Non-pharmacological interventions for sleep quality and insomnia during pregnancy: A systematic review

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Objective: *To systematically review the literature regarding non-pharmacological inteventions for improving sleep quality and insomnia during pregnancy.*

Methods: *An electronic search strategy was conducted using several online databases (CINAHL, PubMed, Medline, Index to Chiropractic Literature) from inception to March 2013. Inclusion criteria consisted of studies evaluating non-pharmacological interventions, published in English in a peer reviewed journal, and assessed sleep quality or insomnia. The full text of suitable articles was reviewed by the authors, and scored using a risk of bias assessment.*

Results: *160 articles were screened and seven studies met the inclusion criteria in the form of three prospective RCTs, one prospective longitudinal trial, one experimental pilot study, and two prospective quasi-randomized trials. Quality scores ranged from five to eight out of twelve on the risk of bias scoring criteria.*

Conclusions: *Exercise, massage, and acupuncture may be associated with improved sleep quality during pregnancy, however, due to the low quality and heterogeneity of the studies yielded, a definitive recommendation cannot be made. Further higher quality research is indicated.*

Objectif : *Examiner systématiquement la documentation portant sur les interventions non pharmacologiques pour l'amélioration de la qualité du sommeil et pour le traitement de l'insomnie pendant la grossesse.*

Méthodologie : *Une stratégie de recherche électronique a été mise en œuvre utilisant plusieurs bases de données en ligne (CINAHL, PubMed, Medline, Index to Chiropractic Literature) depuis la création jusqu'en mars 2013. Les critères d'inclusion consistaient en études évaluant les interventions non pharmacologiques traitant de l'insomnie ou de la qualité du sommeil, et publiées en anglais dans une revue évaluée par des pairs. Les textes intégraux des articles utiles ont été examinés par les auteurs, qui ont accordé une note à chacun selon une évaluation de risque d'impartialité.*

Résultats : *160 articles ont été analysés, et 7 études ont satisfait les critères d'inclusion, dont trois qui sont des ECR prospectifs, un essai longitudinal prospectif, une étude pilote expérimentale et deux essais prospectifs quasi randomisés. Les scores de qualité se situaient entre cinq et huit sur une base de douze, selon les critères de notation des risques d'impartialité.*

Conclusions : *Durant la grossesse, les exercices, le massage et l'acupuncture semblent avoir une relation avec l'amélioration de la qualité du sommeil; cependant, le faible niveau de qualité et l'hétérogénéité obtenus des études ne permettent pas de formuler une recommandation claire. D'autres recherches de meilleure qualité sont recommandées.*

KEY WORDS: sleep, quality, insomnia, interventions

MOTS CLÉS : sommeil, qualité, insomnie, interventions

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Introduction

There are a wide variety of symptoms and concerns that a pregnant woman may encounter. Insomnia and poor sleep quality are among those that can have a substantial effect on a pregnant woman's quality of life. Roughly two-thirds of pregnant woman believe their sleep to be abnormal and associate it with the ongoing physical changes and changes in their overall size.[1] Many pregnant women experience frequent night waking, insomnia, difficulty falling and staying asleep, and restless sleep by the end of their pregnancy.[2] Disorders such as insomnia, sleep apnea, restless leg syndrome, parasomnias and narcolepsy can begin or be exacerbated throughout pregnancy.[1-7] Lying down to sleep can often exacerbate heartburn symptoms in pregnant women and adversely affect their sleep quality, and heartburn is estimated to occur in 30% to 50% of pregnancies, while some populations have reported an occurrence of up to 80%.[8]

Physiological changes such as increased progesterone and prolactin levels, increase in maternal size, fetal movement, and bladder distention can potentially explain some of the disturbances of a pregnant woman's sleep.[7] Pain can also lead to poor sleep quality.[9] The prevalence of low back pain (LBP, described as pain between the 12th rib and the gluteal fold) in pregnant women is high, with studies indicating that it can range in prevalence from 24% to 90% of pregnant women.[10] Furthermore, approximately 20% of woman experience pelvic girdle pain during pregnancy (defined as pain between the posterior iliac crest and the gluteal fold).[11,12] Providing evidence-based pain relieving treatments to pregnant women with poor sleep quality due to pain could decrease pain intensity and frequency, and could potentially improve their sleep quality as well.[2,5-7]

The treatment of poor sleep quality or sleep disorders during pregnancy is complicated, particularly as the Food and Drug Administration (FDA) recommends pregnant women not be exposed to category X drugs.[13] Box 1 depicts the different categories of drugs during pregnancy as classified by the FDA.[14] Category X drugs include sleep medications such as Mefloquine, Flurazepam, and Temazepam, all of which are contraindicated for pregnant and lactating women.[13] Hardy et al determined that at least 0.6% of pregnancies may have been exposed to medications in early pregnancy whose FDA category implies contraindication in pregnancy or risk

Box 1:
FDA Pregnancy Medication Categories:
The FDA-assigned pregnancy categories as used in the Drug Formulary14

Category A
Adequate and well-controlled studies have failed to demonstrate a risk to the fetus in the first trimester of pregnancy (and there is no evidence of risk in later trimesters).

Category B
Animal reproduction studies have failed to demonstrate a risk to the fetus and there are no adequate and well-controlled studies in pregnant women.

Category C
Animal reproduction studies have shown an adverse effect on the fetus and there are no adequate and well-controlled studies in humans, but potential benefits may warrant use of the drug in pregnant women despite potential risks.

Category D
There is positive evidence of human fetal risk based on adverse reaction data from investigational or marketing experience or studies in humans, but potential benefits may warrant use of the drug in pregnant women despite potential risks.

Category X
Studies in animals or humans have demonstrated fetal abnormalities and/or there is positive evidence of human fetal risk based on adverse reaction data from investigational or marketing experience, and the risks involved in use of the drug in pregnant women clearly outweigh potential benefits.

to fetal development.[15] One study showed that Benzodiazepines, a category X drug, accounted for the greatest number (85%) of psychotropic agents used during pregnancy.[16] Zolpidem is frequently prescribed by doctors for pregnant women with insomnia.[17] Zolpidem crosses the human placental rapidly and is a category C drug. Zolpidem does not appear to be a major tetratogenic agent in humans, although it is associated with an increased risk of low birth weight, preterm deliveries, caesarean deliveries

and delivery of small for gestational age infants compared to women who have not received Zolpidem.[18] For this reason, the prescription and use of sleep medications for pregnant patients should be carefully considered by both the patient and their attending medical doctor.

Research indicates that increasingly more pregnant woman are turning to non-pharmacological and natural forms of health care for treatment of pain during pregnancy and sleep issues such as poor sleep quality and insomnia.[3-5,18-22] Wang et al[18] found that massage therapy was the non-pharmacological intervention most commonly recommended to pregnant women with back pain by prenatal health care providers, followed by recommendations for acupuncture, relaxation, exercise, yoga, and chiropractic. Pregnant women may see numerous different health care professionals throughout pregnancy. A pregnant woman's health care team may include an obstetrician, family medical doctor, chiropractor, midwife, massage therapist, acupuncturist, or naturopath, among others.[4,8,16,19,20] These different professionals can each play a role in improving a pregnant woman's quality of sleep and quality of life by providing evidence-based recommendations and information regarding the risk and benefit profiles of different treatments during pregnancy. The aim of this study was to systematically identify and assess the evidence for the use of different non-pharmacological interventions to aid sleep quality and insomnia during pregnancy.

Methods

Objective: The objective of this literature review was to determine what evidence exists and the quality of the evidence for non-pharmacological interventions for improving sleep quality and insomnia during pregnancy.

Search Strategy: A literature search was performed in all languages through EBSCO to access various databases, specifically AMED, MEDLINE, and CINAHL and a separate search was conducted in The Index to Chiropractic Literature (the search strategy may be obtained from the authors). MeSH terms of Pregnancy (exploded) and Pregnancy complications were used, in addition to the text word pregnan*. When searching articles relating to sleep the MeSH terms sleep, sleep deprivation, and sleep initiation were employed, as well as the text terms sleep, and insomnia. Finally, with respect to non-pharmacological interventions MeSH terms of exercise and dietary supplements were both exploded and searched as well

as complementary therapy, exercise therapy, diet, mind-body therapies, and acupuncture. Text words massage, and chiropract* were also used. Finally the terms Pregnancy, Sleep, Low Back Pain and CAM were searched with the boolean character AND. The literature search period was from the start date of each database up to and including March 2013. Hand searching of the reference lists of relevant articles retrieved from the electronic literature search was also performed.

Inclusion Criteria

The specific inclusion criteria employed in this review were:

Study Design: Articles had to be published in a peer-reviewed journal, utilizing intervention-based study designs. Articles were excluded if they were published in conference proceedings, or if they were case reports, cross-sectional and other descriptive designs, or narrative reviews.

Population: Pregnant female patients with uncomplicated pregnancies.

Language: Articles published in English only.

Interventions: Any studies that used some form of non-pharmacological intervention or had at least one study arm that did not involve the use of medication were considered for inclusion.

*Outcome Measures:* Studies had to include a measure of sleep quality or insomnia.

Study Selection

Four reviewers each independently reviewed the titles and abstracts from electronic searches for any articles that appeared to match the inclusion criteria. Each reviewer independently maintained a list of possible articles for inclusion. These lists were reviewed by the group and the full text of potentially suitable articles were evaluated using the inclusion criteria described above. Articles were included based on adherence to the inclusion criteria and any disagreements were resolved by consensus.

Risk of Bias Assessment

The risk of bias scoring criteria[23,24] was used to evaluate the included articles (please see Table 8.5a in Higgins and Green[24] for a complete description of the criteria). This particular scoring criteria was employed as it was recommended for use as part of student research projects (litera-

Figure 1.
PRISMA Flow Chart
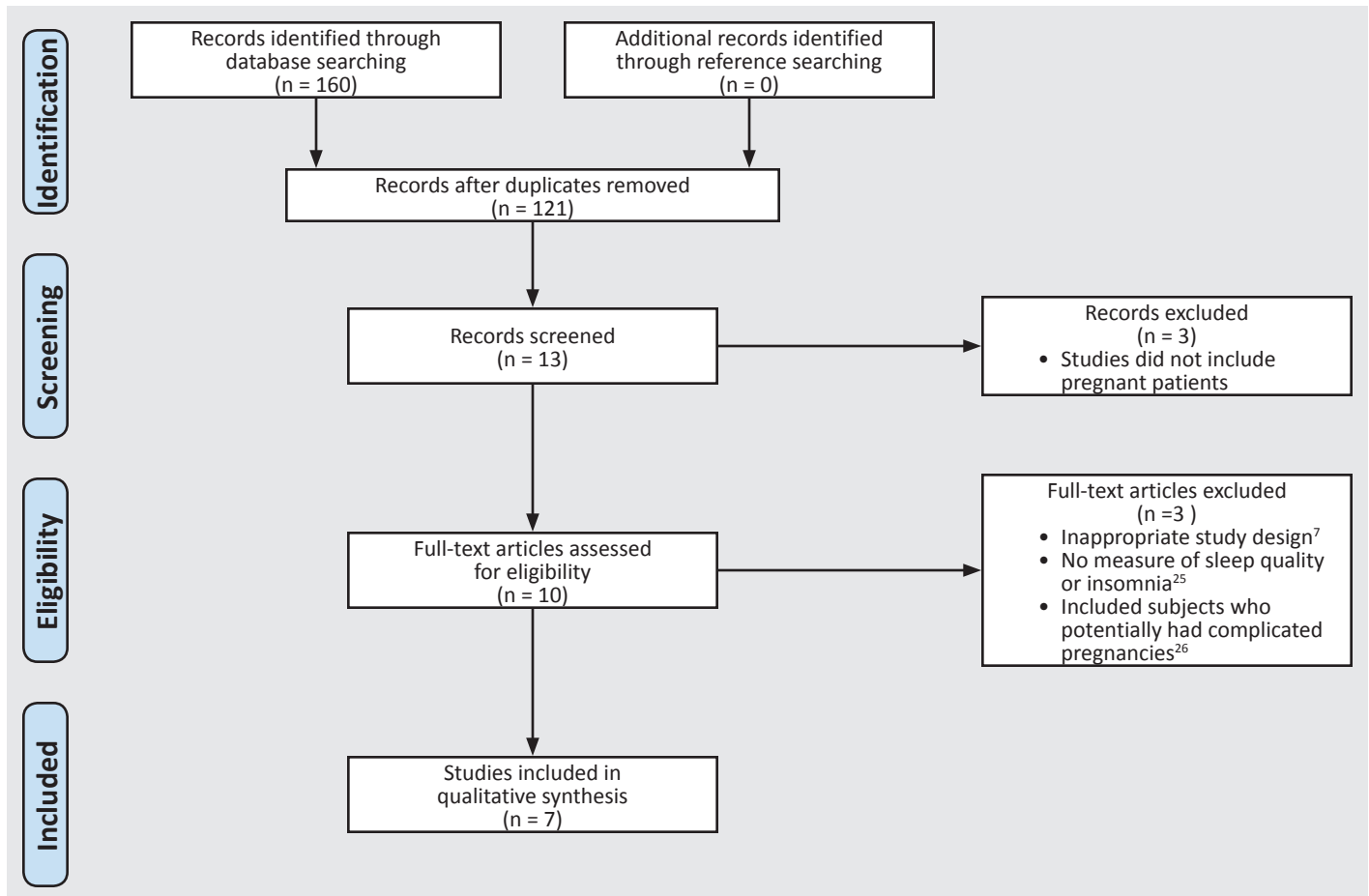
ture reviews or syntheses focusing on interventions in particular) at the Canadian Memorial Chiropractic College. Using the risk of bias scoring criteria,[23,24] included articles were individually scored based on the following criteria: assignment of patients, similarity of baseline characteristics, use of prognostic stratification, relevance of clinical outcomes/significance, blinding strategies, statistical significance, co-interventions, compliance of subjects to the study procedures and follow-up levels. Each article was independently reviewed by three assessors. Any discrepancies found between the quality assessments were discussed in a group setting. Ambiguity was resolved and conclusive scores were finalized by group discussion. If applicable, meta-analyis would be conducted on included studies.

Results

Search Results and Study Designs

Figure 1 shows the flow of studies through this review. A total of 160 studies were screened from the literature search, ten of which were assessed for eligibility, three studies were excluded due to either inappropriate study design[7], not including a measure of sleep quality or insomnia[25], or involving subjects who potentially had complicated pregnancies.[26] As such, seven articles met the inclusion criteria of the review, all of which were identified by the electronic database searches. Of the seven included articles, three were prospective randomized control trials, one was a prospective longitudinal study, one was an experimental pilot study, and two were prospective quasi-

Table 1:
Summary of Included Articles

Study Authors; quality score	Study Design	Sample	Interventions	Outcome measures	Main sleep quality results/conclusions
Guerreiro da Silva et al[4] 2005 8/12	Prospective, quasi-randomized control study	30 patients between 15 and 39 years old between 15 and 30 weeks pregnant	Traditional acupuncture, or no acupuncture performed once per week (twice if severe) over 8 weeks	Numerical rating scale of quality of life at 14 day intervals which included sleep quality	Average insomnia score decreased by over 50% in more than 75% of the patients compared to 30% in the control.
Guerreiro da Silva et al[3] 2009 8/12	Prospective randomized control study	42 pregnant women 15-39 years old, 15 to 30 weeks pregnant.	Traditional acupuncture or no treatment over 8 weeks.	Interviewed by a research assistant, and a numerical rating scale of quality of life which included sleep quality	A statistically significant (p<0.01) greater proportion of the study group (14 out of 20) reported improvements of at least 50% compared with the control group (four of out 16).
Guerreiro da Silva[28] 2007 8/12	Prospective, quasi-randomized control	51 pregnant women 15-39 years old, 15 to 30 weeks pregnant	Traditional acupuncture plus conventional treatment over 8 weeks versus conventional treatment only (physician and nurse counseling and possibly two different phytotherapeutic agents: *Passiflora edulis* for anxiety symptoms, and *Hypericum performatum* for depression symptoms)	Numerical rating scale of emotional distress, and numerical rating scale of five different areas of life including sleep quality.	A statistically significant (p<0.01) greater proportion of the study group (48%) reported improvements of at least 50% compared with the conventional treatment group (5%).
Goodwin et al[21] 2010 5/12	Prospective longitudinal study	65 nulliparous women aged 23-39.	Exercise in pre-natal classes	Sleep quality and duration was collected in a self administered questionnaire given to women at 24 and 29 weeks, general health questionnaire with a variable for sleep	A weak association of physical activity (PA) with sleep duration and quality in late pregnancy. PA is recommended for health benefits but more research is needed if it should be recommended to improve sleep.
Beddoe et al[5] 6/12	Experimental pilot study	15 nulliparous women in 2nd or 3rd trimester	Weekly community based mindfulness meditation and prenatal hatha yoga for 7 weeks	General sleep disturbance scale (GSDS)	Woman who began the yoga in the 2nd trimester has significantly fewer awakenings, less wake time during the night, and less sleep disturbances as compared to those who started in their 3rd trimester.
Field et al[19] 1999 7/12	Prospective randomized control trial	26 pregnant woman between ages 23 and 35 in their 2nd trimester.	Massage or relaxation therapy for 5 weeks.	State anxiety inventory, profile of mood states depression scale, 15 item VAS sleep scale	Only the massage group reported reduced anxiety, improved mood, better sleep, less back pain, and had a decrease in urinary stress hormones.
Tella et al[27] 2011 5/12	Prospective randomized controlled trial	30 pregnant women, between the ages of 18 and 45 years in all three trimesters	Aerobic exercise group (six minute walk exercises, five minutes of stair climbing, four minutes of jogging, five minutes of throwing a ball) over six weeks along with education on sleep hygiene versus an education only control group	Insomnia Severity Index (ISI) and Quality of Life Questionnaire (QoL)	At six weeks, both groups demonstrated statistically significant within group improvements in insomnia levels, and a statistically significant reduction in insomnia levels between groups favouring the aerobic exercise group was observed.

randomized studies.[3-5,19,21,27,28] None of the included studies employed a priori sample size estimations.[3-5,19,21,27,28] Table 1 provides information on the included studies with respect to the study design, sample, interventions, outcome measures, results, and conclusions in addition to the quality score of each article.

Participants

A total of 259 pregnant women participated in the seven included studies. Study sizes varied from 15 to 65 participants. In two studies, the participants were specifically indicated as being nulliparous.[5,21] Beddoe's[5] sample was comprised of 15 women aged 25 to 37 between 12 and 32 weeks gestation. Three studies by Guerreiro da Silva et al [3,4,28] were included, one examined 36 women aged 15 to 39 who were 15 to 30 weeks pregnant,[3] another other looked at looked at 22 women aged 15-39 who were 15-30 weeks pregnant,[4] and the final study looked at 51 women aged 15-39 who were 15 to 30 weeks pregnant.[28] Goodwin et al[21] examined 65 women aged 20 to 40 who were 14 to 20 weeks pregnant. Field et al examined 26 pregnant women aged 23 to 35 where all subjects were between 14 and 30 weeks pregnant.[19] Tella et al[27] looked at 30 women aged 18 to 45 years old whose gestational age spanned all three trimesters, with 20 subjects in their second trimester, and five each in their first and third trimesters respectively.

Outcome Measures Employed

One study employed a ten point numerical rating scale for sleep quality over seven domains of sleep disturbance, which included delayed sleep onset, frequent awakenings, early awakenings, waking tired, disrupted sleep, day napping and nightmares.[4] In another study, aside from the primary outcome measure of dyspepsia, secondary efficacy variables were also considered including sleep quality, which was quantified by means of a ten-point numerical rating scale (NRS).[3] Another study evaluated the primary outcome measure of emotional distress, while sleep quality was assessed as a secondary variable.[28] Field et al[19] used a 15-item visual analog sleep scale over three subcategories including sleep disturbance, sleep effectiveness and supplementary sleep; the subjects placed a mark across an answer line that ranged from 'did not awaken' to 'was awake ten hours'. The General Health Questionnaire (GHQ-28), which consists of four subsets of ques-

tions including somatic symptoms, social dysfunction, depression, and anxiety and insomnia was employed by Goodwin et al.[21] In the study by Beddoe et al[5], subjective sleep disturbance was measured with the General Sleep Disturbance Scale (GSDS), a 7-point scale that asks questions regarding the past week's poor sleep experiences. Tella et al[27] used the Insomnia Severity Index to assess their level of insomnia, as well as the Quality of Life Questionnaire to assess levels of fatigue.

Intervention Type

Three studies evaluated acupuncture on pregnant women. One study focused on the treatment of dyspepsia[3], another focused on the treatment of insomnia,[4] and the last looked at the treatment of mild to moderate emotional complaints.[28] All three of the studies employed eight week acupuncture programs with a minimum of eight and to a maximum of twelve sessions.[3,4,28] Exercise intervention was examined in three studies consisting of two studies that evaluated the effects of aerobic exercise[21,27], and one study that looked at the effect of a seven week mindfulness yoga intervention.[5] Another study examined massage therapy and relaxation therapy interventions[19], which included ten twenty-minute massages or ten twenty-minute relaxation therapy sessions over a five-week period. One employed sleep hygiene education in both groups.[4]

Primary Outcome Measure: Sleep Quality and Insomnia

Guerreiro da Silva[3] found in their prospective randomized controlled trial (RCT) comparing acupuncture with a control group, that with regards to sleep measures, a statistically significant (p<0.01) greater proportion of the study group (14 out of 20) reported improvements of at least 50% compared with the control group (four of out 16).

Guerreiro da Silva et al[4] conducted a subsequent prospective, quasi-randomized controlled study comparing acupuncture to no acupuncture for the treatment of insomnia. This study found a statistically significant (p<0.01) greater reduction in insomnia in the acupuncture group compared with the control group. Average insomnia scores were decreased by at least 50% over the course of the study in most members of the study group (9 out of 12 participants) versus fewer than half of the members of the control group (3 out of 10 participants).

Guerreiro da Silva[28] conducted another prospective,

Table 2:
Risk of Bias Scoring Criteria results.

Brief Item Description	Guerrerio da Silva et al[4]	Guerrerio da Silva et al[3]	Guerrerio de Silva[28]	Field et al[19]	Beddoe et al[5]	Goodwin et al[21]	Tella et al[27]
Was the method of randomization adequate?	1	1	1	1	0	0	0
Was the treatment allocation concealed?	0	0	0	0	0	0	0
Was the patient blinded to the intervention?	0	0	0	0	0	0	0
Was the care provider blinded to the intervention?	0	0	0	0	0	0	0
Was the outcome assessor blinded to the intervention?	1	1	1	0	0	0	0
Was the dropout rate described and acceptable?	1	1	1	0	1	1	0
Were all randomized participants analyzed to the group to which they were allocated?	0	0	1	1	1	1	1
Are reports of the study free of suggestion of selected outcome reporting?	1	1	1	1	1	1	1
Were the groups similar at baseline regarding the most important prognostic indicators?	1	1	1	1	1	0	1
Were co-interventions avoided or similar?	1	1	1	1	0	0	0
Was the compliance acceptable in all groups?	1	1	1	1	1	1	1
Was the timing of the outcome assessment in all groups?	1	1	1	1	1	1	1
Total Score (/12)	8	8	8	7	6	5	5

Legend. 0 = Item was not fulfilled, 1 = Item was fulfilled

quasi-randomized controlled study comparing acupuncture to conventional treatment (physician and nurse counseling and possibly two different phytotherapeutic agents: *Passiflora edulis* for anxiety symptoms, and *Hypericum performatum* for depression symptoms). They found that with respect to sleep measures, a statistically significant (p<0.01) greater proportion of the study group (48%) reported improvements of at least 50% compared with the control group (5%).

Field et al[19] found in their prospective randomized controlled trial of massage therapy versus relaxation therapy that only the massage therapy group reported reduced anxiety, improved mood and sleep, and less back pain compared to the non-massage group over the five week study period, which was statistically significant (MANOVA, $F(4.21) = 2.86; p < 0.05$).

In a prospective longitudinal study on the effect of exercise, Goodwin et al[21] found that there was a significant decrease on the GHQ-28 composite score for the exercise

group as well as reduced frequency of somatic symptoms, anxiety and insomnia, as well as a higher level of psychological well-being. There was a weak association between physical activity and sleep duration and quality in later pregnancy. The authors recommended physical activity for pregnant woman for health benefits but indicated that more research was needed to recommend it for improving sleep.

Tella et al[27] conducted an RCT comparing aerobic exercise and sleep hygiene education intervention to a control of sleep hygiene education only over six weeks and found that there was a statistically significant difference in average insomnia levels between the groups favoring the exercise group (p<0.01). Although the exercise group showed greater improvement, it must be noted that both groups demonstrated statistically significant improvements in average insomnia levels within groups (p<0.01 in the control group and p<0.001 in the exercise group).

Beddoe et al[5] found in their pilot study of a mindfulness-based yoga instervention on sleep quality during

pregnancy that women who began the yoga program in their second trimester reported less wake-time and less perceived sleep disturbance versus women who began the intervention in their third trimester. At baseline measures for second trimester women, the GSDS mean score was 2.9. Those in the third trimester had a mean baseline score of 1.8. After a seven week mindfulness yoga intervention, women in the second trimester group demonstrated significantly improved sleep by total GSDS score and fewer nights of poorer sleep. There was a mean decrease of 2.03 from the GSDS for the women in their second trimester. The third trimester group reported worse sleep by a mean increase of 1.6 and more nights with poorer sleep.

Quality of Methods and Risk of Bias Determination
The quality of each included article was scored out of a possible 12 marks, as seen in Table 2. Scores ranged from five to eight out of twelve. Due to differences in outcome measure use and heterogeneity of populations and treatments employed, meta-analysis was not feasible. Four articles did not have or report sufficient randomization methods.[5,19,21,27] None of the reviewed articles had adequate blinding or employed a priori sample size estimations; four articles had no blinding of the patient, care-provider nor the assessor.[5,19,21,27] The studies by Guerrerio da Silva[3,4,28] had blinding of the outcome assessor, however they lacked blinding of patients and care-providers. Another flaw of all seven studies was that treatment allocation was not concealed. Control over co-interventions was not done in the Goodwin[21] or Tella[27] studies, other sources of bias including non-uniform base line characteristics were a flaw of both the Goodwin[21] and Beddoe[5] studies. There was also concern about the inappropriate application of the MANOVA in the study by Field et al[19], particularly as there were only 26 subjects total in their sample.

Discussion
To our knowledge, this is the first literature review of non-pharmacological interventions for sleep quality during pregnancy. The review identified three studies of acupuncture, one of yoga, two on aerobic exercise, and one massage therapy study.[3-5,19,21,27,28] No adverse effects were reported in any of the studies; however, studies on non-pharmacological interventions and sleep disturbances in the pregnant population were scarce, and those identified were generally of low quality.

Sleep changes in pregnancy contribute to perinatal mood disturbance and somatic complaints.[29] Furthermore; insomnia tends to worsen over the course of a pregnancy.[30] Common physical symptoms such as edema, muscle spasms, cramps and fatigue, may lead to difficulty sleeping due to discomfort and body pains.[29,30] Moreover, melatonin levels are usually lower in pregnant women with sleeping difficulties compared to those without sleep issues.[31]

Despite the knowledge that insomnia can cause a reduced quality of life, often patients with insomnia are not treated with medications for fear of adverse effects.[4] In a study by Auerbach et al[32], the newborns of mothers who received antipsychotic and anti-anxiety medications during pregnancy exhibited poor neonatal motor functioning, including tremulousness, hyper- tonicity, and poor motor maturity.

Acupuncture
In a subjective assessment by Becker-Carus et al[33] acupuncture was used as an effective treatment for insomnia, however this study did not include pregnant subjects. Guerreiro da Silva et al[4] used traditional acupuncture once or twice per week over eight weeks in 17 women, and results showed that over half of these women experienced statistically significant decreased insomnia when compared with controls. The authors opined that self-reported sleep quality does not provide high quality data; however, they evaluated the subjects this way to observe results under real life conditions. The authors did not suggest reasons why acupuncture treatment was effective, however they agreed that more research was needed.

Another study by Guerreiro da Silva et al[3] observed the effects of acupuncture in practice on the treatment of dyspepsia in pregnancy. They evaluated subjects using a numerical rating scale related to quality of life that included sleep quality, suggesting that dyspepsia may cause a reduced sleep quality in pregnant women. They concluded that after acupuncture treatment, the NRS differences in the treatment group were significantly higher in comparison to the control group. Based on Guerreiro da Silva's work[3,4,28], acupuncture may be an effective therapy for sleep difficulties and showed no adverse effects. To our knowledge, only Guerreiro da Silva and colleagues have conducted research on the effects of acupuncture for sleep improvements in a pregnant population, thus, addi-

tional research could further justify its use in this population.

Yoga

Although past intervention studies have looked at yoga's effect on sleep, the first and only controlled study demonstrating the effects of mindfulness-based interventions on sleep quality in the pregnant women was done by Beddoe et al.[5] Several studies have focused on prenatal yoga and its benefits, however this was the first to focus on sleep alone. For example, Narendran et al[34] conducted a prenatal yoga intervention study which used yoga postures, breathing practices, and meditation for pregnant women. The yoga group reported a significantly lower incidence of adverse perinatal outcomes in the treatment group compared to controls who did not practice yoga.[34] Beddoe et al[5] proposed a seven-week prenatal mindful Hatha style yoga as an approach to alter stress appraisal and thereby attenuate the stress response. They used a subjective and objective method of sleep evaluation to enhance the study design. Results found that no significant sleep improvements were shown with a yoga intervention, however, women who began the intervention in their second trimester had fewer awakenings and less wake time during the night compared to women who began a yoga intervention in their third trimester.

Beddoe et al's study contradicted past research suggesting that sleep gets worse as women progress through pregnancy[26,30] Beddoe et al[5] showed that baseline subjective sleep measurements were worse in the second trimester versus those in the third. Therefore, it is plausible that non-pharmacological interventions may be helpful in earlier stages of a pregnancy. More specifically, yoga may improve sleep quality when started in the second trimester of a pregnancy.

Aerobic Exercise

Sternfeld et al[35] found that aerobic exercise may be associated with fewer perceived pregnancy symptoms, but did not focus on sleep quality as an outcome measure. In a longitudinal study by Goodwin et al,[21] a subjective assessment of exercise in 72 nulliparous women in late pregnancy compared perceptions of body image and psychological well being. Goodwin et al used the General Health Questionnaire which includes items related to sleep. When the exercise group was compared to the non-

exercise group in late pregnancy, a significant difference was found for overall psychological well being in the area of somatic symptoms, anxiety, and insomnia. Although this study's main focus was not on sleep, it suggests that exercise has beneficial effects on improving sleep quality in late pregnancy and may warrant further research.[21] Tella et al[27] found that insomnia improved following six weeks of aerobic exercise and sleep hygiene education to a statistically significant degree greater than a sleep hygiene education only control group, although both groups did see statistically significant within groups differences.

Massage/Relaxation Therapy:

Field and colleagues[36] found that although massage therapy had not been studied as a treatment for many symptoms associated with pregnancy, massage during labor has been shown to reduce labor time, hospital stay and to decrease postpartum. However, in a follow up study Field et al focused on just massage and relaxation, indicating that massage and relaxation interventions might have a positive impact on pregnant women by decreasing stress hormones and potential stressors, improved mood, and sleep.[19] After their treatment period there was less disruption of sleep for the massage therapy group and an increase in supplemental daytime sleep for the relaxation group as measured using a visual analog sleep scale.

Strengths and Weaknesses

Although this systematic review yielded few papers, a thorough literature search was performed to strengthen the findings. The authors searched multiple relevant electronic databases over all searchable years and employed reference searching. Furthermore numerous authors were involved in selecting articles and reviewing them for quality, using discussion to resolve differences. Furthermore, several non-pharmacological interventions were evaluated in this review, as articles assessing yoga, massage, exercise, and acupuncture were included.[3-5,19,21,27,28]

The main limitation of this review was the small number of studies included. However as mentioned above the methods of this review were robust, although the yield may have potentially been improved by including articles from languages other than English, by searching additional databases, and by inclusion of studies from the grey literature. Regardless, no articles were excluded from this review due to being published in a language other than

English or because they were found in the grey literature. Of the articles included in the review, some employed lower quality methods as exhibited by their risk of bias scores. Three of the included studies[5,21,27] had risk of bias scores at or below six out of twelve or 50%, and their findings in particular should be viewed with caution due to the inherently heightened risk of bias. The lack of sample size estimations in all studies and questionable use of MANOVA in one study[19] are cause for concern over study quality as well. Furthermore, sleep quality was measured subjectively in nearly all included studies. Such subjective outcome measures may be liable to subject-reporting errors and may adversely impact the results. The risk of bias scoring criteria that was employed in this review[23,24] is best suited for use on RCTs and several of the studies included in this review were not RCTs. As such, more valid scoring of quasi-randomized or observational studies may have been obtained through use of a difference risk of bias scoring method.

Despite the lack of evidence generated herein, the findings of this review may help direct the need for further research in the field of pregnancy and sleep disturbances or insomnia. Higher quality randomized controlled trials are needed to evaluate the possible role of non-pharmacological interventions in impacting sleep quality and insomnia in the pregnant population specifically. Such studies will need to have more consistent application of validated sleep quality outcome measures.

Conclusions

There were only seven articles included in this review, these suggest that exercise[5,21,27], acupuncture[3,4,28], and massage[19] each may be associated with improved sleep quality or insomnia levels in pregnant women. However, the quality of methods of included studies was generally low. Although no adverse effects of non-pharmacological interventions were reported, higher quality research is clearly needed to determine their effects on sleep.

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