Comprehensive Psychiatry 98 (2020) 152168

Contents lists available at ScienceDirect

Comprehensive Psychiatry

journal homepage: www.elsevier.com/locate/comppsych

Prevalence and associated risk factors of insomnia among pregnant women in China

Wen-Jing Wang [a,b], Cai-Lan Hou [b,*], Yan-Ping Jiang [c], Feng-zhen Han [c], Xiao-Yun Wang [c], Shi-Bin Wang [b], C.H. Ng [d], Fu-Jun Jia [a,b,**]

[a] The Second School of Clinical Medicine, Southern Medical University, Guangzhou, Guangdong Province, China
[b] Guangdong Mental Health Center, Guangdong Provincial People's Hospital, Guangdong Academy of Medical Sciences, Guangzhou, Guangdong Province, China
[c] Department of Obstetrics, Guangdong Provincial People's Hospital, Guangdong Academy of Medical Sciences, Guangzhou, Guangdong Province, China
[d] Department of Psychiatry, The University of Melbourne, Melbourne, Victoria, Australia

ARTICLE INFO

Keywords:
Insomnia
Pregnancy
Prevalence
Sleepiness
Somatic discomfort

ABSTRACT

Background: Insomnia is common during pregnancy but the prevalence and risk factors of insomnia in Chinese women during pregnancy is not well studied. This study aimed to examine the prevalence of insomnia and its risk factors in Chinese women during pregnancy.
Methods: In this cross sectional study, 436 Chinese pregnant women with Insomnia Severity Index (ISI) ≥ 8 were clinically assessed using the insomnia criteria based on the combination of DSM-IV (Diagnostic and Statistical Manual-4th Edition) and ICD-10 (International Classification of Dieases, 10th Edition). Beck Depression Inventory (BDI), State-Trait Anxiety Inventory (STAI), Dysfunctional Beliefs and Attitudes about Sleep Scale (DBAS), Pregnancy Pressure Scale (PPS), Perceived physical discomfort level and number, Epworth Sleepiness Scale (ESS), and a general socio-demographic questionnaire were administered.
Results: The results showed that about 20% of the pregnant women met the strict diagnosis criteria of insomnia. Independent-samples *t*-test revealed that several risk factors were correlated with the group with insomnia (N = 84) compared to the group without insomnia (N = 352). Binary Logistic regression analysis found that more significant bed partner influence (OR = 1.92, 95% CI: 1.03–3.60), depressive symptoms (OR = 1.07, 95% CI: 1.00–1.14), daytime sleepiness (OR = 1.07, 95% CI: 1.01–1.14), subjective somatic discomfort (OR = 2.27, 95% CI: 1.11–4.65), kinds of somatic discomfort (OR = 1.14, 95% CI: 1.03–1.27) and later gestation (OR = 1.05, 95% CI: 1.01–1.09) were significantly associated with insomnia.
Conclusion: In this cohort of Chinese pregnant women, about a fifth of women suffered from clinically significant insomnia. Measures to prevent the adverse effects of insomnia should be provided to pregnant women with depressive symptoms, Sleep disturbance of the bed partner, excessive daytime sleepiness and somatic discomfort, especially late in gestation.
© 2020 The Authors. Published by Elsevier Inc. This is an open access article under the CC BY-NC-ND license (http://creativecommons.org/licenses/by-nc-nd/4.0/).

1. Introduction

Insomnia is the most prevalent sleep disturbance experienced in women during pregnancy, affecting 52%–61% of pregnant women [1]. The prevalence of insomnia during pregnancy is high from the start and two thirds of pregnant women suffer from insomnia in the later period of pregnancy [2]. One previous study found that 97% of the women at the end of pregnancy reported middle-of-the-night awakenings, but only less than a third of the women considered sleep disruption as a problem [3].

It has been shown that insomnia is related to a number of potential maternal and infant health risks, such as adverse pregnancy outcomes (hypertension, gestational diabetes mellitus (GDM)) [4–7]. Disturbed sleep in early and late pregnancy may also augment the risk for cardio-metabolic risk factors, which is associated with maternal and infant morbidity [4]. In addition, insomnia is frequently related to a variety of psychiatric disorders, such as depression and anxiety during pregnancy [8,9] and during the postpartum period [9–11]. Insomnia symptoms are also related to BMI increase in post-pregnancy [12]. In addition, sleep loss during pregnancy is related to fetal intrauterine growth retardation, longer duration of delivery, and unplanned cesarean section [13,14]. Pregnant women who slept <6 h per night appear

* Corresponding author.
** Correspondence to: F.J. Jia, 7/F, Guangdong Mental Health Centre, Guangzhou, Guangdong province, China.
E-mail addresses: houcl1975@163.com (C.-L. Hou), jiafujun@126.com (F.-J. Jia).

https://doi.org/10.1016/j.comppsych.2020.152168
0010-440X/© 2020 The Authors. Published by Elsevier Inc. This is an open access article under the CC BY-NC-ND license (http://creativecommons.org/licenses/by-nc-nd/4.0/).

to have longer labor and 4.5 times higher likelihood of a cesarean section [13,15,16].

Current evidence shows that the major physiological, psychological, and social changes occurred during pregnancy may be identified risk factors for insomnia, even if common pregnancy related complaints such as back pain, nausea, gastro-esophageal reflux, fetal movement, vomiting and urinary frequency, all of which could affect sleep [17]. Worsening quality of sleep during pregnancy may also be linked to restless legs syndrome, sleep apnea and snoring [18]. In addition, poor sleep quality during pregnancy is associated with psychosocial and physiologic stress [19]. Furthermore, past history of insomnia, advanced trimester, high BMI, age and depression symptoms are risk factors for insomnia [2,20], while moderate physical activity has protective effects [21].

Now it is important to pay more attention to examine the prevalence and risk factors of insomnia for health professionals to clear the influence on the pregnant population. However, the majority of previous prevalence studies of insomnia in pregnancy used insomnia symptoms [5] or less rigorous diagnostic criteria of insomnia based on the different assessment tools [2,9,22]. In addition, the prevalence and risk factors of insomnia in Chinese women during pregnancy is not well studied. Therefore, our aims were to investigate the prevalence of insomnia during pregnancy in a Chinese population and explore its related clinical correlates, which would provide an idea to make preventive intervention potentially.

2. Methods

2.1. Study design and participants

This cross-sectional study consecutively recruited women who visited the outpatient obstetrics clinic of the Guangdong Provincial People's Hospital (which is the largest general hospital in Guangdong Province) in Guangzhou, From January 1, 2015, to December 31, 2017. The inclusion criteria included Chinese pregnant women above or equal to 18 years old in any trimester of pregnancy and able to understand the research proposal. The exclusion criteria included 1) a history of significant physical chronic diseases and psychiatric diseases; 2) had benzodiazepine or other medications, or consumed caffeinated drinks or alcohol during pregnancy; 3) had sleep disturbance before pregnancy; 4) had crossed time zone during flight or had night shift during pregnancy; 5) had any medical or psychiatric conditions during pregnancy.

The subjects were screened using The Insomnia Severity Index (ISI), and participants who scored above a cutoff of 8 were interviewed face-to-face according to the criteria based on the combination of DSM-IV (Diagnostic and Statistical Manual-4th Edition) and ICD-10 (International Classification of Diseases, 10th Edition) including the presence of difficulty of falling asleep, difficulty of maintaining sleep or non-restorative sleep. In addition, to meet the stringent criteria of clinically significant insomnia, the above-mentioned symptoms should occur at least three times per week, lasting at least one month, and result in significant clinical distress in social or occupational functioning. A complete reproductive and physical examination were conducted by a senior obstetrician.

Informed consent was provided by all participants. The study and all related procedures were approved by the Hospital Research Ethics Committee.

2.2. Assessments

For all subjects, the following data were collected: sociodemographic characteristics (age, marriage status, education level, occupation status, nuclear family, economic status), lifestyle information (passive smoking behavior), sleep habit (coping strategies for insomnia, anticipated sleeping hour, daytime nap, influence from bed partner or the environment), reproductive history (planned pregnancy, gestational week, number of gestation, abortion history, number of child), the level of stress, somatic pain or discomfort, and kinds of subjective physical discomfort from pregnancy.

We utilized common instruments to assess sleep disturbances. The Insomnia Severity Index (ISI) was developed to evaluate insomnia in clinical settings [23]. The questionnaire has 7-item to rate the severity of insomnia over the past 2 weeks: absence of insomnia (0–7); sub-threshold insomnia (8–14); moderate insomnia (15–21); severe insomnia (22–28). We also used the Epworth Sleepiness Scale (ESS) to assess daytime sleepiness or dozing propensity [24] and Pittsburgh Sleep Quality Index (PSQI) [25] to assess sleep quality of the past month. The PSQI is a self-rated questionnaire with 19-item, designed to assess sleep disturbance and sleep quality over the past month among clinical population. The 19 items are divided into 7 components with a total score of 0 to 21. The higher the total score, the worse the quality of sleep [26]. The total ESS score can range between 0 and 24 on a 4-point scale (0–3). The higher the total score is, the higher the level of excessive daytime sleepiness. ESS score > 10 is indicated as excessive daytime sleepiness and PSQI > 5 is considered as bad sleep quality.

A brief version of Dysfunctional Beliefs and Attitudes about Sleep Scale (DBAS-16) [27] was applied to determine the individual beliefs and attitudes about sleep which was originally a 30-item scale initially designed by Morin et al., and later shortened to a 16-item scale. The scoring range of each item was from 0 (at the "strongly disagree" pole) to 10 (at the "strongly agree" pole). The total score of DBAS-16 based on the average score of 16 items.

Two questions designed to rate nap in the daytime, including "would you need the nap during the daytime", and the five alternatives are categorized to three groups, respectively no need or can't, 1–5 days/week, daily or nearly daily; "how long do you usually have a nap", the five responses to the question were categorized into: 15 min or less, 16–30 min, or 31 min or more.

We used the Beck Depression Inventory (BDI) [28] to measure the symptoms of depression, and State-Trait Anxiety Inventory (STAI) consisting of 2 subscales of 20 items each, to respectively measure states anxiety (S-anxiety) and trait anxiety (T-anxiety) [29]. Items were rated on a 4 point Likert scale (1 = almost never, 2 = sometimes, 3 = often, and 4 = almost always). The STAI score for each subscale (S-anxiety and T-anxiety) ranges from 20 to 80 for the 20 items, with higher scores suggesting greater anxiety.

Four self-reported questions about pregnancy expectation, stress, fatigue, and physical discomfort severity were administered. The subject were asked "what level of expectation of pregnancy do you have", "Have you had stress about pregnancy at present", "Have you had pain during the last month", "How strong is the physical discomfort do you feel during the last month". Participants rated themselves on the visual analog scales anchored at one end by "0 stands for none" and at the other end "10 stands for the strongest level". Mild level scored from 0 to 3, middle level scored form 4–6, strong level scored from 7 to 10. In addition, subjects needed to choose from 24 common physical symptoms during pregnancy in the past month such as having no comfortable position while sleeping, nausea, vomiting, urinary frequency, and shortness of breath. Body mass index (BMI; kg/m2) was collected, with BMI ≥ 25 considered as high BMI.

To assess pregnancy-related stress we used the Pregnancy Pressure Scale (PPS), which is a self-report measurement with 30-items and a 4 -point scale (1–4), and designed according to Chinese culture with good psychometric properties, Internal consistency coefficient = 0.9 [30], Cronbach's $\alpha = 0.840$ [31]. The measure assesses stress in relation to the health and safety of mother and child, the recognition of parental roles, and the changes in body shape and physical activity.

Table 1
Socio-demographic and reproductive characteristics of the insomnia group and non-insomnia group of pregnant women.

	Total (N = 436)		IG (N = 84)		NIG (N = 352)		Statistics		
	n	%	n	%	n	%	χ^2	df	p
Employed	349	80	69	82.1	280	79.5	0.2	1	0.59
College education	363	83.4	70	83.3	293	83.5	0	1	0.97
Age (≥35)	89	20.4	22	26.2	67	19	2.1	1	0.14
Married status	427	97.9	80	95.2	347	98.6	3.7	1	**0.05**
Economic status (average or above)	413	94.7	79	94	334	94.9	0	1	0.75
Nuclear family	266	61.4	53	63.1	213	61	0.1	1	0.72
Satisfied life	422	96.8	82	97.6	340	96.6	0.2	1	0.63
Support from husband	427	98.6	81	97.6	346	98.9	0.7	1	0.37
Passive smoking	133	30.7	27	32.1	106	30.4	0.1	1	0.75
Trimester									
<13 weeks	63	14.4	10	11.9	53	15.1			
13–27 weeks	285	65.4	47	56	238	67.6	9.2	2	**0.01**
≥28 weeks	88	20.2	27	32.1	61	17.3			
Number of gestation (>1)	232	53.2	46	54.8	186	52.8	0.1	1	0.75
Number of child (>1)	180	41.4	41	48.8	139	39.6	2.3	1	0.12
Abortion (yes)	149	34.2	26	31	123	34.9	0.4	1	0.48
Planned pregnancy	319	73.7	60	73.2	259	73.8	0	1	0.9
Anticipated natural labor	344	79.8	60	71.4	284	81.8	4.5	1	**0.03**

Bold values: P < 0.05; IG: insomnia group; NIG: non-insomnia group.

2.3. Statistical analysis

The statistical analyses were conducted using SPSS V.21.0 statistical software. Comparisons between insomnia and non-insomnia groups with respect to sociodemographic, reproductive characteristics, sleep variable, psychological and physical characteristics were performed using independent-samples *t*-test and Pearson chi-square tests, significance test between the two mean scores (t), Measurable data were presented together with means (X) and Standard Deviations (SD). Non-parametric continuous data were compared with the Mann–Whitney *U* test (two independent samples). Odds ratios were calculated using binomial logistic regression models, with insomnia being the dependent variable for all independent factors. Risk factors that affect insomnia were identified according to the enter Logistic Regression analysis results, and statistical significance was taken as P < 0.05 (two-tailed). Sensitivity analysis was performed according to different pregnancy trimester with the backward stepwise multivariate logistic regression analysis.

3. Results

Table 1 shows the sociodemographic and reproductive characteristics between insomnia and non-insomnia groups.

Totally, 436 Chinese pregnant women participated in the study and were assigned to insomnia (N = 84) and non-insomnia (N = 352) groups. The average age of the participants was approximately 30 years (20–44), and 20.4% of them are over 35 years old. Besides, 80% of the pregnant women were employed, 83.3% of them had college education level or above. 97.9% of the pregnant women were married. Most reported that good quality of life, economic status, marital relationship and family support. Further, 61.4% of them lived in a nuclear family and 30.7% women had passive smoking.

The mean weeks of gestation were 25.1 ± 8.1 weeks. Overall 20.2% of the participants were in the third trimester, 65.4% in the second trimester, 73.7% had planned pregnancy, 53.2% were multigravida, 41.4%

Table 2
Sleep, psychological and physical characteristics of the insomnia and non-insomnia groups of pregnant women.

	Total (N = 436)		IG (N = 84)		NIG (N = 352)		Statistics		
	N	%	N	%	N	%	χ^2	df	*P*
Strong desire for pregnancy	379	87.5	76	90.5	303	86.8	0.8	1	0.36
Strong subjective pressure level	265	60.8	57	67.9	208	59.1	2.1	1	0.13
Strong subjective somatic discomfort	231	53	65	77.4	166	47.2	24.8	1	<**0.001**
Strong subjective fatigue	310	71.6	69	82.1	241	69.1	5.7	1	**0.01**
ISI (≥8)	214	49.1	82	97.6	132	37.5	98	1	<**0.001**
PSQI (>5)	214	49.9	80	96.4	134	38.7	89	1	<**0.001**
ESS (>10)	86	19.7	27	32.1	59	16.8	10.1	1	**0.001**
Daytime nap habit							0.6	2	0.73
No need or can't	73	16.8	13	15.5	60	17.1			
1–5 days/week	109	25.1	19	22.6	90	25.6			
Every day	253	58.2	52	61.9	201	57.3			
Time of daytime nap									
15 min or less	59	13.7	10	11.9	49	14.1			
16–30 min	269	61.4	51	60.7	218	62.8	0.8	2	0.66
31 min or more	103	23.9	23	27.4	80	23.1			
Bed partner influence	214	49.5	56	67.5	158	45.3	13.2	1	<**0.001**
Environmental influence	40	9.2	10	12	30	8.6	0.9	1	0.32
Coping strategy for insomnia	393	90.1	74	88.1	319	90.6	0.4	1	0.48

	Mean	SD	Mean	SD	Mean	SD	T/Z	df	p
Age (years)	30.5	4.3	31.1	4.4	30.4	4.2	1.3	434	0.17
Gestational weeks	22.9	7.7	25.1	8.1	22.4	7.5	2.9	434	<**0.01**
Anticipated sleeping time	8.4	1.0	8.3	1.2	8.4	1.0	−0.6	100	0.54
Actual sleeping time	7.3	1.2	6.3	1.4	7.6	1.0	−7.2	104	<**0.001**
ESS	6.8	4.5	8.2	5.6	6.5	4.1	2.6	105	<**0.01**
ISI	7.6	4.7	12.8	3.7	6.4	4	13.4	434	<**0.001**
BMI (before pregnancy)	20.5	2.6	20.8	2.5	20.4	2.6	1.3	434	0.19
Any kinds of somatic discomfort	4.8	2.9	6.3	2.9	4.5	2.8	5	431	<**0.001**
BDI	5.7	5.4	7.9	4.6	5.2	5.5	5.6	433	<**0.001***
STAI-trait	37.3	9	39.6	8.5	36.8	9	2.5	426	**0.01**
STAI-anxiety	36.1	10.1	38.7	9.8	35.5	10.1	2.6	428	<**0.01**
DBAS	4.4	1.6	4.9	1.4	4.3	1.6	2.6	431	<**0.01**
PPS	46.5	13.4	49.8	13.4	45.7	13.3	2.4	416	**0.01**
SSS	45.9	7.8	44	7.4	46.3	7.8	−2.4	414	**0.01**

Bold values: P < 0.05; BDI: Beck Depression Inventory; BMI: Body Mass Index; DBAS: Dysfunctional Beliefs and Attitudes about Sleep Scale; ESS: Epworth Sleepiness Scale; IG: insomnia group; NIG: non-insomnia group; ISI: Insomnia Severity Index; PSQI: Pittsburgh Sleep Quality Index; PPS: Pregnancy Pressure Scale; SSS: Social Support Scale; STAI: State-Trait Anxiety Inventory; *median (quartiles 2,8) for continuous variables without normal distribution.

Table 3
Sociodemographic, sleep variable, psychological and physical correlates independently associated with insomnia using binary logistic regression analysis.

Associated risk factors	P	OR	95% CI
Gestational weeks	<**0.01**	1.05	1.01–1.09
Bed partner influence	**0.04**	1.92	1.03–3.60
ESS	**0.02**	1.07	1.01–1.14
Moderate or severe subjective fatigue	0.14	0.56	0.25–1.23
Any kinds of somatic discomfort	<**0.01**	1.14	1.03–1.27
Anticipated natural labor	0.28	0.68	0.34–1.36
Moderate and severe subjective somatic discomfort	**0.02**	2.27	1.11–4.65
BDI	**0.04**	1.07	1.00–1.14
STAI-trait	0.14	0.95	0.90–1.01
STAI-anxiety	0.34	1.02	0.97–1.08
DBAS	0.06	1.20	0.99–1.46
PPS	0.18	0.98	0.95–1.00
SSS	0.32	0.97	0.94–1.02

BDI: Beck Depression Inventory; Bold values: P < 0.05; 95% C.I.: 95% confidence interval; OR: odds ratio; CI: confidence interval; DBAS: Dysfunctional Beliefs and Attitudes about Sleep Scale; ESS: Epworth Sleepiness Scale; PPS: Pregnancy Pressure Scale; SSS: Social Support Scale; STAI: State-Trait Anxiety Inventory.

were multipara, 34.2% had a history of abortion, and 79.8% had anticipated a natural birth.

The between-group analyses indicated that married status ($\chi^2 = 3.7$, $p = 0.05$), gestation weeks (t = 9.2, $p = 0.01$), planned natural birth ($\chi^2 = 4.5$, $p = 0.03$) had significant difference.

Table 2 shows sleep variable, psychological and physical characteristics between insomnia and non-insomnia groups.

Of the 436 Chinese pregnant women, 49.1% women met the significant insomnia based on the ISI score of 8 or above. Although insomnia occurred at least three nights per week in about 60% of the samples, only 19.2% of the samples received a diagnosis of insomnia based on ISI score and the criteria of DSM-IV and ICD-10. About 90% of the participants had coping strategies for insomnia. According to the self-reported questions, 49.5% of them experienced interruption from their bed partner, and 9.2% had been interrupted from their environment. Further, 16.8% of them had no need for daytime nap, 25.1% needed daytime nap for 1–5 days once a week, and about 58% women needed daytime nap daily. About 70% of them reported have 30 min or less nap in the daytime, 49.1% had high scores of ISI (≥8) and 19.7% had the high score of ESS (>10). The anticipated sleeping time was 8.4 ± 1.0 h, but the mean actual sleeping time was 7.3 ± 1.2 h. The mean scores of DBAS were 4.4 ± 1.6.

Respectively, 60.8%, 53%, 71.6% of them reported moderate or severe level of subjective pressure, physical discomfort, fatigue caused by pregnancy. The mean subjective physical discomfort was 4.8 ± 2.9, the mean BMI before pregnancy was 20.5 ± 2.6, and the mean total scores of STAI – trait and STAI - anxiety were 37.3 ± 9.0 and 36.1 ± 10.1 respectively. The median of BDI score was 5 (interquartile range: 2–8).

The between-group analyses indicated that the interruption by the bed partner ($\chi^2 = 13.2$, $p < 0.001$), the rate of moderate or strong level of subjective fatigue ($\chi^2 = 5.7$, $p = 0.01$), the moderate or strong subjective level of physical discomfort ($\chi^2 = 24.8$, $p < 0.001$), the total score of BDI (z = 5.6, $p < 0.001$), the total score of STAI-trait (t = 2.5, $p = 0.01$), the total score of STAI-anxiety (t = 2.6, $p < 0.01$), the score of DBAS (t = 2.6, $p < 0.01$), the total score of PPS (t = 2.4, $p = 0.01$), actual sleeping time (t = −7.2, $p < 0.001$), social support (t = −2.4, $p = 0.01$), sleepiness ($\chi^2 = 10.1$, $p = 0.001$), subjective somatic type ($t = 5.0$, $p < 0.001$) had significant difference between the insomnia group and non-insomnia group. Other variables showed not significant difference between groups.

Table 3 shows sociodemographic, sleep variable, psychological and physical correlates independently associated with insomnia (binary logistic regression analysis).

Multivariate logistic regression confirmed the bed partner interruption (OR = 1.92, 95% CI 1.03–3.60), the moderate and severe level of physical discomfort (OR = 2.27, 95% CI: 1.11–4.65) and the kinds of somatic discomfort (OR = 1.14, 95% CI: 1.03–1.27), gestational weeks (OR = 1.05,95% CI: 1.01–1.09), the total score of BDI (OR = 1.07, 95% CI: 1.00–1.14) and daytime sleepiness (OR = 1.07, 95% CI: 1.01–1.14) were significant predictors of insomnia in pregnancy. The results showed that the moderate and severe level of subjective physical discomfort (OR: 2.27) was found to be most prominent risk factors for insomnia.

Table 4 shows correlates associated with insomnia in different pregnancy trimester (Multivariate logistic regression analysis with backward stepwise method).

The result of sensitivity analysis showed that the kinds of somatic discomfort (OR = 1.74, 95% CI: 1.18–2.58) was significant predictors of insomnia in the early pregnancy. The bed partner interruption (OR = 2.46, 95% CI 1.09–5.51) and the kinds of somatic discomfort (OR = 1.20, 95% CI: 1.07–1.35) were significant predictors of insomnia in the second trimester pregnancy. The moderate and severe level of physical discomfort (OR = 18.51, 95% CI: 2.12–161.67) and the anticipated natural labor (OR = 0.14, 95% CI: 0.02–1.01) were significant predictors of insomnia in the third trimester pregnancy.

4. Discussion

To the best of our knowledge, this was the first study on the prevalence and risk factors of insomnia in pregnant women in China. In this study, we found that 19.2% of the participants met the diagnostic criteria for insomnia based on the combination DSM-IV and ICD-10, which is higher than the previous findings in general population [32–34]. A study found a prevalence of insomnia of 9.5% in the general population as defined by DSM-IV and ICD-10 [32]. The pooled prevalence of insomnia in general population was 15.0% in China [35]. In addition, in our study, about half of the pregnant women who did not consumed caffeinated drinks or alcohol during pregnancy displayed different levels of sleep disturbances and poor sleep quality (total ISI score 8–28 or PSQI > 5), and 60% had insomnia at least three nights per week.

Differences in the definitions of insomnia, methodology and measurement tools between studies [2,5,9,22], may account for the inconsistency in the results across studies. In our study, initial screening with ISI, which is the most common measure of insomnia in pregnant women [23], was later confirmed by strict diagnostic criteria. Similar

Table 4
Correlates associated with insomnia in different pregnancy trimester.

Associated risk factors	<13 weeks			13–27 weeks			≥28 weeks		
	P	OR	95% CI	P	OR	95% CI	P	OR	95% CI
Gestational weeks	–	–	–	–	–	–	0.09	**1.22**	**0.96–1.56**
Bed partner influence	–	–	–	**0.02**	**2.46**	**1.09–5.51**	<**0.01**	**18.51**	**2.12–161.67**
Any kinds of somatic discomfort	<**0.01**	**1.74**	**1.18–2.58**	<**0.01**	**1.20**	**1.07–1.35**	–	–	–
Anticipated natural labor	–	–	–	–	–	–	**0.05**	**0.14**	**0.02–1.01**
Moderate and severe subjective somatic discomfort	0.06	0.15	0.02–1.15-	–	–	–	–	–	–
BDI	–	–	–	–	–	–	0.06	**1.14**	**0.99–1.32**
PPS	–	–	–	–	–	–	0.09	**0.94**	**0.88–1.01**

Multivariate logistic regression analysis was used with backward stepwise method.
Bold values: P < 0.05; 95% C.I.: 95% confidence interval; OR: odds ratio; CI: confidence interval; BDI: Beck Depression Inventory; PPS: Pregnancy Pressure Scale.

to our data, Swanson et al. identified 45% in pregnant women above the cut-off score of ISI [36], and Fernandez-Alonso et al. reported 73.5% of women experienced insomnia (total ISI score 8–28) in late pregnancy [37]. However, only 17% of participants met the ISI-based criterion (ISI ≥ 10) for clinically significant insomnia across all trimesters [38], which was significantly lower than the prevalence in our study.

Other measurements of insomnia were used in other epidemiological studies of pregnant women. Kizilirmak et al. identified >50% of women who scored positive for insomnia symptoms using the Women's Health Initiative Insomnia Rating Scale (WHIRS) [21]. Michele L. Okun et al. identified 12.6% of the women who had insomnia in early pregnancy with Insomnia Symptom Questionnaire (ISQ), which was consistent with established diagnostic criteria [39]. Dorheim et al. used the Bergen insomnia Scale (BIS) in 2816 women and found that 61.9% of women met the criteria of DSM-IV-TR and mean BIS score 17.5 at 32 weeks gestation [8].

The present result showed that pregnant women with insomnia had higher subjective physical discomfort. Insomnia in pregnant women can be caused by consequences of physiological and anatomical changes such as urinary frequency, nausea, vomiting, fetal movement and pain [17]. In addition, other factors contributing to insomnia may be a result of hormonal changes during pregnancy including estrogen and progesterone via influences on smooth muscles, respiration and the nervous system [21], or effects on the other hormones [40], or the hormonal effects on the sleep-wake cycle [41]. Although sleep changes may be a result of normal physiological changes of pregnancy [42], women and doctors may underscore the fact that the strong physical discomfort associated with insomnia should never be considered as “normal”.

Our findings was consistent with previous studies which have found that insomnia disturbances increase progressively across the gestational period [2]. The prevalence of insomnia symptoms was 12.6% of mothers at the start of pregnancy, and increased across trimesters [39], and up to 73.5% at a median of 39 weeks [37]. In a French study conducted with 871 women, insomnia was found in 46% of women in the first trimester of pregnancy and was 63% in the third trimester [43]. Kizilrmak found that the risk of developing insomnia in the third trimester was 2.03 times more than women in the other trimesters [21]. In the third trimester, sleep disruptions may increase with more daily naps [44], disturbed dreams [45], increased cortical arousal and increased wakefulness after sleep onset [46].

The relationship of excessive daytime sleepiness and insomnia was also found in this study. In addition, about 19.7% women reported excessive daytime sleep (EDS) with ESS > 10 and the higher prevalence of EDS was found in individuals with insomnia. However, Ebert et al. reported that frequent daytime naps did not significantly influence nocturnal sleep quantity or quality [47]. This suggest that the issue that daytime sleepiness considered be compensatory for insomnia may perpetuate sleep difficulties or be a useful strategy to deal with insomnia remains unclear.

Depression was a common mental health problem during pregnancy [48]. Our study also found that women with more significant depressive symptoms also had greater risk of insomnia. The greater impact on the adverse outcomes of pregnancy may be associated with the interaction between disturbed sleep and depression in early gestation [49]. Depression and insomnia may be strongly inter-related, and have common pathophysiology, such as inflammation and neuroendocrine dysregulation [50–52].

Another problem experienced during pregnancy was the interruption from a bed partner, which was found as one of predictor of higher prevalence of insomnia in our study. To our best knowledge, there has been not previous research on this factor during pregnancy. Our result suggested that sleep interruption from a bed partner increases the risk of insomnia 1.97 times during pregnancy. More research is required regarding this factor in the future.

Although the comparison between insomnia and non-insomnia groups found that women with BMI of 25 and over in pre-pregnancy had more insomnia complaints, logistic regression analysis did not estimated this variable as the risk factor of insomnia. We also did not detect any relationship between BMI during pregnancy and insomnia. Previous study also did not find any relationship between insomnia and body weight gain [53,54].

As a result of logistic regression analysis we did not find stress as a risk factor for insomnia during pregnancy. It is possible that short-term insomnia (assessed in our cross-sectional study) is different from chronic insomnia and may have no relationship with subjective stress. Several studies have suggested that chronic sleep loss experienced during pregnancy may be considered both a result of stress and a stressor per se [55]. Our study could not estimate the proportion of the women with chronic insomnia.

The results of sensitivity analysis according to different pregnancy trimester showed that there are differences in the influencing factors of insomnia in different pregnancy periods. The number of kinds of somatic discomfort may be considered as the risk factor of insomnia in the early pregnancy. The bed partner interruption and the number of kinds of somatic discomfort were associated with the risk predictors of insomnia in the second trimester pregnancy. However, the moderate and severe level of somatic discomfort was the risk factor of insomnia in the third trimester. Furthermore, the anticipated natural labor was protective factor of insomnia in the third trimester pregnancy.

The major strengths of the study were as followed. Firstly, our study explored the prevalence of insomnia and the risk factors in pregnant women using strict diagnostic criteria above. Secondly, the study coincided with the peak fertility period after the start of the two child policy in China, which may have a significant influence on pregnant women as a result of the policy change. Thirdly, risk factors for insomnia were explored comprehensively in the study, including the level and type of physical discomfort and psychological variables. Lastly, all interviews were carried out by only one observer, increasing the homogeneity of the collected data.

There were however several limitations. Firstly, the subjects were recruited from one obstetrics department of a general city hospital, which will limit the generalizability of the results. Secondly, more reliable and objective sleep related data could be available if polysomnography was used. Third, the absence of the use of standard assessment of depression and somatic discomfort. Fourth, it was possible that many other sleep problems were not assessed such as eating at night, nightmares, snoring, restless legs syndrome, and sleep apnea may interfere with the results.

In conclusion, our study of Chinese pregnant women in any trimester of pregnancy found that two third of pregnant women had sleeping problems and about a fifth had a clinical diagnosis of insomnia. Several risk factors of insomnia during pregnancy were similar as in other population with insomnia, such as depressive symptoms and excessive daytime sleepiness. Physical discomfort during pregnancy was an important risk factor for the pregnant women with insomnia. Clinicians need to pay more attention to the importance of physical complaints especially late in pregnancy. These risk factors should be routinely evaluated during antenatal care and appropriate intervention should be provided for pregnant women with insomnia.

Funding/Support

The study was supported by Department of Science and Technology of Guangdong Province (grant number: 2018A030313816), Guangdong Provincial People's Hospital (grant number: 2017zh02) and National Natural Science Foundation of China (grant number: 81803302).

Contributors

Study design: WJ W, CL H, and FJ J. Data collection and typing: WJ W, YP Z, XY W, and FZ H. Analysis and interpretation of data: WJ W, YP J,

and SB W. Draft of the manuscript: WJ W and CL H. Critical revision of the manuscript: CL H, NgC. Approval of the final version for publication: all coauthors.

Declaration of competing interest

The authors had no conflicts of interest in conducting this study or preparing the manuscript.

References

[1] Abbott SM, Attarian H, Zee PC. Sleep disorders in perinatal women. Best Pract Res Clin Obstet Gynaecol 2014;28(1):159–68. https://doi.org/10.1016/j.bpobgyn.2013.09.003.

[2] Román-Gálvez RM, Amezcua-Prieto C, Salcedo-Bellido I, Martínez-Galiano JM, Khan KS, Bueno-Cavanillas A. Factors associated with insomnia in pregnancy: a prospective Cohort Study. Eur J Obstet Gynecol Reprod Biol 2018;221:70–5.

[3] Mindell JA, Cook RA, Nikolovski J. Sleep patterns and sleep disturbances across pregnancy. Sleep Med 2015;16(4):483–8. https://doi.org/10.1016/j.sleep.2014.12.006.

[4] Haney A, Buysse DJ, Rosario BL, Chen YF, Okun ML. Sleep disturbance and cardiometabolic risk factors in early pregnancy: a preliminary study. Sleep Med 2014;15(4):444–50. https://doi.org/10.1016/j.sleep.2014.01.003.

[5] Okun ML, O'Brien LM. Concurrent insomnia and habitual snoring are associated with adverse pregnancy outcomes. Sleep Medicine 2018;46:12–9 S1389945718300741.

[6] Wilkerson AK, Uhde TW. Perinatal sleep problems: causes, complications, and management. Obstet Gynecol Clin North Am 2018;45(3):483–94. https://doi.org/10.1016/j.ogc.2018.04.003.

[7] Zhong C, Chen R, Zhou X, Xu S, Li Q, Cui W, et al. Poor sleep during early pregnancy increases subsequent risk of gestational diabetes mellitus. Sleep Med 2018;S1389945718300789.

[8] Dorheim SK, Bjorvatn B, Eberhard-Gran M. Insomnia and depressive symptoms in late pregnancy: a population-based study. Behav Sleep Med 2012;10(3):152–66. https://doi.org/10.1080/15402002.2012.660588.

[9] Osnes RS, Roaldset JO, Follestad T, Eberhard-Gran M. Insomnia late in pregnancy is associated with perinatal anxiety: a longitudinal cohort study. J Affect Disord 2019;248:155–65. https://doi.org/10.1016/j.jad.2019.01.027.

[10] Dorheim SK, Bjorvatn B, Eberhard-Gran M. Can insomnia in pregnancy predict postpartum depression? A longitudinal, population-based study. Plos One 2014;9(4):e94674. https://doi.org/10.1371/journal.pone.0094674.

[11] Park EM, Meltzer-Brody S, Stickgold R. Poor sleep maintenance and subjective sleep quality are associated with postpartum maternal depression symptom severity. Arch Womens Ment Health 2013;16(6):539–47. https://doi.org/10.1007/s00737-013-0356-9.

[12] Rognmo K, Sivertsen B, Eberhard-Gran M. Self-reported short sleep duration and insomnia symptoms as predictors of post-pregnancy weight change: results from a cohort study. Acta Obstet Gynecol Scand 2016;12(5):465–74. https://doi.org/10.1111/aogs.13056.

[13] Micheli K, Komninos I, Bagkeris E, Roumeliotaki T, Koutis A, Kogevinas M, et al. Sleep patterns in late pregnancy and risk of preterm birth and fetal growth restriction. Epidemiology 2011;22(5):738–44. https://doi.org/10.1097/EDE.0b013e31822546fd.

[14] Sharma SK, Nehra A, Sinha S, Soneja M, Sunesh K, Sreenivas V, et al. Sleep disorders in pregnancy and their association with pregnancy outcomes: a prospective observational study. Sleep Breath 2016;20(1):87–93. https://doi.org/10.1007/s11325-015-1188-9.

[15] Felder JN, Baer RJ, Rand L, Jelliffe-Pawlowski LL, Prather AA. Sleep disorder diagnosis during pregnancy and risk of preterm birth. Obstetrics & Gynecology 2017;130(3):1.

[16] Naghi I, Keypour F, Ahari SB, Tavalai SA, Khak M. Sleep disturbance in late pregnancy and type and duration of labour. J Obstet Gynaecol 2011;31(6):489–91. https://doi.org/10.3109/01443615.2011.579196.

[17] Hashmi AM, Bhatia SK, Bhatia SK, Khawaja IS. Insomnia during pregnancy: diagnosis and rational interventions. Pak J Med Sci 2016;32(4):1030–7. https://doi.org/10.12669/pjms.324.10421.

[18] Uglane MT, Westad S, Backe B. Restless legs syndrome in pregnancy is a frequent disorder with a good prognosis. Acta Obstet Gynecol Scand 2011;90(9):1046–8. https://doi.org/10.1111/j.1600-0412.2011.01157.x.

[19] Pillai V, Roth T, Mullins HM, Drake CL. Moderators and mediators of the relationship between stress and insomnia: stressor chronicity, cognitive intrusion, and coping. Sleep 2014;37(7):1199–208. https://doi.org/10.5665/sleep.3838.

[20] Jarrin DC, Chen IY, Ivers H, Morin CM. The role of vulnerability in stress-related insomnia, social support and coping styles on incidence and persistence of insomnia. J Sleep Res 2014;23(6):681–8. https://doi.org/10.1111/jsr.12172.

[21] Kizilirmak A, Timur S, Kartal B. Insomnia in pregnancy and factors related to insomnia. ScientificWorldJournal 2012;2012:197093. https://doi.org/10.1100/2012/197093.

[22] Kalmbach DA, Cheng P, Ong JC, Ciesla JA, Kingsberg SA, Sangha R, et al. Depression and suicidal ideation in pregnancy: exploring relationships with insomnia, short sleep, and nocturnal rumination. Sleep Med 2019;65:62–73. https://doi.org/10.1016/j.sleep.2019.07.010.

[23] Bastien CH, Vallieres A, Morin CM. Validation of the Insomnia Severity Index as an outcome measure for insomnia research. Sleep Med 2001;2(4):297–307.

[24] Johns MW. A new method for measuring daytime sleepiness: the Epworth sleepiness scale. Sleep 1991;14(6):540–5.

[25] Buysse DJ, Reynolds 3rd CF, Monk TH, Berman SR, Kupfer DJ. The Pittsburgh Sleep Quality Index: a new instrument for psychiatric practice and research. Psychiatry Res 1989;28(2):193–213.

[26] Zhong, Q. Y., Bizu, G., E., S. S., & A., W. M. (2015). Psychometric Properties of the Pittsburgh Sleep Quality Index (PSQI) in a cohort of Peruvian pregnant women. Journal of Clinical Sleep Medicine Jcsm Official Publication of the American Academy of Sleep Medicine.

[27] Morin CM, Vallieres A, Ivers H. Dysfunctional beliefs and attitudes about sleep (DBAS): validation of a brief version (DBAS-16). Sleep 2007;30(11):1547–54.

[28] Richer P, Heerlein WJ, Kraus A, Sauer H. On the validity of the Beck Depression Inventory. A review. Psychopathology 1998;31(3):160–8.

[29] LJ J. Measures of anxiety: State-Trait Anxiety Inventory (STAI), Beck Anxiety Inventory (BAI), and Hospital Anxiety and Depression Scale-Anxiety (HADS-A). Athritis Care Res (Hoboken) 2011;63(Suppl. 11):S467–72.

[30] Dan Li PW, Liu S. Reliability and validity of pregnancy stress scale for pregnant women (in Chinese). Psychol Res 2013;6(2):64–9.

[31] Pan Y, Wang H, Hu M. Investigation and analysis of psychological stress of pregnant women (in Chinese). Journal of Nnursing Science, Comprehensive Edition 2003;12:891–3.

[32] Morin CM, Leblanc M, Daley M, Gregoire JP, Mérette C. Epidemiology of insomnia: prevalence, self-help treatments, consultations, and determinants of help-seeking behaviors. Sleep Med 2006;7(2):123–30.

[33] Ohayon MM. Epidemiology of insomnia: what we know and what we still need to learn. Sleep Med Rev 2002;6(2):97–111.

[34] Pallesen S, Sivertsen B, Nordhus IH, Bjorvatn B. A 10-year trend of insomnia prevalence in the adult Norwegian population. Sleep Med 2014;15(2):173–9. https://doi.org/10.1016/j.sleep.2013.10.009.

[35] Cao XL, Wang SB, Zhong BL, Zhang L, Ungvari GS, Ng CH, et al. The prevalence of insomnia in the general population in China: a meta-analysis. Plos One 2017;12(2):e0170772.

[36] Swanson LM, Pickett SM, Flynn H, Armitage R. Relationships among depression, anxiety, and insomnia symptoms in perinatal women seeking mental health treatment. J Womens Health (Larchmt) 2011;20(4):553–8. https://doi.org/10.1089/jwh.2010.2371.

[37] Fernandez-Alonso AM, Trabalon-Pastor M, Chedraui P, Perez-Lopez FR. Factors related to insomnia and sleepiness in the late third trimester of pregnancy. Arch Gynecol Obstet 2012;286(1):55–61. https://doi.org/10.1007/s00404-012-2248-z.

[38] Manber R, Steidtmann D, Chambers AS, Ganger W, Horwitz S, Connelly CD. Factors associated with clinically significant insomnia among pregnant low-income Latinas. J Womens Health (Larchmt) 2013;22(8):694–701. https://doi.org/10.1089/jwh.2012.4039.

[39] Okun ML, Buysse DJ, Hall MH. Identifying insomnia in early pregnancy: validation of the Insomnia Symptoms Questionnaire (ISQ) in pregnant women. J Clin Sleep Med 2015;11(6):645–54. https://doi.org/10.5664/jcsm.4776.

[40] Miller EH. Women and insomnia. Clin Cornerstone 2004;6(Suppl 1B):S8–18.

[41] Won CH. Sleeping for two: the great paradox of sleep in pregnancy. J Clin Sleep Med 2015;11(6):593–4. https://doi.org/10.5664/jcsm.4760.

[42] Oyiengo D, Louis M, Hott B, Bourjeily G. Sleep disorders in pregnancy. Clin Chest Med 2014;35(3):571–87. https://doi.org/10.1016/j.ccm.2014.06.012.

[43] Neau JP, Texier B, Ingrand P. Sleep and vigilance disorders in pregnancy. Eur Neurol 2009;62(1):23–9. https://doi.org/10.1159/000215877.

[44] Tsai SY, Lin JW, Kuo LT, Thomas KA. Daily sleep and fatigue characteristics in nulliparous women during the third trimester of pregnancy. Sleep 2012;35(2):257–62. https://doi.org/10.5665/sleep.1634.

[45] Lara-Carrasco J, Simard V, Saint-Onge K, Lamoureux-Tremblay V, Nielsen T. Disturbed dreaming during the third trimester of pregnancy. Sleep Med 2014;15(6):694–700. https://doi.org/10.1016/j.sleep.2014.01.026.

[46] Wilson DL, Barnes M, Ellett L, Permezel M, Jackson M, Crowe SF. Decreased sleep efficiency, increased wake after sleep onset and increased cortical arousals in late pregnancy. Aust N Z J Obstet Gynaecol 2011;51(1):38–46. https://doi.org/10.1111/j.1479-828X.2010.01252.x.

[47] Ebert RM, Annette W, Okun ML. Minimal effect of daytime napping behavior on nocturnal sleep in pregnant women. J Clin Sleep Med 2015;11(6):635–43.

[48] Evans J, Heron J, Francomb H, Oke S, Golding J. Cohort study of depressed mood during pregnancy and after childbirth. Bmj 2001;323(7307):257–60.

[49] Okun ML, Kerith K, Luther JF, Wisniewski SR, Wisner KL. Sleep disturbances in depressed and nondepressed pregnant women. Depression & Anxiety 2011;28(8):676–85.

[50] Cyranowski JM, Marsland AL, Bromberger JT, Whiteside TL, Yuefang C, Matthews KA. Depressive symptoms and production of proinflammatory cytokines by peripheral blood mononuclear cells stimulated in vitro. Brain Behavior & Immunity 2007;21(2):229–37.

[51] Groer MW, Morgan K. Immune, health and endocrine characteristics of depressed postpartum mothers. Psychoneuroendocrinology 2007;32(2):133–9.

[52] Okun ML, Martica H, Coussons-Read ME. Sleep disturbances increase interleukin-6 production during pregnancy: implications for pregnancy complications. Reprod Sci 2007;14(6):560.

[53] Kızılırmak A, Timur S, Kartal B. Insomnia in pregnancy and factors related to insomnia. Thescientificworldjournal 2012;2012(2):197093.

[54] Wołyńczyk-Gmaj D, Różańska-Walędziak A, Ziemka S, Ufnal M, Brzezicka A, Gmaj B, et al. Insomnia in pregnancy is associated with depressive symptoms and eating at night. Journal of Clinical Sleep Medicine Jcsm Official Publication of the American Academy of Sleep Medicine 2017;13(10).

[55] Palagini L, Gemignani A, Banti S, Manconi M, Mauri M, Riemann D. Chronic sleep loss during pregnancy as a determinant of stress: impact on pregnancy outcome. Sleep Med 2014;15(8):853–9. https://doi.org/10.1016/j.sleep.2014.02.013.