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Review Article

Chronic sleep loss during pregnancy as a determinant of stress: impact on pregnancy outcome

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ABSTRACT

Short sleep duration, poor sleep quality, and insomnia frequently characterize sleep in pregnancy during all three trimesters. We aimed: (i) to review the clinical evidence of the association between conditions of sleep loss during pregnancy and adverse pregnancy outcomes; and (ii) to discuss the potential pathophysiological mechanisms that may be involved. A systematic search of cross-sectional, longitudinal studies using Medline, Embase, and PsychINFO, and MeSH headings and key words for conditions of sleep loss such as 'insomnia', 'poor sleep quality', 'short sleep duration', and 'pregnancy outcome' was made for papers published between January 1, 1960 and July 2013. Twenty studies met inclusion criteria for sleep loss and pregnancy outcome: seven studies on prenatal depression, three on gestational diabetes, three on hypertension, pre-eclampsia/eclampsia, six on length of labor/type of delivery, eight on preterm birth, and three on birth grow/birth weight. Two main results emerged: (i) conditions of chronic sleep loss are related to adverse pregnancy outcomes; and (ii) chronic sleep loss yields a stress-related hypothalamic–pituitary–adrenal axis and abnormal immune/inflammatory, reaction, which, in turn, influences pregnancy outcome negatively. Chronic sleep loss frequently characterizes sleep throughout the course of pregnancy and may contribute to adverse pregnancy outcomes. Common pathophysiological mechanisms emerged as being related to stress system activation. We propose that in accordance to the allostatic load hypothesis, chronic sleep loss during pregnancy may also be regarded as both a result of stress and a physiological stressor per se, leading to stress 'overload'. It may account for adverse pregnancy outcomes and somatic and mental disorders in pregnancy.

1. Introduction

Pregnancy is one of the most important periods in a woman's life. Despite being a natural phenomenon, pregnancy is accompanied by major physiological, psychological and social changes [1,2]. Sleep disorders are among the most widespread major problems experienced in pregnancy [3–8]. In a recent poll by the National Sleep Foundation, more than 79% of women reported that their sleep had been altered during pregnancy compared to any other time [6].

Sleep restriction, short sleep duration, poor sleep quality, sleep-disordered breathing, and parasomnias have been described as widespread sleep problems during pregnancy [3,5,9–14]. The quantity and quality of sleep of pregnant women have been shown to be altered during pregnancy [3,4,13]. Previous studies have documented trimester-specific changes in sleep architecture [3–6,8–10]. Emerging evidence also indicates that sleep disturbances during pregnancy are associated with women's poor health outcomes [15–17]. In addition, recent data indicate that sleep disturbances are associated with adverse pregnancy outcomes including intrauterine growth restriction and preterm birth [18–20].

As other sleep disorders in pregnancy such as sleep-disordered breathing, and parasomnias have already been covered in detail elsewhere [5,10,11,16,20,21], this study focuses on the available data concerning conditions of sleep loss such as short sleep duration, poor sleep quality, and insomnia with respect to the outcome

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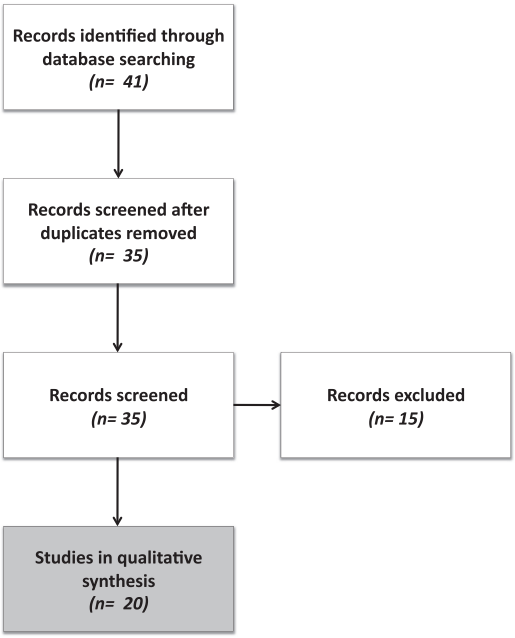

Fig. 1. Flow of information through the different phases of the systematic review.

of pregnancy. It has already been hypothesized that such sleep conditions cause serious consequences, which include depression, diabetes, and various cardiovascular dysfunctions [22–28]. The primary aim of this article is systematically to review the clinical evidence of the association of such sleep conditions and pregnancy outcome. The secondary aim is to discuss the potential pathophysiological mechanisms that may be involved in this interaction. A model of the role of chronic sleep loss in modulating stress response (allostasis) [29–31] and consequences on pregnancy outcome will be proposed.

2. Methods

2.1. Search strategy

A systematic search of Medline, Embase, and PsychINFO was performed. The initial search was conducted in November 2011 with a final search in July 2013. The search strategies used MeSH headings and keywords for 'insomnia', 'poor sleep quality', 'short sleep duration' or 'sleep restriction' and 'pregnancy outcome'.

2.2. Inclusion and exclusion criteria

Studies were included if they: (1) involved human adult pregnant women aged >18 years; (2) were longitudinal observational, case–control, or cross-sectional studies, or meta-analyses; (3) analyzed prevalence and characteristics of disturbed sleep such as insomnia and poor sleep quality, short sleep duration and pregnancy outcome; and (4) were published between January 1, 1960 and July 2013. Studies were excluded if: (1) they did not control for confounding factors such as other sleep disorders or other comorbid disorders (i.e. other sleep disorders, sleep-disordered breathing, restless leg syndrome, depression; (2) they did not analyze data stratified by race and age; (3) they were not available in full text; or (4) they were not available in English.

3. Results

3.1. Selection of articles

Forty-one articles were retrieved, 21 of which were excluded after detailed review as they did not meet the inclusion criteria. Twenty papers were included and their data retrieved (Fig. 1).

Three studies focused on prenatal depression (Table 1), two on gestational diabetes (Table 2), three on hypertension, pre-eclampsia/eclampsia (Table 3), five on the length of labor/type of delivery (Table 4), five on preterm birth (Table 5) and three on fetal growth (Table 6).

3.2. Chronic sleep loss during pregnancy and adverse pregnancy outcome: clinical evidence

In the USA, more than one million pregnancies each year result in adverse outcomes that increase maternal and infant morbidity [31–36]. Even if only few investigations have focused on this issue, emerging evidence indicates that conditions of sleep loss may have a role in adverse outcome of pregnancy. Changes in sleep pattern during pregnancy have been widely described in all three trimesters of pregnancy since 1968 [for overviews see 3–10]. Conditions of sleep loss such as short sleep duration [37–39], poor sleep quality [4,13,38–51], poor sleep efficiency with an increase in time spent awake during the night [13,42,46], and insomnia [38,52] characterize the sleep of pregnant women during the period of pregnancy. The most frequent adverse outcomes include conditions related to mother morbidity such as prenatal depression, gestational diabetes, and pre-eclampsia. In addition, abnormal duration of labor, type of delivery, intrauterine growth restriction, and preterm birth have been considered adverse pregnancy outcomes.

Prenatal depression prevalence estimates range from 10% to 25% [53–57], and it is a significant risk factor for miscarriage, preterm birth, and low birth weight [53,58–62]. Sleep disturbances are more frequent in depressed than in non-depressed women during pregnancy, especially in early gestation [57,63–65]. Although few studies have investigated the role of sleep loss in the development of depressive symptoms during pregnancy [51,66,67] (Table 1), they show that it may constitute a risk for developing

Table 1
Sleep loss and prenatal depression.

Authors	Study design	Study population	Week of gestation	Sleep evaluation	Main findings
Skouteris et al. [66]	Longitudinal	273 pregnant women	From 14th week until delivery every 8 weeks	PSQI BDI	Poor sleep quality earlier in pregnancy predicted higher levels of depressive symptoms at later stage of pregnancy
Skouteris et al. [67]	Longitudinal	252 pregnant women	Mid/late pregnancy	PSQI BDI	Sleep problems are risk factors for increased depressive symptoms during pregnancy
Kamysheva et al. [51]	Longitudinal	252 pregnant women	Early–mid 2nd trimester and late 3rd trimester	BDI PSQI	Poor sleep quality is a risk for depressive symptoms early–mid 2nd trimester, late 3rd trimester

PSQI, Pittsburgh Sleep Quality Index; BDI, Beck Depression Inventory.