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REVIEW ARTICLE

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Psycho-educational interventions focused on maternal or infant sleep for pregnant women to prevent the onset of antenatal and postnatal depression: A systematic review

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Abstract

Aims: This systematic review aimed to evaluate randomized controlled trials (RCTs) to examine the effect of maternal and infant sleep intervention during women's pregnancy for the purpose of preventing perinatal depression.

Method: A systematic search (from inception to January 28, 2019) for RCTs using five electronic databases—the Cochrane Controlled Register of Trials (CENTRAL), Embase, PubMed, PsycINFO, and Ichushi Web (Japan Medical Abstracts Society)—was conducted. Twelve investigators independently conducted initial screenings based on title and abstract, and then, two researchers performed full-text reviews one by one. A meta-analysis would be conducted if at least three studies were found. However, only two articles that met inclusion criteria, and narrative data synthesis was conducted for these two articles. The study protocol has been registered at PROSPERO (CRD42019119999).

Result: A total of 13 654 studies were initially searched. After removing duplicates, 10 547 studies were screened, and finally, two studies met the inclusion criteria. In both studies, the intervention was a one-time face-to-face session during pregnancy to deliver the behavioral knowledge and skills for optimizing sleep hygiene for both infant and mother. Effectiveness of the intervention in improving maternal mood was not significant in one study. In the other, there was a significant difference in maternal mood between the intervention and control group. No mood comparison was made between baseline and postintervention.

Abbreviations: AND, antenatal depression; CBT-I, cognitive behavioral therapy for insomnia; PICO, participants, interventions, comparisons, and outcomes; PND, perinatal depression; PPD, postpartum depression; RCT, randomized controlled trial; SHE, sleep hygiene education; TAU, treatment as usual.

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Conclusion: This study found limited evidence to support the effectiveness of sleep intervention for all pregnant women, which means "universal intervention," to protect maternal mental health. Further well-designed RCTs are needed to confirm these findings.

KEYWORDS
antenatal depression, CBT-I, maternal and child health (MCH), postnatal depression, sleep disturbance, sleep hygiene, universal prevention

1 | BACKGROUND

Perinatal depression (PND), defined as a major or minor depressive episode that occurs during pregnancy or within the postpartum year,[1] imposes a staggering public health burden.[2] PND has become regarded as a significant public health issue because of its high worldwide prevalence among perinatal women; antenatal depression (AND) has a rate of 5% to 15%[3] and postpartum depression (PPD): a rate of 15%.[4] Depression during pregnancy not only severely affects mothers' emotions, but causes difficulty performing usual activities, poor sleep, reduced breastfeeding, and failure to seek prenatal care, as well as an increased risk of PPD.[5-7] Also, PPD creates a risk of tragedy for both mother and infant, that is, suicide, which accounts for 20% of deaths in postpartum women.[8] Higher prenatal depressive symptoms of mothers were also associated with poor infant physical health: preterm birth, low birth weight,[9] early gestational age,[10] increased risk of infant hospitalization,[11] and longer-term temperament and behavioral problems of the child.[12] In addition, because PPD is the strongest predictor of parenting stress,[13] it may cause abusive parenting behavior,[14] impaired affectional ties (bonding), or poor offspring physical/socioemotional development.[15] These impacts of PPD highlight the need for preventive interventions from the early perinatal phase.[5]

Sleep problems in the perinatal period can also be a cause of AND and PPD,[16] as well as insomnia is generally known as a predictor for depression.[17] A previous review has suggested that sleep deprivation during pregnancy increases the risk of PPD through the mechanism of systematic inflammation (eg, higher levels of pro-inflammatory serum cytokines).[18] Insomnia or poor sleep quality in pregnancy are extremely common. Estimated prevalence of insomnia in pregnancy ranges from 50% to over 60%,[19-21] while studies using objective sleep measures revealed more sleep needs in pregnancy.[18] Self-reported poor sleep quality in pregnancy is also predictive of poor postpartum sleep.[21,22] Fragmented sleep during the perinatal period can be caused by hormonal alterations and a newborn with random/short sleep-wake patterns after childbirth.[23-26] Short sleep duration increases the risk of the onset of depression (RR = 1.31),[27] producing negative effects on mental and physical health.[28] In fact, insomnia treatment with trazodone or diphenhydramine during the third trimester of pregnancy was effective for reducing depressive symptoms after childbirth.[29] Sleep disturbance can cause a variety of physical symptoms and social dysfunctions, and it is also a burdensome and unbearable condition in itself.[30] In this target population (perinatal women), interventions aimed at improving sleep are important to alleviate sleep-related symptoms, as well as to prevent depression.

Psycho-educational interventions for sleep problems among perinatal women can be differentiated into two approaches: those focusing on maternal sleep and those focusing on infant sleep. For maternal sleep, in general, sleep hygiene education (SHE) and cognitive behavioral therapy for insomnia (CBT-I) have been shown to be effective for improving sleep problems,[31,32] although SHE was reported to be less effective than CBT-I for insomnia in general population.[32] For pregnant women with insomnia, a group based CBT-I intervention achieved significant reductions in insomnia symptoms and increases in subjective sleep quality.[33] Digital CBT-I program was also revealed its significant improvements for insomnia symptoms using a randomized controlled design.[34] Infant sleep is also important psycho-educational target because the newborn's random/short sleep-wake mainly affects maternal sleep cycles. Interventions to improve infant sleep quality have been commonly based on developmental and behavioral psychology. The contents include supplying information such as normal infant sleep and crying patterns, settling techniques, and medical causes of crying and are delivered via face-to-face sessions, booklets, media, or telephone consultation.[35] A previous meta-analysis of randomized controlled trials (RCTs) indicated that interventions focused on infant sleep improved infant nocturnal total sleep time and reduced the number of nighttime awakenings [36]. Enhancement of infant sleep promotes maternal sleep, because the majority of sleep disturbances are caused by the newborns' sleep and feeding schedules.[37] Sleep-focused psycho-educational interventions would reduce health burdens of maternal sleep in the perinatal period.

Maternal mood might also be protected by sleep interventions. CBT-I has been shown to be effective for reducing depressive symptoms not only among people with insomnia in general,[38-42] but also among postpartum women with insomnia,[43] although research on cognitive behavioral sleep interventions is still in its infancy. One RCT designed study of postnatal education focusing on maternal and infant sleep showed significant effectiveness for the reduction of risk of high depression scores (adjusted odds ratio = 0.57, 95% confidence interval; 0.34-0.94).[35] However, evidence regarding prevention of AND and PPD is still limited. In 2016, a systematic review of five RCTs[36] investigated the effectiveness of psychosocial sleep interventions among pregnant or postnatal women for improving

maternal mood after childbirth, showing improvements (Hedge's g = 0.15, *P* = .01). The studies reviewed included the article above.[35] However, all participants in the included studies were postnatal women and a funnel plot suggested a publication bias.

Postnatal women with insomnia have been targeted by preventive interventions, but pregnant women are also an important population to be approached. While the most potent overall clinical predictor of PND is a previous depressive episode,[44] AND is regarded as an especially significant risk factors for PPD.[13] Poor sleep quality in pregnancy is also predictive of poor postpartum sleep.[21,22] In addition, universal prevention for the entire pregnant population, including no-risk and high-risk groups, has been noted as a new strategy to prevent PND. The collective frequency of any risk factors in women of reproductive age is relatively high, suggesting the difficulty of effective screening.[2] As a universal prevention strategy during pregnancy, psychosocial interventions have much to recommend them because they can be delivered at low cost and with minimal invasiveness.[45] It compels consideration of whether all pregnant women, including high-risk populations, should have the opportunity to receive preventive psychosocial intervention as a standard of practice in maternity care.[2] In addition, pregnant women have more spare time to learn than postnatal women, and thus, pregnancy is a good time to introduce interventions. However, it is still unknown whether universal psycho-educational intervention targeted at sleep problems would have the potential to effectively prevent depression, considering the high prevalence of sleep problems among perinatal women. The research discussed above suggests that it is very relevant to investigate whether psycho-educational intervention (ie, CBT-I and sleep education) can prevent PND for all pregnant women.

The aim of this study is to evaluate published RCTs to examine the effectiveness of universal intervention focused on sleep problems and started during pregnancy for preventing PND. This result will help care workers and policymakers in public health to decide whether psycho-educational sleep interventions for prenatal women are worth promoting or not.

2 | METHODS

2.1 | Study design

The method was reported according to the Preferred Reporting Items for Systematic Review and Meta-Analysis (PRISMA) guidelines.[46] The PRISMA checklist document showed this in more detail (see Appendix 1). The study protocol has been registered at PROSPERO (CRD42019119999).

2.2 | Data sources and searches

Search terms were constructed, referring to previous comprehensive meta-analysis.[47] Search terms used in this study are listed in Appendix 2. Article extraction was conducted on January 28th, 2019. There were no restrictions or limitations for search dates or publication period before the first screening. Studies published as original articles written in English or Japanese that were published prior to January 29th in 2019 were included. The databases defined as information sources were MEDLINE, EMBASE, the Cochrane Central Register of Controlled Trials (CENTRAL), PsycINFO, and Ichushi Web (Japan Medical Abstracts Society). The search strategy for all sources is included in the relevant section. The following relevant information was extracted from the selected studies: author, year of publication, country, number of participants, details of the intervention and control conditions, age of participants, duration of follow-up, measurement tool, scores for postpartum depression and other outcomes, and attrition. If there was missing information in the article, authors asked the corresponding author to provide it.

2.3 | Eligibility criteria

Eligible studies were those that (a) were conducted to evaluate the association between sleep intervention and PND; (b) used a randomized controlled trial design; (c) were not restricted to a high-risk population as a target; (d) were published in English or Japanese; (e) were published up to the data extraction day, January 28th, 2019; and (f) were not protocol papers or conference abstracts. To formulate research questions and facilitate the literature search, the PICO framework (participants, interventions, comparisons, and outcomes; PICO)[48] of the current study in the systematic review and meta-analysis was defined as follows:

2.4 | Participants

All adult pregnant women over 18 years old, with no restrictions in terms of psychological diagnosis, sleep problems, age, ethnicity, race, and other demographic characteristics. Studies that only included a high-risk population (selective/indicated target) were excluded.

2.5 | Interventions

Psycho-educational intervention focused on maternal or infant sleep, with at least one session provided during pregnancy. There were no restrictions in terms of setting, timing, or content; interventions could be conducted at every levels of healthcare or at participant's home; interventions could be continued after childbirth if they started during pregnancy; and interventions of any sort could be adopted if they were focused on maternal or infant sleep. The contents of perinatal sleep-focused intervention can be considered to involve two approaches: (a) sleep education for the mother and (b) childcare education for improving infant sleep.

2.5.1 | Sleep education for the mother

Psycho-educational sleep intervention could include, for instance, stimulus control (eg, to use their bed only for sleeping, to go to bed only when they were sleepy); sleep restriction (eg, reducing time in bed with the aim of enhancing homoeostatic sleep pressure); cognitive therapies (eg, regarding dysfunctional attitudes and beliefs toward sleep); and sleep hygiene and relaxation training.[38,40]

2.5.2 | Childcare education for improving infant sleep

Infant sleep interventions included, for example, supplying information about normal development patterns of infant sleep and crying; settling techniques (with emphasizing the importance of baby's self-settling or self-regulation of sleep); creating sleep time rituals (eg, bath, massage, swaddling, soft music, infant self-soothing); safe sleep practices (eg, to prevent sudden unexpected death in infancy); and medical causes of crying and parent self-care.[35,49,50]

2.6 | Comparisons

A wait-list or information only condition. The intervention was compared to no treatment, wait-list control, treatment as usual (TAU), or active control. TAU is standard management for perinatal women, established according to current norms or according to the criterion of the clinician at the relevant level of healthcare, conducted naturalistically.

2.7 | Outcomes

Antenatal or postnatal depression/depressive symptoms. The primary outcome measured was antenatal or postnatal reduction in depressive symptoms after intervention, which was determined by diagnostic interview or validated self-reported psychological questionnaire. The secondary outcome was maternal sleep-related outcome, if primary outcome was evaluated in the included study.

2.8 | Study selection

All the records yielded by the database search were compiled and managed using Microsoft Excel (Washington, USA). Duplicate studies were excluded by NY before screening. Thereafter, twelve investigators (NS, NY, DN, EO, ZN, JS, TI, AI, YY, RY, AM, and TS) were divided into six groups of two people. Each group performed the first screening for one-six of all studies after duplication removal.

They excluded studies which did not meet the eligibility criteria based on a title and abstract assessment (first screening). In this stage, kappa statistics of each pair of investigators were calculated to assess the reliability of their ratings and agreement. Then, NS and DN individually conducted full-text reviews of those studies for which the eligibility criteria could not be judged only by the title and the abstract. Studies which did not meet the eligibility criteria after full-text review were discussed by all investigators, and we recorded the reasons for excluding studies at the full-text review phase. Studies meeting the eligibility criteria were selected for inclusion in the review.

2.9 | Risk of bias: individual studies

NS and DN independently conducted quality assessment by using the GRADE approach, which is Cochrane Collaboration's risk of bias tool containing information about sequence generation, allocation concealment, blinding of outcome assessors, incomplete outcome data, selective outcome reporting, and other sources of bias.[51] This approach classifies levels of quality into three categories (high, low, and uncertain).

2.10 | Statistical methods

For the main analysis, we synthesized all types of sleep interventions and all types of outcomes related to depression or depressive symptoms. Meta-analysis would be conducted if at least three eligible studies were found. If a meta-analysis was not appropriate (ie, only two or fewer studies were eligible and included), the results would be presented in a narrative format.

3 | RESULT

3.1 | Database searching

Database searching yielded 13 654 abstracts (CENTRAL n = 739, PubMed n = 3211, EMBASE n = 5387, PsycINFO n = 3689, Japan Medical Abstracts Society n = 628). After removing 3107 duplicates, 10 547 records were included in the first screening, after which 10 538 records were excluded and nine records proceeded to full-text screening. Subsequently, seven studies that did not meet the criteria for article type (n = 3), participant (n = 3), and study design (n = 1) were excluded. Finally, two studies[24,52] were included in the qualitative systematic review. The data of 10 547 records are available in Appendix S1. The study selection flowchart is shown in Figure 1. At the first screening, the kappa statistic of each pair of investigators was 0-0.67.

3.2 | Study description

A summary of the included studies is shown in Table 1. One study[52] was conducted in the USA in 2014 and the other[24] in New Zealand in 2017. The included US study (Bhati, 2014) was a preliminary RCT of PhD thesis. Participants were not restricted to high-risk pregnant

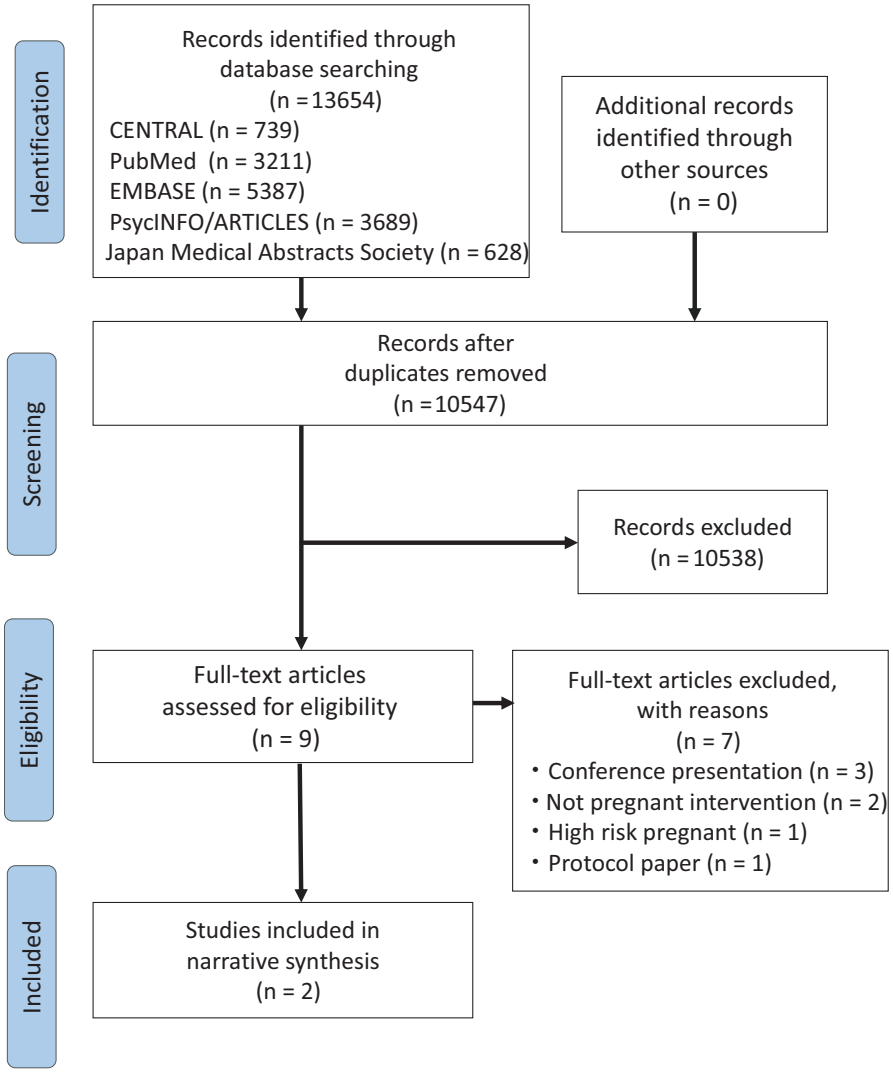

FIGURE 1 PRISMA 2009 Flow Diagram; Flowchart of systematic review search results

women, and participants were divided into two groups (both third trimester) in terms of number of weeks' gestation, 36-42[52] and 28-30,[24] respectively. The total number of participants in the two studies was 34[52] and 802,[24] respectively. Interventions were focused on infant and maternal sleep in both studies and conducted one session during the antenatal period and another session postpartum. Outcome was measured with the EPDS for depressive symptoms in both studies and with an original questionnaire for sleep outcomes, including refreshed sleep,[52] sleep quantity and quality, sleep duration (hour), and sleep latency (>30 minutes).[24] Effectiveness of the intervention for both maternal mood and sleep outcome was not significant in one study.[24] The other study found a statistically significant difference between the intervention and control groups; however, baseline data before intervention were not obtained.[52] Effectiveness for perinatal depression and sleep outcome was not reported in either article.

3.3 | Risk of bias assessment

The result for risk of bias and quality assessment are shown in Table 2. Participant blinding could not be guaranteed within each of these studies as the interventions were psychosocial; this item therefore was rated as high risk in all studies.

3.4 | Results of individual intervention

The contents of each intervention are summarized in Table 3. Both interventions provided explanation about benefit of sleep, sleep hygiene principles, and acceptance of help offers. One study included information the prevention of infant sudden death and making babies settle by themselves.[24] The other discussed the importance of sunlight and bright light to establish normal circadian rhythm.[52]

4 | DISCUSSION

This is the first review to investigate the effectiveness of universal prenatal intervention focused on sleep for preventing PND. The effectiveness for AND and PPD or for maternal sleep is still unknown, because the available evidence has not been sufficient to draw conclusions. Further RCT studies should be done in the future, because

TABLE 1 Selected characteristics of included randomized controlled trials

Author, Year, (ref)	Country	Participant	Number of participants (intervention/ control)	Intervention type	Number of sessions	Time of one session	Control type	Duration of follow-up	Outcome measures	Primary Outcome (depression)	Secondary Outcome (maternal sleep)
Bhati, 2014[52]	USA	36-42 wk gestation	Total 34	Maternal and infant sleep individual education	2 sessions Antenatal face-to-face education + weekly text message of cellular phone in postpartum	45 min	Active control (education)	6 wk (postnatal)	EPDS	t(32) = 2.2, $P = .037$	[a] t (32) = 2.904, $P = .007$
Galland, 2017[24]	New Zealand	28-30 wk gestation	1)209 2)205 3)192 4)196	1) Control 2) Food, activity, and breastfeeding intervention 3) Maternal and infant sleep group education 4) Combined intervention group receiving both 2) and 3)	2 Sessions 3) Sleep Antenatal group session + home visit at 3 wk postpartum (with a booklet)	1 h	Usual care	6 mo (postnatal)	EPDS	NS	[b] N.S.

Abbreviation: NS, not significant.

[a]Refreshed sleep, defined as nonrestorative sleep which is a core symptom of insomnia, was measured by these two items: (i) how many hours of sleep do you need per night to feel refreshed and (ii) on an average how many hours of sleep did you obtain per night since your baby was born?

[b]Sleep quantity and quality, sleep duration (from sleep onset to offset), and sleep latency (time taken to fall asleep) were measured by original questionnaire.

TABLE 2 GRADE risk of bias assessment

Bias	Authors' judgment	Support for judgment
Galland, B. C., 2017		
Random sequence generation	Low	A computerized random-number generator was used to assign blocks of participants to the four arms
Allocation concealment	Low	Allocation was concealed by opening an opaque presealed envelope
Blinding of participants and researchers	High	Not blinded to participants or researchers
Blinding of outcome assessment	High	Using a self-report questionnaire
Incomplete outcome data	High	Not declared conducting intent-to-treat (ITT) analysis
Selective reporting	Low	Outcomes were the same as reported in protocol paper
Other bias	Low	No other bias
Bhati, S. R., 2014		
Random sequence generation	Low	Using the computerized randomizer which generated the numbers for randomization
Allocation concealment	Uncertain	Not described in detail
Blinding of participants and researchers	High	Not blinded to participants or researchers
Blinding of outcome assessment	High	Using a self-report questionnaire
Incomplete outcome data	High	Not declared conducting ITT analysis
Selective reporting	Uncertain	No protocol paper
Other bias	Low	No other bias

sleep-focused interventions can be expected as a preventive strategy based on theoretical support. The present study achieved new insights about universal sleep-related interventions during pregnancy and suggested the further research directions.

The effectiveness of the interventions in PND prevention was inconsistent between the two studies included in the current review. Although the effectiveness of sleep intervention during pregnancy is unclear at this time, it may be more difficult to improve postpartum outcomes by interventions started during pregnancy, because there is a time lag between pregnancy and the postpartum period. Considering the evidence that postpartum interventions of CBT-I and sleep hygiene education for mothers with insomnia showed effectiveness for reducing PND,[39] postnatal women or patients with insomnia possibly be more eligible than pregnant women. However, the fact that two RCTs in THE antenatal period were included in this study might indicate that prevention in the antenatal period has gradually attracted attention, although the number of RCT designed studies provided for all pregnant women remains limited. Considering the high prevalence of sleep problems in pregnancy, one would expect to see an increase in RCTs of evidence-based sleep intervention (ie, CBT-I) focusing on maternal sleep during pregnancy in the future.

From the narrative review of intervention contents in Table 2, overviews in recent trends are illustrated. The contents of education about maternal and infant sleep have been established since the 1980s as parent training.[53] Tips for making good sleep-waking patterns (ie, independent infant sleep, feeding in daytime) have not been significantly updated. However, new options on how to convey intervention can be adapted in novel ways, such as Internet-delivered programs, SMS text message, and Apps. Bhati (2014) applied weekly text message to postpartum women for the intervention group. Digital health preventive interventions for pregnant individuals may be studied in the future.[45] Additionally, complex interventions mixed with other kinds of childcare (eg, breastfeeding, vaccination, skin care) or a psychological approach (eg, CB based) are options which may promote maternal and child health. Providing familiar information (eg, SHE) may be more acceptable for general perinatal women without high psychological distress. Additionally, offering two or more sessions may prove beneficial, as both studies conducted only a single session during pregnancy. Further study is

TABLE 3 Intervention details

Bhati, S. R., 2014	Galland, B. C., 2017
Sleep Support for Moms Intervention (SSMI)	The sleep intervention
45 min, face-to-face education	1 h, group education
Role of sleep In health and wellness • Restores and repairs the cells in the body • Decreases stress and increases energy • Increases emotional well-being • Maintains normal blood pressure Lack of Sleep • Impairs cognition • Increases propensity for accidents, motor vehicle injuries, and death **Postpartum sleep deprivation** is linked to: Postpartum depression / Fatigue / Obesity **Postpartum depression (PPD)** is: • The most common complication of childbirth second only to postpartum hemorrhage. • Statistics: 12%–15% of women suffer with PPD. Incidence is higher than breast cancer • Some simple ways to prevent postpartum depression maybe to get enough of sleep. **Negotiating sleep with partners and family**: • Never refuse offers of help from partner, family, and friends • Don't stay up to finish chores like laundry, dishes, and chores for your baby **Sleep hygiene principles for postpartum woman**: • Avoid stimulants like caffeine 6 h before bedtime • Avoid alcohol 4 h before bedtime • Exercise regularly but not 2 h before bedtime • Allow one hour to unwind before bedtime • Maintain a regular sleep schedule • Keep the bedroom dark and quiet –Use a nightlight when feeding and changing the baby • Avoid bright light at bedtime • Consider having the infant in a bassinet by your bed so minimal sleep disruption is achieved • If your infant sleeps in a separate room, a. Try to get the infant on a regular sleep schedule b. Keep the infants room dark and quiet at night c. Minimize noise around the infants room at night **Sunlight/Bright light** is by far the most effective anti-depressive measure • Exercise may also play a role • Sunlight is important in regulating the circadian rhythm • Daylight increases melatonin which helps in regulating sleep. • Make sure you and your infant get at least one-two hours of sunlight each day. • Take your infant out with you and sit on the porch, etc or you can sit in a room where there is sunlight. If unable to sit in sunlight, turn on the bright lights in your home for most of the morning or at least 2 h • You can also open all the shades in your home during the day so your baby and you get plenty of sunshine **Summary:** • Try to get 7-8 of sleep each night • Take the offers of family and friends to help out • Sleep as soon as you are drowsy, don't wait to finish one more thing as the urge to sleep will wane off and it will be difficult to fall asleep. • Get some daylight every day.	**Why sleep?** • Critical to a child's development, health, and quality of life • Good for parents' well-being and more **What's normal** • Waking frequently during the night • Active and quiet sleep cycles • Sleeping through the night—a milestone to look forward to • Babies can learn their sleep routines • Babies need to be given a chance to learn to settle themselves • Some babies learn easily—others need more help **Healthy sleep patterns** • Try to set some limits on "handling" of baby • Establish some regular pattern • Notice and act on baby's tired signs early • Darken sleeping place day and night ("cue" for sleep time) • Try to put baby into their bed awake • Give baby a brief chance to settle by themselves/learn to go to sleep on their own • Keep night-time quiet time—no "play" **Safe sleeping** • Own sleep place in your room • On back • Clean firm tightly fitting mattress • Keep bed clear of "extras" • Co-sleeping is unsafe a. If mother smoked during pregnancy b. Adults (either) have been drinking, taking drugs, sedatives c. Baby is less than 3 mo old (for smoking and nonsmoking mothers) **Looking after yourselves** • Your rest and sleep is important too • Try to get a nap during the day • Meals in freezer • Limit visitors and looking after them • Accept offers of help • Go to bed early…soon after baby

imperative to optimize the most appropriate intervention (ie, delivery, contents, the number and duration of the session).

This study has some limitations. The number of included studies was only two. The total number of participants was too few to conduct synthesis with meta-analysis. The languages were restricted to only English and Japanese. The included American study (Bhati, 2014) was a preliminary RCT for a PhD thesis and was not published in a peer-review journal. The pre- and

Section/topic	#	Checklist item	Information reported		Line number(s)
			Yes	No	
ADMINISTRATIVE INFORMATION					
Title					
Identification	1a	Identify the report as a protocol of a systematic review	☒	☐	1-3
Update	1b	If the protocol is for an update of a previous systematic review, identify as such	☐	☒	N/A
Registration	2	If registered, provide the name of the registry (e.g., PROSPERO) and registration number in the Abstract	☒	☐	49-50
Authors					
Contact	3a	Provide name, institutional affiliation, and e-mail address of all protocol authors; provide physical mailing address of corresponding author	☒	☐	5-36
Contributions	3b	Describe contributions of protocol authors and identify the guarantor of the review	☒	☐	350-356
Amendments	4	If the protocol represents an amendment of a previously completed or published protocol, identify as such and list changes; otherwise, state plan for documenting important protocol amendments	☐	☒	N/A
Support					
Sources	5a	Indicate sources of financial or other support for the review	☒	☐	358-356
Sponsor	5b	Provide name for the review funder and/or sponsor	☒	☐	358-356
Role of sponsor/funder	5c	Describe roles of funder(s), sponsor(s), and/or institution(s), if any, in developing the protocol	☐	☒	N/A
INTRODUCTION					
Rationale	6	Describe the rationale for the review in the context of what is already known	☒	☐	69-141
Objectives	7	Provide an explicit statement of the question(s) the review will address with reference to participants, interventions, comparators, and outcomes (PICO)	☒	☐	143-146
METHODS					
Eligibility criteria	8	Specify the study characteristics (e.g., PICO, study design, setting, time frame) and report characteristics (e.g., years considered, language, publication status) to be used as criteria for eligibility for the review	☒	☐	169-214
Information sources	9	Describe all intended information sources (e.g., electronic databases, contact with study authors, trial registers, or other grey literature sources) with planned dates of coverage	☒	☐	154-166
Search strategy	10	Present draft of search strategy to be used for at least one electronic database, including planned limits, such that it could be repeated	☒	☐	154-166
STUDY RECORDS					
Data management	11a	Describe the mechanism(s) that will be used to manage records and data throughout the review	☒	☐	154-166
Selection process	11b	State the process that will be used for selecting studies (e.g., two independent reviewers) through each phase of the review (i.e., screening, eligibility, and inclusion in meta-analysis)	☒	☐	216-226
Data collection process	11c	Describe planned method of extracting data from reports (e.g., piloting forms, done independently, in duplicate), any processes for obtaining and confirming data from investigators	☒	☐	216-226
Data items	12	List and define all variables for which data will be sought (e.g., PICO items, funding sources), any pre-planned data assumptions and simplifications	☒	☐	169-214
Outcomes and prioritization	13	List and define all outcomes for which data will be sought, including prioritization of main and additional outcomes, with rationale	☒	☐	209-214
Risk of bias in individual studies	14	Describe anticipated methods for assessing risk of bias of individual studies, including whether this will be done at the outcome or study level, or both; state how this information will be used in data synthesis	☒	☐	228-233
DATA					
Synthesis	15a	Describe criteria under which study data will be quantitatively synthesized	☐	☒	N/A
	15b	If data are appropriate for quantitative synthesis, describe planned summary measures, methods of handling data, and methods of combining data from studies, including any planned exploration of consistency (e.g., I^2, Kendall's tau)	☐	☒	N/A
	15c	Describe any proposed additional analyses (e.g., sensitivity or subgroup analyses, meta-regression)	☐	☒	N/A
	15d	If quantitative synthesis is not appropriate, describe the type of summary planned	☒	☐	235-239
Meta-bias(es)	16	Specify any planned assessment of meta-bias(es) (e.g., publication bias across studies, selective reporting within studies)	☐	☒	N/A
Confidence in cumulative evidence	17	Describe how the strength of the body of evidence will be assessed (e.g., GRADE)	☐	☒	N/A

postintervention results for depressive symptoms cannot be compared, because the baseline survey did not include the EPDS. Despite these limitations, these studies provide preliminary evidence suggesting that sleep interventions during pregnancy for all pregnant women would be theoretically beneficial for effective prevention of PND. Universal prenatal intervention has advantages of saving money on cost of screening and of targeting clients with more spare time to learn than new mothers.[2] Further well-designed studies are needed to firmly establish the benefits of prenatal sleep interventions.

5 | CONCLUSION AND IMPLICATIONS

High prevalence of sleep problems (ie, low sleep efficiency, poor sleep maintenance, and fragmented sleep) in the antenatal and postnatal period has been recognized as a critical health issue, which must be focused on for preventing PPD. Interventions to improve maternal sleep quality and teach mothers how to manage newborns' random/shortened sleep-wake patterns after childbirth would be worth disseminating during pregnancy because it is time-efficient and low in cost. This study found limited evidence to support the effectiveness of universal sleep interventions for pregnant women to protect maternal mental health. Further well-designed studies are needed to firmly establish the reliability of these effects.

CONFLICT OF INTEREST

None declared.

AUTHORS' CONTRIBUTIONS

The corresponding author was in charge of this study design. The first author wrote the first draft. Twelve investigators (NS, NY, DN, EO, ZN, JS, TI, AI, YY, RY, AM, and TS) conducted the screening of the literature. All authors contributed to finalize the manuscript.

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ETHICAL APPROVAL

The systematic review was not reviewed by ethics board because the study was on previously published literature.

Registry and the Registration: The study protocol has been registered at PROSPERO (CRD42019119999).

DATA AVAILABILITY STATEMENT

The data that support the findings of this study are available in the supplementary material of this article (Appendix S1).

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SUPPORTING INFORMATION

Additional supporting information may be found online in the Supporting Information section.

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APPENDIX 1

PRISMA-P 2015 CHECKLIST

This checklist has been adapted for use with systematic review protocol submissions to BioMed Central journals from Table 3 in Moher D et al: Preferred reporting items for systematic review and meta-analysis protocols (PRISMA-P) 2015 statement. Systematic Reviews 2015 4:1

An Editorial from the Editors-in-Chief of Systematic Reviews details why this checklist was adapted—Moher D, Stewart L & Shekelle P: Implementing PRISMA-P: recommendations for prospective authors. Systematic Reviews 2016 5:15

APPENDIX 2

SEARCH TERMS

PubMed

(pregnan* OR antenatal* OR ante-natal* OR antepartum* OR antepartum* OR prenatal*

OR pre-natal* OR mother* OR (expectant mother*)) AND (("depressive disorder"[MeSH Terms] OR ("depressive"[All Fields] AND "disorder"[All Fields]) OR "depressive disorder"[All Fields] OR "depression"[All Fields] OR "depression"[MeSH Terms]) OR depressive[All Fields]) AND (("prevention and control"[Subheading] OR("prevention"[All Fields] AND "control"[All Fields]) OR "prevention and control"[All Fields] OR "prevention"[All Fields]) OR preventive[All Fields])

MEDLINE, EMBASE, CENTRAL and PsycINFO

(pregnan* OR antenatal* OR ante-natal* OR antepartum* OR antepartum* OR prenatal* OR pre-natal* OR mother* OR (expectant mother*)) AND ((depressive disorder) OR depression OR depressive) AND ((prevention and control) OR prevention OR preventive)

Japan Medical Abstracts Society (in Japanese)

(pregnancy OR pregnant OR antenatal OR antepartum OR mother OR perinatal mental health) AND (depression OR depressive symptom OR depressive disorder OR postpartum depression OR prenatal depression OR perinatal depression) AND prevention