conceiving with IVF/ICSI using their own gametes, & NC couples.</p>	<p>Mean (SD) sleeping difficulties^k: Preg: OD=1.65 (0.48), IVF/ICSI=1.64 (0.57), NC=1.56 (0.47) 2M pp: OD=1.86 (0.47), IVF/ICSI=1.59 (0.46), NC=1.68 (0.53) 6M pp: OD=1.60 (0.48), for IVF/ICSI=1.57 (0.46), NC=1.64 (0.50) Differences between groups NS</p>

Married: OD=69.2%,
IVF/ICSI=76.6%, NC=60.9%.

32 (29) Saxbe, Guardino & Shalowitz (2016) ⁴¹ / United States / L	Mothers recruited for the Child Community Health Network (CCHN) study (5 sites). Fathers invited to participate "with mothers' consent"; IC: NRS. Couples in romantic relationship. Mothers between 18 & 40, & self-identified as either African American, White, or Latina EC: NR Stated AT: 1M, 6M, 12M pp (Actual AT: NR)	N: NR (NR); n(mothers at 1M)=1453, n(couples at 6M)=711; Mean age (SD, range) =28.9 (7.1, 17.9-62.7); Predominantly low-income sample, 25% of fathers foreign born, 40% African-American, 26% Latino. Compared to population data, participants more likely to be non-white, lower income, single-parent households (NRS)	To clarify causal pathways linking sleep & pp depression via longitudinal path modeling. Hypotheses: Parents' sleep quality at 6M mediates change in depressive symptoms from 1 to 6M pp, & from 1 to 12M pp. Each parent's sleep quality mediates assoc between other parent's 1 & 6 / 12M pp depressive symptoms	Mean (SD) sleep quality/quantity ¹ score at 6M pp: 2.8 (1.4)
33 (30) Smart & Hiscock (2007) ⁷⁶ / Australia / X	Recruitment from hospital paediatric outpatient clinic. Parents waiting for first appointment at 'Unsettled Babies' clinic in Melbourne; IC: Parents of infants 0-7 months with crying, sleeping and/or feeding problems, referred by GP, maternal, family & child health nurse, hospital Emergency department; EC: NR; Stated AT: birth to 7M (Actual	N=59 (86%); n=59 at baseline; Mean age (SD) =34.5 (5.2); 75% born in Australia or NZ, 97% married or in de facto relationship, 96% employed, 37% completed post-secondary education. 65% first infant in family	To assess the impact of a brief paediatric intervention on parents' perceptions of infant sleeping/crying problems & temperament, & parent mental health, sleeping quality & quantity, & relationship satisfaction	"Good enough" / "More than good enough" sleep quality: 34% pre- & 23% post-intervention, NS ($p=0.27$) "Enough" / "More than enough" sleep quantity: 32% pre- & 43% post-intervention, NS ($p=0.11$)

	AT: Mean (<i>SD</i>) 14.9 (6.6) W at baseline)			
34 (26) Vilska, Unikila-Kallio, Punamäki, Poikkeus, Repokari, Sinkkonen, Tiitinen & Tulppala (2009) ⁷⁷ / Finland / L (includes sample of parents with singletons in paper 25)	Study group: couples from 5 infertility clinics in Helsinki; Control group: recruited at Helsinki University Central Hospital by consecutive sampling from patient list for screening ultrasound scans at 16–18W of gest; IC: Study group: Finnish speaking, achieved viable preg via ART as a result of fresh / frozen embryo transfer following IVF / ICSI; Control group: SC, Finnish speakers, no history of infertility, mother >25 y; EC: NR; Stated AT: 18-20W gest, 2M pp & 12M pp (Actual AT: mean (<i>SD</i>)=19.75 (3.5) W gest, 2.3 (0.9) M & 14 (1.6) M pp)	N(ART)=572, N(control)=497 couples (NR) Preg: n(ART)=460 couples (367 with singletons, 91 with twins, 2 with triplets); n(control)=400 couples (379 with singletons, 20 twins, 1 triplets) 2M: n(ART)=396 couples (324 singletons, 72 twins); n(control)=319 couples (304 singletons, 15 twins) 12M: n(ART)=325 couples (270 singletons, 55 twins); n(control)=262 couples (251 singletons, 11 twins) Mean age (<i>SD</i>): ART singletons=35.0 (5.8), ART twins=33.7 (4.5); Control singletons=34.2 (5.4); Control twins=32.9 (5.4), Retained fathers had lower SES & higher prevalence premature infants	To evaluate differences between the psychological well-being of ART & SC parents of twins & singletons	Mean (<i>SD</i>) sleep difficulties ^k : 2M pp: 1.66 (0.06) for ART twins, 1.87 (0.03) for ART singletons, 1.87 (0.13) for SC twins & 1.62 (0.03) for SC singletons. Differences NS between fathers of twins & singletons, $F=1.67$, & between SC & ART, $F=0.95$, NS. 12M pp: 1.76 (0.08) for ART twins, 1.60 (0.03) for ART singletons, 2.00 (0.17) for SC twins & 1.59 (0.03) for SC singletons. Sleeping difficulties more common in SC fathers of twins than in SC fathers of singletons ($F=6.66$, $p<0.01$). Difference NS between SC & ART groups, $F=1.10$

35 (31) Wulff & Siegmund (2000) ⁵⁹ / Germany / L	Couples who attended a birth preparation course in Berlin; IC: Primiparous, no preg complications; cohabiting without other family. Fathers employed, not night shifts; EC: NR; Stated AT: 37W gest, & 1-3W, 7-9W & 13-15W pp (Actual AT: NR)	N: NR (NR); n=7; Range of father age: 26-46; All high education, upper middle class.	To investigate changes in parents nocturnal activity-rest patterns from preg to pp & the structure of these family patterns in the first 4M pp; to clarify concordance between family activity patterns	Mean (SD): Duration of nocturnal rest excluding interruptions (in hrs, actigraphy): 07:03 (00:28) in preg, 06:50 (00:43) during 1-3W pp Duration of nocturnal activity (hrs, actigraphy): 00:53 (00:19) in preg, 01:11 (00:25) during 1-3W Changes NS During 1-3W pp, fathers' nocturnal time patterns were disrupted in concordance with the activity of mother & infant
36 (32) Yamazaki, Lee, Kennedy & Weiss (2005) ⁷⁸ / Japan / L	Couples recruited using convenience sampling from four sites in Japan where couples attend prenatal care; IC: Parents expecting their first child; EC: couples with medical, psychiatric or obstetric complications; Stated AT: 32-36W gest, & 4-5W after birth (Actual AT: NR)	N=278 couples (NR); n=101 couples (both assessment points); Mean age (SD, range)=31.6 (4.9, 21-53); All married, > 90% employed. Other demographics NRS	To examine how sleeping arrangements are related to sleep-wake cycles & social rhythms of Japanese parents before & after the birth of their first child	Mean (SD) TST (sleep log, averaged over 7 days): 07:20 (00:49) in preg, NR pp, changes NS Change in sleep wake rhythm (autocorrelation of daily recorded bedtime & wake time with a 7-day lag) from preg to pp NS Fathers who slept separately from the mother & baby had more irregular sleep-wake rhythm, compared to fathers who slept with mother & baby. Marginal auto correlations only presented in figures, appears to be 0.54 when sleeping with mother & baby, 0.34 when sleeping separately

Standardised sleep measures: ^a Pittsburgh Sleep Quality Index (PSQI, range 0 to 21, higher scores=more sleep difficulties), ^b 13-item Lee Fatigue Scale (LFS, range 0 to 10; higher scores=higher fatigue), ^c 21-item General Sleep Disturbance Scale (GSDS, range 0 to 147, higher scores=more sleep disturbance), ^d 7-item numerical rating version of the Visual Analog Scale for Fatigue (VAS-F, range 0 to 10, higher scores=higher fatigue), ^e Vitality subscale of the General Health Questionnaire-36 (GHQ-36, range for this subscale 4 to 24, higher scores=higher vitality), ^f Stanford Sleepiness Scale (SSS, range 1 to 7, higher scores=higher subjective sleepiness), ^g Visual Analogue of Fatigue Scale (VAFS, range 0 to 100, higher scores=higher fatigue), ^h Sleep quality subscale from the GSDS (range not stated, assumed to be 0 to 49, higher scores=poorer sleep quality), ⁱ Insomnia subscale of the Sleep Diagnostics Questionnaire Fatigue Assessment Scale (range 15 to 75, higher scores=more insomnia), ^j FAS, range 0 to 50, higher scores=higher fatigue), ^k Sleeping difficulties scale of the GHQ-36 (range 1 - 6, higher scores=more sleeping difficulties), ^l Abbreviated version (3 items) of the PSQI (range 0 to 9, higher scores=better sleep quality) .

Abbreviation key (in alphabetical order): ALSPAC: Avon Longitudinal Study of Parents and Children; am: morning; ART: Assisted Reproductive Technologies; assoc: association / associated; AT: assessment time; DAS: Dyadic Adjustment Scale; df: degrees of freedom; EC: exclusion criteria; EPDS: Edinburgh Postnatal Depression Scale; gest: gestation; hr(s): hour(s); IC: inclusion criteria; IVF/ICSI: In vitro fertilization / intracytoplasmic sperm injection; L: Longitudinal; M: months; min: minutes; MR: Maternal report; N/A: Not applicable; NC: Natural conception; NICU: Neonatal Intensive Care Unit; NR: Not reported; NRS: Not reported separately for fathers; NS: Not significant / Not significantly; OD: Oocyte donation; pm: evening; pp: postpartum; preg: pregnancy; sig: significant / significantly; Q: Qualitative; RCT: Randomised Controlled Trial; SC: Spontaneous conception; SD: Standard deviation; SES: Socio-economic status. SR: self-report; TST: Total sleep time; WASO: Wake after sleep onset; W: weeks; X: Cross-sectional; y: years.

497 Table 2 Associations between paternal sleep and paternal mental health and wellbeing

Paper / design	Paternal wellbeing variable, data source	Main findings: associations between paternal sleep and mental health and wellbeing
4 ⁴² / L	Depressive symptoms: EPDS (≥10, reference <10)	Adj for (1) to (13): Poor sleep quality (PSQI global score) and concurrent dep at 2M (OR 1.25, CI: 1.10, 1.42, p<0.01). Poor sleep quality during preg and dep 2M (OR 1.34, CI: 1.14, 1.58, p<0.01). Decline in sleep quality (from preg to 2M) and dep 2M (OR 1.36, CI: 1.17, 1.59, p<0.01) Poor sleep quality and concurrent dep at 6M (OR 1.37, CI: 1.16, 1.65). Poor sleep quality during preg and dep 6M (OR 1.29, CI: 1.04, 1.61, p=0.02). Assoc between decline in sleep quality (from preg to 6M) and dep 6M N/S
6 ⁴⁷ / Q	N/A	Exhaustion can lead to physical symptoms and difficulties with concentrating at work; Difficult to disentangle fatigue from symptoms of mental stress and coping with the stress of fatigue; Stress and worry can lead to difficulties sleeping
9 ⁶⁸ / L	1. Depressive symptoms: CES-D; 2. Marital satisfaction: DAS	Unadj assocs: 1. Higher am fatigue scores assoc with higher depression scores at 8W (r=0.367, p<0.05); NS and NR at other time points; Higher pm fatigue scores assoc with higher depression scores in preg (r=0.488, p<0.01) and at 4W (r=0.385, p<0.01); NS and NR at other time points; 2. Assoc between fathers' am or pm fatigue & marital satisfaction NS at any time point; statistics NR
10 ⁶⁹ / X	For each day (SR): 1. Wellbeing: happiness with one's life 2. Intimacy / connection with partner 3. Number of arguments with partner 4. Emotional closeness with child 5. Physical affection with child	Adj for (13): 1. Father wellbeing assoc with less father sleep (average over 8 nights), B(SE)=-.303 (.114), p<0.01 (Assoc with less sleep the night before NS) 2. Father-reported couple intimacy assoc with less father sleep (average over 8 nights), B(SE)=-.263 (.083), p<.01 (Assoc with less sleep the night before NS) 3. Assoc between number of arguments with partner and father sleep duration (the night before and average over 8 nights) NS 4. Father-reported closeness with infant assoc with less father sleep (average over 8 nights), B(SE)=-.209 (.082), p<.01, assoc with more sleep the night before, B(SE)=.046 (.020), p<.05 5. Father-reported physical affection with infant assoc with more father sleep the night before, B(SE) = .045(.022), p<.05 (Assoc with sleep on average NS)

14 ⁷¹ / L	Partner satisfaction: single item adapted from the Kansas Marital Satisfaction Scale.	Only variables assoc with marital satisfaction rating in univariate analyses are reported in stepwise multiple regression. Father sleep was not included, therefore assoc NS
15 ³⁶ / X	Relationship satisfaction: Comprehensive Marital/Relationship Satisfaction Scale	Adj for (14) to (16): Actigraphy measured TST independently predicted SR relationship satisfaction, $R^2 = 0.30$, $F(1, 18)=7.71$, $p<0.05$, $\beta=0.55$
18 ⁴⁰ / Q	N/A	When caring for an infant with excessive crying, both parents reported feeling exhausted, which impacted multiple other areas of their lives. Parents were willing to take risks to get some reprieve, including driving while tired (a father). Mostly, NRS
19 ³¹ / X	1. Depression: CES-D; 2. Perceived stress: PSS; 3. General Health: 1 item, 5 point Likert scale All assessed in preg only	Adj model NRS. Unadj assocs: 1. Depression scores (in preg) assoc with fatigue in preg ($r=0.42$, $p<0.001$), at 3M ($p=0.20$, $p<0.05$) and at 6M ($r=0.38$, $p<0.001$). Assoc NS $r=0.18$ at 1M Assoc between depression scores and sleep quality NS ($r=0.13$) 2. Perceived stress scores (in preg) assoc with fatigue in preg ($r=0.27$, $p<0.01$) and at 6M ($r=0.28$, $p<0.01$). Assoc NS $r=0.18$ at 1 and 3M Assoc between perceived stress scores and sleep quality NS ($r=0.01$) 3. General health (in preg) assoc with fatigue in preg ($r=0.24$, $p<0.05$), at 1M ($p=0.21$, $p<0.05$), at 3M ($p=0.23$, $p<0.05$) and at 6M ($r=0.23$, $p<0.05$) Assoc between general health ratings and sleep quality NS ($r=0.13$)
23 ³³ / L	1. Depressive symptoms: Depression subscale of the SCL-90 –R. 2. Quality of co-parenting: CRS	Adj model NRS. Unadj assocs: 1. Assoc between depressive symptoms at 1M and number of night wakings* NS at 1M ($r=0.10$) or 3M ($r=0.19$); Depressive symptoms at 3M assoc with number of night wakings at 3M ($r=0.22$, $p<0.05$) but not at 1 month ($r=0.07$, NS); Depressive symptoms at 1M assoc with sleep quality* at 1 month ($r=-0.19$, $p<0.05$) and 3M ($r=-0.19$, $p<0.05$); Depressive symptoms at 3M assoc with sleep quality at 3M ($r=-0.24$, $p<0.01$) but not at 1 month ($r=-0.16$, NS) 2. Assoc between CRS scores at 1M and number of night wakings NS at 1 month ($r=0.01$) or 3M ($r=-0.09$); Assoc between CRS scores at 3M and number of night wakings NS at 1 month ($r=0.05$) or 3M ($r=-0.02$); Assoc between CRS scores at 1 month and sleep quality NS at 1 month ($r=0.03$) or 3M ($r=-0.08$); Assoc between CRS scores at 3M and sleep quality NS at 1 month ($r=-0.01$) but sig at 3M ($r=0.13$, $p<0.01$) *Items adapted from 24-hour sleep patterns interview

24 ³⁹ / L	<p>1. Marital Satisfaction: 4-item scale (study specific)</p> <p>2. Couple problem solving: IPSI</p>	<p>1. NS assoc between marital satisfaction and insomnia ($\beta=-0.19$);</p> <p>2. Sig assoc between couple problem-solving ability and less insomnia ($\beta=-2.73$, $p<0.05$).</p> <p>Not clear which variables were adjusted for</p>
25 ²⁸ / L	<p>1. Safety compliance: subscale of Safety Behavior at Work Scale</p> <p>2. Safety participation: subscale of Safety Behavior at Work Scale</p>	<p>Unadj assoc:</p> <p>1.Compliance assoc with fatigue: $r=-0.32$, $p<0.001$ at 6W, $r=-0.39$, $p<0.001$ at 12W; Assoc between compliance and interrupted sleep NS: $r=-0.07$ at 6W and $r=-0.06$ at 12W; Compliance assoc with sleep duration $r=-0.26$, $p=0.003$ at 12W but NS at 6W ($r=0.02$);</p> <p>2.Participation assoc with fatigue: $r=-0.19$, $p<0.001$ at 6W and $r=-0.39$, $p<0.001$ at 12W; Assoc between participation and interrupted sleep NS: $r=0.10$ at 6W and $r=0.03$ at 12W; Participation assoc with sleep duration: $r=-0.21$, $p=0.002$ at 12W but not at 6W ($r=-0.06$).</p> <p>Adj for (15), (17), (18):</p> <p>1.Compliance assoc with fatigue: $\beta=-0.31$, $t=-4.68$, $p<0.001$ at 6W, $\beta=-.38$, $t=-5.972$, $p<0.001$ at 12W; Assoc between compliance and sleep interruption NS: $\beta=0.08$, $t=1.02$, $p=0.307$ at 6W, $\beta=0.08$, $t=1.13$, $p=0.261$ at 12W; Compliance assoc with sleep duration: $\beta=0.19$, $t=2.40$, $p=0.017$ at 12W but NS at 6W ($\beta=-0.04$, $t=-0.43$, $p=0.667$);</p> <p>2.Participation assoc with fatigue: $\beta=-.20$, $t=-2.95$, $p=0.004$ at 6W, $\beta=-0.32$, $t=-4.92$, $p<0.001$ at 12W; Assoc between participation and sleep interruption NS: $\beta=0.06$, $t=0.79$, $p=0.430$ at 6W, $\beta=0.10$, $t=1.30$, $p=0.195$ at 12W; Participation assoc with sleep duration: $\beta=0.17$, $t=2.09$, $p=0.037$ at 12W but NS at 6W ($\beta=-0.08$, $t=-0.99$, $p=0.327$)</p>
26 ⁴⁸ / Q	N/A	<p>Fathers required to return to work earlier (due to paternity leave restrictions), thus required to maintain a sleep schedule to be fit to work. Mothers required to care for infants both during work hrs and at night, perpetuating traditional gender roles. New fathers want to be more involved with their children; but the reality of the pressures during the early weeks of new parenting makes this difficult to achieve.</p>
29 ⁷⁴ / L	<p>1. Mental health: Subscale of GHQ-36;</p> <p>2. Trait anxiety: Spielberger Trait Anxiety Inventory;</p> <p>3. Worry about the child: study-specific 4-item scale</p>	<p>1. Assocs between mental health and sleep difficulties NR;</p> <p>2. Among both groups, trait anxiety was assoc with high levels of sleeping difficulties;</p> <p>3. Worry about the child assoc with higher levels of sleeping difficulties among all men ($p<0.001$).</p> <p>Further statistics NR</p>

32 ⁴¹ /L	Depressive symptoms: EPDS without sleep item	Unadj assoc between sleep quality / quantity scores at 6M and scores on modified EPDS: $r=0.20$, $p<0.01$ at 1M, $r=0.29$, $p<0.1$ at 6M and $r=0.24$, $p<0.01$ at 12M; Adj for (1) to (3), (5), (19) to (28): $\beta=0.22$, $SE=0.03$, $p=0.001$ at 6M, $\beta=0.15$, $SE=.04$, $p=0.001$ at 12M; Concurrent SEM model: Sleep quality 6M assoc with EPDS scores 6M (0.29, $p<0.001$) 6M longitudinal SEM model: EPDS scores 1M predicted worse sleep quality 6M (0.18, $p<0.001$), sleep quality 6M assoc with EPDS scores 6M (0.22, $p<0.001$). Sleep quality sig mediated assoc between depression 1M and 6M, model fit improved when indirect paths added (direct 0.34, $p<0.001$) 12M longitudinal SEM model: EPDS scores 1M predicted worse sleep quality 6M (0.17, $p<0.001$), sleep quality 6M assoc with EPDS scores 12M (0.15, $p<0.001$). Sleep quality sig mediated assoc between depression 1M and 12M, model fit improved when indirect paths added (direct 0.44, $p<0.001$)
36 ⁷⁸ /L	Daily social rhythm regularity: Daily Social Rhythm Metric	Fathers who slept with the mother and baby had improved social rhythms from preg (3.5 ± 1.07) to pp (3.9 ± 1.38); Fathers who slept alone had a slight improvement in social rhythm from preg (3.4 ± 1.05) to pp (3.5 ± 1.09)

Abbreviation key (in alphabetical order): adj: Adjusted; am: morning; AMD: Adjusted Mean Difference; AOR: Adjusted odds ratio; assoc(s): association(s) / associated; CES-D: Centre for Epidemiological Studies – Depression Scale; DAS: Dyadic Adjustment Scale; EPDS: Edinburgh Postnatal Depression Scale; GHQ: General Health Questionnaire; hr(s): hour(s); IPSI: Interactional Problem-Solving Inventory; LSAC: Longitudinal Study of Australian Children; M: months; min: minutes; NR: Not reported; NRS: Not reported separately for fathers; NS: Not significant / Not significantly; OR: Odds ratio; pm: evening; pp: postpartum; preg: pregnancy; POMS: Profile of Mood States;): PSS: Perceived Stress Scale; SCL-90: Symptoms Checklist-90; SEM: Structural Equation Modelling; sig: significant / significantly; SR: self-report; TST: Total sleep time; unadj: Unadjusted; WASO: Wake After Sleep Onset.

Variables adjusted for in analyses: (1) paternal education (2) partner mental health score (3) indicators of socio-economic status, (4) indicators of partner relationship satisfaction (5) ethnicity, (6) paternal age, (7) marital status, (8) time with partner, (9) smoking, (10) work status, (11) parenting stress, (12) social support, (13) trial arm, (14) own mental health score, (15) self-reported measures of sleep, (16) actigraphy-assessed measures of sleep, (17) work hrs, (18) physical intensity of work, (19) race, (20) BMI, (21) C-section, (22) infant birth weight, (23) cohabitation, (24) foreign birth, (25) maternal parity, (26) maternal sleep quality / quantity, (27) breastfeeding, (28) baby sleeping with parents

509 Table 3: Associations between infant sleep and paternal wellbeing

Paper number	Paternal variables	Main findings: Associations between infant sleep and father wellbeing
2 ⁴⁵ /X	Depressive symptoms: EPDS	Unadj assoc between infant sleep behaviours* and depressive symptoms: 0.17, $p < 0.05$. Assoc NS when Adj for (1) to (10),: $B = 0.05$, $\beta = 0.03$, $p = 0.748$ <i>*getting to sleep at night /in the day, staying asleep, & too little sleep, adopted from ALSPAC</i>
3 ³⁰ /L	1. Depressive symptoms: EPDS; 2, 3, 4. Parental Cognitions about Infant Sleep Questionnaire: Adapted from Maternal Cognitions about Infant Sleep Questionnaire (MCISQ) - scales include 2. doubt about ability to parent at bedtime 3. anger towards infant 4. ability to set limits at bedtime; 5. Sleep Quality: single item from PSQI – dichotomised; 6. Sleep Quantity: Single item from PSQI – dichotomised; 7. Perceived social support: Two items from LSAC	Infant sleep is a problem $n(\%)$: 58 (56.9) at 4M and 49 (54.4) at 6M Adj for (1) to (3), (11) fathers reporting infant sleep was a problem versus not a problem: 1. higher EPDS scores at 4 M: Mean (SD) 4.86 (3.89) versus 2.63 (2.57), $AOR = 2.64$, $95\%CI = [1.27, 4.00]$, $p < 0.001$; and at 6M Mean (SD) 4.24 (3.36) versus 1.60 (2.16), $AOR = 2.56$, $95\%CI = [1.28, 3.84]$, $p < 0.001$; 2. more doubt about their ability to parent their infant at bedtime at 4 M: Mean (SD) 5.36 (3.84) versus 3.63 (2.72), $AOR = 1.82$, $95\%CI = [0.40, 3.25]$, $p = 0.01$. NS at 6 M; 3. more anger towards their infant at 4 M: Mean (SD) 5.88 (3.15) versus 3.93 (3.45), $AOR = 1.86$, $95\%CI = [0.51, 3.20]$, $p = 0.01$; and at 6M Mean (SD) 5.24 (3.34) versus 3.45 (2.02), $AOR = 1.63$, $95\%CI = [0.40, 2.87]$, $p = 0.01$; 4. difference in limit setting scores NS at either 4 or 6 M; 5. more likely to indicate sleep quality “not good enough” at 4M $n(\%)$: 34 (58.5%) versus 12 (27.3%), $AOR = 0.20$, $95\%CI = [0.08, 0.51]$, $p < 0.001$; and at 6M $n(\%)$: 27 (55.1%) versus 10 (24.4%), $AOR = 0.28$, $95\%CI = [0.11, 0.72]$, $p = 0.01$; 6. more likely to indicate sleep quantity “not enough” at 4M $n(\%)$: 39 (67.2%) versus 14 (31.8%), $AOR = 0.21$, $95\%CI = [0.09, 0.51]$, $p < 0.001$; at 6M $n(\%)$: 32 (66.7%) versus 9 (22.0%), $AOR = 0.14$, $95\%CI = [0.05, 0.38]$, $p < 0.001$; 7. more likely to indicate not enough support from family & friends at 4M $n(\%)$: 16 (27.6) versus 4 (9.1) $AOR = 0.23$, $95\%CI = [0.07, 0.82]$, $p = 0.02$. NS at 6 M; more likely to indicate not enough support overall at 4M $n(\%)$: 29 (50.0) versus 11 (25.0) $AOR = 0.32$, $95\%CI = [0.13, 0.79]$, $p = 0.01$. NS at 6 M
11 ³⁸ /L	Depressive symptoms: EPDS Also assessed sleep duration, latency to sleep (≥ 30 min), rating of sleep quality, rating of sleep quantity, fatigue	4M: 11.7% of fathers reported that infant’s sleep was problematic; 6M: 16.6% Intervention to prevent infant sleep problems was not effective in preventing the development of parent-reported infant sleep problems. No differences between groups in terms of EPDS scores, sleep quality or prevalence of latency to sleep (≥ 30 min)
18 ⁴⁰ /Q		Infants' excessive crying is suggested to be a causal factor in the sleep deprivation of parents

19 ³¹ / X	1. Depression: CES-D (assessed during preg); 2. Stress: PSS; 3. General Health: single item; 4. Fatigue: 13 item VAS-F; 5. Sleep quality: 7 item subscale of GSDS	Adj assocs NRS. Unadj assocs between number of hrs infant slept in a row at 1M and: 1. depression scores: $r=0.03$, NS; 2. perceived stress scores: $r=0.05$, NS; 3. general health item response: $r=0.08$, NS; 4. fatigue scores at 1M: $r=-0.07$, ns; 3M: $r=-0.08$, ns; 6M: $r=-0.06$, NS; 5. sleep quality scores: $r=-0.20$, $p<0.05$
20 ⁴⁴ / X	1. Depressive symptoms: BDI-II; 2. Marital satisfaction: DAS; 3. Parenting stress: modified Parenting Daily Hassles Scale (PDH); 4. Family unit functioning: Family Assessment Device (FAD) 5. "Psychological functioning index" (PFI): derived from scores on BDI & PDH; 6. "Relational functioning index" (RFI): derived from FAD & DAS.	Mean (SD) infant longest duration of night-time sleep on a typical night ("parent" report during joint interview)= 6.5 (2.3) hrs Unadj assocs between shorter duration of infant sleep and: 1. depression scores: $r=0.09$, NS; 2. DAS scores: $r=0.12$, NS; 3. parenting stress scores: $r=-0.34$, $p<0.01$; 4. family unit functioning scores: $r=-0.24$, $p<0.05$; 5. psychological functioning index: $r=-0.33$, $p<0.01$; 6. relationship functioning index: $r=0.21$, NS Adj for (3), (4), (9), (12), assocs between shorter duration of infant sleep and: 5. Psychological functioning index: $B=0.16$, $\beta=-0.31$, $p<0.05$; 6. Relationship functioning index: $B=0.82$, $\beta=0.13$, NS
21 ⁷² / X	Depressive symptoms: EPDS Stress: PSS Social support: Social Support Rating Scale	Only variables assoc with EPDS scores in univariate analyses were included in stepwise multiple regression. Infant sleep duration (<12 hours, 12 - 20 hours or > 20 hours) was not included, therefore assoc NS
22 ⁴⁶ / X	1. Psychological distress: Kessler-6 (K-6), scores ≤ 18 indicative of distress; 2. General Health: Item SF-36, from 1 poor) to 5 excellent	Unadj assocs between infant sleep problems (MR) and: 1. Paternal psychological distress: OR=1.90, 95%CI [1.21, 2.99], $p=0.006$; 2. fair/poor general health: OR=1.52, 95%CI [1.16, 1.99] Adj for (5), (12) to (14): assocs NS

23 ³³ / L	1. Depressive symptoms: depression subscale of the Symptom Checklist-90-Revised (SCL-90-R); 2. Quality of co-parenting relationship: CRS; 3. Frequency of night waking: SR; 4. Perceived sleep quality: SR	Adj assoc NRS. Unadj assoc between number of times infant woke at night (SR) at 1M and: 1. depression scores at 1M (r=-0.09, NS), 3M (r=-0.09, NS); 2. CRS scores at 1M (r=0.15, NS), 3M (r=0.07, NS); 3. number of paternal night wakings at 1M (r= 0.36, p< 0.001), 3M (r= 0.11, NS); 4. paternal sleep quality at 1M (r=-0.02, NS), 3M (r= 0.11, NS) Unadj assoc between number of times infant woke at night at 3M and: 1. depression scores at 1M (r=-0.04, NS), 3M (r= 0.02, NS); 2. CRS scores at 1M (r= 0.13, NS), 3M (r= 0.02, NS); 3. number of paternal night wakings at 1M (r= 0.11, NS), 3M (r=0.28, p< 0.01); 4. paternal sleep quality at 1M (r=0.05, NS), 3M (r=-0.02, NS)
24 ³⁹ / L	1. Marital Satisfaction: 4-item scale (study specific); 2. Couple problem solving: Interactional Problem-Solving Inventory (IPSI); 3. Insomnia: 15 item subscale of Sleep Diagnostic Questionnaire	Adj analysis (not clear which variables controlled for), infant longest sleep in past 2W (SR) NS assoc with: 1. Marital satisfaction: RC=0.08, NS; 2. Couple problem solving: RC=-2.65, NS 3. Paternal insomnia: RC=-0.96, NS Infant awake at night duration NS assoc with: 1. Marital satisfaction, 2. Couple problem solving, 3. Paternal insomnia
27 ⁷³ / X	Depressive symptoms: EPDS	Assoc between disconfirmed expectations of infant sleep and EPDS scores NS. Statistics NR
28 ⁴³ / X	Paternal postnatal depression: EPDS (minor dep ≥ 9, reference <9; major dep ≥ 12, reference <12)	Among fathers with EPDS ≥9, 58.8% reported infant sleep problems, compared to 21.6% among fathers with EPDS < 9 (p= 0.002); Adj for (5), (11), (15): AOR=3.97 (95% CI .941 - 16.74, p= 0.060); Assoc between infant sleep problems & major depression NS

Abbreviation key (in alphabetical order): BDI: Beck Depression Inventory; CES-D: Centre for Epidemiological Studies – Depression Scale; DAS: Dyadic Adjustment Scale; EPDS: Edinburgh Postnatal Depression Scale; GHQ: General Health Questionnaire; GSDS: General Sleep Disturbance Scale; IPSI: Interactional Problem-Solving Inventory; LSAC: Longitudinal Study of Australian Children; POMS: Profile of Mood States; PSS: Perceived Stress Scale; SCL-90: Symptom Checklist-90; SF-36: Short Form Health Survey–36; VAS-F: Visual Analog Scale for Fatigue
adj: Adjusted; ALSPAC: Australian Longitudinal Study of Parents and Children; AMD: Adjusted Mean Difference; AOR: Adjusted odds ratio; assoc: association / associated; B: unstandardized coefficient; β: standardised coefficient; CI: Confidence Intervals; hr: hour; L: Longitudinal; M: months; min: minutes; MR: Maternal report; NRS: Not reported separately for fathers; NS: Not significant; OR: Odds ratio; preg: pregnancy; Q: Qualitative RC: Regression coefficient (not further specified); SR: self-report; unadj: Unadjusted; X: Cross-sectional

Variables adjusted for: (1) infant gender, (2) infant age, (3) paternal education, (4) paternal age, (5) partner support (6) other support, (7) life events, (8) fathers' regulation beliefs, (9) infant temperament / negativity, (10) infant feeding behaviours, (11) indicators of socio-economic status, (12) partner's mental health score, (13) unemployment, (14) indicators of partner relationship satisfaction, (15) full-term pregnancy

Figure 1: PRISMA flow chart showing screening and identification of eligible papers