

# Determinants of sleep quality among pregnant women in China: A cross-sectional survey

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## Abstract

**Background:** Sleep problems are common during pregnancy. Few studies are currently available regarding the determinants of sleep quality among pregnant women in China. The aim of the present study was to (a) calculate the prevalence of sleep disorder during pregnancy, (b) examine the difference in sleep quality among three trimesters, and (c) identify determinants of sleep quality in pregnant women.

**Methods:** This study was designed as a cross-sectional survey. 500 pregnant women were recruited at the outpatient department of obstetrics and gynecology of two teaching hospitals in central China. Five self-report questionnaires were used for gathering data, including information of sample characteristics, sleep quality (Pittsburgh Sleep Quality Index, PSQI), prenatal depression (the Edinburgh Postnatal Depression Scale, EPDS), perceived stress (Perceived Stress Scale, PSS) and perceived social support (Multidimensional Scale of Perceived Social Support, MSPSS).

**Results:** A total of 454 pregnant women participated in the study between December 2013 and July 2014. 87% pregnant women experience sleep disorder (PSQI score > 5). Poorer global sleep quality, subjective sleep quality, lower sleep efficiency and sleep disturbances were most prevalent during third trimester. The significant contributors of sleep quality for pregnant women were prenatal depression, age and gestational age.

**Conclusions:** Sleep disorder is a common problem for pregnant women in China. Depressive symptoms, increased age and gestational age are determinants of sleep quality. Health care professionals should identify determinants to conduct preventive intervention.

## Abbreviations

BMI: Body mass index; PSQI: The Pittsburgh sleep quality index; EPDS: The Edinburgh postnatal depression scale; PSS: Perceived stress scale; MSPSS: Multidimensional scale of perceived social support

## Introduction

Pregnancy is a process that creates significant anatomical, physiological, and biochemical changes in a woman's life. These changes affect the physical and emotional behaviors of women and may lead to sleep disturbances, even in women without prior sleep problems [1]. Moreover, sleep changes during pregnancy may not be returned to the same sleep quality before pregnancy for years [2]. The National Sleep Foundation [3] noted that 78% of pregnant women reported more sleep disturbances during pregnancy than at any other time in their lives. What's more, most pregnant women (84%) report sleep disturbances of some severity, and 30% report that they rarely or never get a good night's sleep during pregnancy [4]. A study based on Chinese population showed that 35.8% of pregnant women suffer from sleep disorders [5]. Consequently, poor sleep quality during pregnancy has become a frequent problem threatening pregnant women's health.

Assessment of sleep quality is clinically relevant in view of the previous findings that sleep quality may be associated with some factors, such as mood disorders (e.g., depression, stress) and gestational age [6,7]. Women's body changes dramatically in a relatively short time during pregnancy, both physiologically and psychologically, which results in a significant alternation of sleep pattern [6]. Women experienced sleep disturbances as early as during the first trimester of pregnancy [8]. As pregnancy proceeds, both the number and duration of sleep disorders

increase [6]. Sut *et al.* [9] and Facco *et al.* [10] indicated that the risk of poor sleep quality increased in the second and third trimester when compared with the first trimester. Depression symptom was previously indicated to be associated with sleep disturbances during pregnancy [11]. Prenatal depression as well as postpartum depression were strongly linked with sleep quality [12]. Consistent with this, depressive pregnant women reportedly have various types of insomnia symptoms and decreased sleep efficiency [13,14].

Sleep disorders may influence pregnancy outcomes and may manifest differently in different cultural and social societies [15]. However, few studies have investigated sleep quality during pregnancy in China. Thus, we conducted this cross-sectional survey to explore the sleep quality in China, with the purpose of (1) calculating the prevalence of sleep disorder during pregnancy, (2) examining the difference in sleep quality among three trimesters, and (3) identifying determinants of sleep quality in pregnant women.

## Materials and methods

### Design and sample

The cross-sectional survey was conducted at the outpatient

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department of obstetrics and gynecology of two teaching hospitals in central China between December 2013 and July 2014. 500 pregnant women meet following inclusion criteria were recruited in this study: (1) pregnant women aged 18 and above, (2) willing to participate in the study, (3) have basic ability of reading and understanding, and (4) mentally competent to give informed consent. Participants eligible for inclusion were provided with comprehensive information on reasons for the research, advantages, results, confidentiality, and methods of the research. Three well-trained research assistants obtained informed consent and collected self-report questionnaires from the participants.

## Instruments

Five forms were used as data collection instruments: (1) a Personal Information Form, to determine the participants' demographic, personal characteristics and Gestational age etc. (2) the Pittsburgh Sleep Quality Index (PSQI), (3) the Edinburgh Postnatal Depression Scale (EPDS), (4) the Perceived Stress Scale (PSS), and (5) the Multidimensional Scale of Perceived Social Support (MSPSS).

PSQI is self-report measure that assesses sleep quality and disturbances over a 1-month interval, which was developed by Buysse *et al.* [16]. It includes 19 items, generating 7 component scores: subjective sleep quality, sleep latency, sleep duration, habitual sleep efficiency, sleep disturbances, use of sleeping medication, and daytime dysfunction. A global score is obtained by summing the 7 component scores and has a possible range of 0–21 points. Higher scores indicate poorer sleep quality. A global score higher than 5 is assessed as poor sleep quality or sleep disorder. This cutoff point has good psychometric properties with a diagnostic sensitivity of 89.6% and specificity of 86.5% in differentiating good and poor sleepers [16]. The validity and reliability of the Chinese version of the PSQI were reported by Liu *et al.* [17] in 1996 (Cronbach's  $\alpha=0.8420$ ).

EPDS is a self-report questionnaire of postnatal depression, developed by Cox *et al.* [18]. Cox *et al.* also evidenced it suitable for the screening of prenatal depression in 2003 [19]. EPDS contains ten multiple-choice questions, with four possible answers for each question and 0–3 points for each answer. The total score ranges from 0 to 30 with higher scores indicating more severe depressive symptoms [18]. EPDS was translated into Chinese version by Pen *et al.* [20]. The Chinese version of EPDS was applied to assess prenatal depression in Chinese mainland population (Cronbach's  $\alpha=0.79$ ), with the sensitivity and specificity of 80.00% and 83.03%, respectively [21]. The recommended cut-off score of EPDS for Chinese mainland population is 9.5, a total score of 9.5 or greater indicates prenatal depression.

PSS designed by Cohen *et al.* [22] was utilized to measure the degree to which situations in one's life are appraised as stressful. PSS is a validated instrument consisting of 10 multiple choice questions individually scored 0 to 4 (with requisite reverse scoring for 4 items) [22]. The reliability and validity of Chinese version of 10-item PSS were evaluated among Chinese population, with a Cronbach's  $\alpha$  of 0.83 [23].

MSPSS is a 12-item self-report instrument that assesses the adequacy of one's perceived social support from family, friends and significant others [24]. MSPSS consists of three subscales (family's support, friends' support and significant others' support) and 12 items. Item scores range from 1 to 7, with responses averaged to create total and sub-scale scores. In all cases, higher scores indicate greater perceived social support [25].

## Statistical analysis

Statistical analysis was performed by the Statistical Package for Social Sciences (SPSS) version 21.0 in this study. Descriptive statistics including means, frequency, and standard deviations etc. were calculated for all the variables. One-way ANOVA was operated to reveal the difference of sleep quality among three trimesters. A Pearson's correlation matrix was computed to examine the bivariate correlations between sleep quality and each potential predictor variable. Multivariable stepwise linear regression was applied to confirm the determinants of sleep quality. In all analyses, a *P*-value of  $\leq 0.05$  was considered significant.

## Results

### General characteristics

Among the 500 pregnant women admitted during the study period, 454 (90.8%) between 19 and 40 years old (mean 28.5) finished our survey. Of the 454 participants, 22 (4.8%) were in first trimester, 246 (54.2%) in second trimester, and 186 (41.0%) in third trimester. The demographic characteristics are summarized in Table 1.

The mean EPDS (depression) score was  $8.49 \pm 4.44$  (range 0–24), of which 181 pregnant women (39.9%) were identified as prenatal depression (EPDS score  $\geq 9.5$ ). Besides, the score of PSS (stress) and MSPSS (social support) were  $13.23 \pm 6.05$ , and  $64.30 \pm 11.19$ , respectively.

### Sleep quality

PSQI score and the results of one-way ANOVA are listed in Table 2. The global PSQI score in our sample was  $7.68 \pm 1.96$  (range 4–15), with 395 pregnant women (87.0%) classified as sleep disorder (global PSQI score  $> 5$ ). The number of poor sleeper in first, second, and third trimester were 18 (81.8%), 215 (87.4%), and 162 (87.1%), respectively. Significant differences of global PSQI score and three component scale (subjective sleep quality, habitual sleep efficiency, and sleep

**Table 1.** Demographic characteristics of pregnant women (N=454).

Variable	N (%)
<b>BMI</b>	
Underweight (BMI<19)	14 (3.1)
Normal weight (19≤BMI≤25)	247 (54.4)
Overweight (25<BMI≤30)	158 (34.8)
Obesity (BMI>30)	35 (7.7)
<b>Marital status</b>	
Married	450 (99.1)
Single	4 (0.9)
<b>Working status</b>	
Employed	163 (35.9)
Unemployed	291 (64.1)
<b>Educational level</b>	
Low educational level (below bachelor's degree)	271 (59.7)
High educational level (bachelor's degree or higher)	183 (40.3)
<b>Levels of income (yuan per month)</b>	
≤2000	66 (14.5)
2000–4000	187 (41.2)
4000–6000	96 (21.2)
≥6000	105 (23.1)
<b>Gestational age</b>	
First trimester	22 (4.8)
Second trimester	246 (54.2)
Third trimester	186 (41.0)

**Table 2.** PSQI score and the differences among three trimesters.

Components			Gestational age		<i>F</i>	<i>P</i>
	Mean score (n=454)	First trimester (n=22)	Second trimester (n=246)	Third trimester (n=186)		
Global score	7.68 ± 1.96	7.18 ± 1.97	7.51 ± 1.83	7.96 ± 2.10	3.58	0.03
Component score						
Subjective sleep quality	1.14 ± 0.59	1.00 ± 0.53	1.08 ± 0.56	1.23 ± 0.63	3.80	0.02
Sleep latency	1.29 ± 0.85	1.18 ± 0.96	1.28 ± 0.81	1.32 ± 0.89	0.29	0.75
Sleep duration	0.10 ± 0.08	0.14 ± 0.35	0.07 ± 0.31	0.15 ± 0.52	1.90	0.15
Habitual sleep efficiency	0.96 ± 0.49	0.75 ± 0.67	0.78 ± 0.54	0.86 ± 0.79	9.10	0.00
Sleep disturbances	1.50 ± 0.56	1.23 ± 0.43	1.44 ± 0.54	1.61 ± 0.58	8.13	0.00
Use of sleeping medication	0.05 ± 0.03	0.00 ± 0.00	0.06 ± 0.35	0.04 ± 0.33	0.42	0.66
Daytime dysfunction	0.60 ± 0.58	0.64 ± 0.66	0.58 ± 0.59	0.62 ± 0.55	0.26	0.77

**Table 3.** Correlation coefficients between sleep quality and other variables.

Variable	<i>r</i>	<i>P</i>
Age	0.12	≤0.01
BMI	0.04	
Gestational age	0.15	≤0.01
EPDS score	0.43	≤0.01
PSS score	0.32	≤0.01
MSPSS score	-0.17	

**Table 4.** Results of multiple linear regression model predicting sleep quality.

Predictors	Beta	SE Beta	<i>t</i>	<i>P</i>
Age	0.09	0.16	3.79	<0.001
Gestational age	0.04	0.14	3.46	<0.001
EPDS score	0.19	0.44	10.57	<0.001

disturbances) scores were found among three trimesters ( $P < 0.05$ ).

When compared with second trimester, pregnant women in third trimester experienced higher score of global PSQI, subjective sleep quality, habitual sleep efficiency, and sleep disturbances ( $P < 0.05$ ). When compared with first trimester, pregnant women in third trimester experienced higher score of habitual sleep efficiency and sleep disturbances ( $P < 0.05$ ).

### Bivariate associations

Pearson coefficients were computed to identify correlates of sleep quality in pregnant women. As shown in Table 3, age, gestational age, EPDS score, and PSS score were positively correlated with poorer sleep quality.

### Multivariable linear regression

The results of the standard multivariable linear regression model in which all the variables were entered simultaneously are presented in Table 4 ( $F = 44.149$ ,  $R^2 = 0.23$ ,  $P < 0.001$ ). Age, gestational age, and prenatal depression were significant determinants of sleep quality ( $P < 0.001$ ), which predicted 22.7% of the variance in sleep quality.

### Discussion

Women experience significant sleep problems during pregnancy [6], and poor sleep quality in pregnancy has been associated with preterm birth [26]. Sleep disturbances seen in pregnancy may be linked to adverse outcomes, such as gestational hypertension and cesarean birth [27]. Furthermore, Zafarghandi *et al.* [28] reported that the quality and duration of sleep can affect birth type, labor length, birth weight, and Apgar score. The prevalence of sleep disorder in the present study was 87.0%, in which the proportion was reported by

81.80%, 87.40% and 87.10% during the three trimesters, respectively. Our survey declared a higher prevalence of sleep disorder than those of Mindell *et al.* [6] (76%), Xie *et al.* [29] (64%) and Van Ravesteyn *et al.* [30] (39%). These findings indicate that at least one-third of pregnant women experience poor sleep quality during any part of pregnancy.

We found support from correlation analysis and multiple regression model in understanding sleep quality of pregnant women. The important determinants of sleep quality were age, gestational age, and prenatal depression.

Maternal age was identified as a determinant of sleep disorder in our study, suggesting that general sleep quality declines as age grows among pregnant women. Hung *et al.* [7] and Zhang *et al.* [5] have reported the similar result. As a potential high-risk factor, women with advanced maternal age were more likely affected by physiological and psychological factors [31], thus leading to the deterioration of sleep quality [32].

Significant association between gestational age and sleep quality was discovered, showing that general sleep quality declines as pregnancy proceeds. When compared with the first and second trimester, significant deteriorations in sleep quality in the third trimester were observed. Poorer global sleep quality, subjective sleep quality, lower sleep efficiency and sleep disturbances were most prevalent during third trimester. These findings were supported by several studies [9,10], including a report of Chinese pregnant women population [33]. The sleep patterns of most pregnant women changed during pregnancy, which might be the reason [6]. However, future researches are still needed to clear the in-depth connections in regarding to sleep quality among three trimesters.

A relationship between prenatal depression and sleep quality in pregnant women has previously been demonstrated, showing that higher levels of prenatal depression predicted poorer sleep quality, as depression is one of the main psychological factors contributing to sleep complaints [7,14,34,35]. The association between poor sleep quality and depressed mood has also been shown in epidemiologic studies of sleep in the general population [36], and with postpartum women [37,38]. Longitudinal data also suggested that increasing of depressive symptoms worsens sleep quality [39]. Furthermore, epidemiologic and electroencephalographic sleep studies have shown a role for sleep disturbances in the pathogenesis of depression [40-42], which reminded that prenatal depressive mood may be important area to target in interventions aimed at promoting sleep in pregnant women.

Bivariate analyses indicated a significant relationship between age, gestational age, prenatal depression, perceived stress and sleep quality.

However, perceived stress did not remain significant in the multiple regression models, suggesting that the relationship between sleep quality and perceived stress may be weak or nonlinear. Alternatively, perceived stress may indirectly influence sleep quality.

## Conclusions

Sleep disorder is a common problem for pregnant women in China, with a prevalence of 87.0%. Furthermore, depressive symptoms, increased age and gestational age are detected to be determinants of sleep quality in pregnant women. Therefore, we recommend that healthcare professionals pay more attention to sleep problems and provide sleep counseling during prenatal checkups, particularly for pregnant women with depressive tendencies and advanced maternal age. Since prenatal depression, increased age and gestational age are determinants of sleep quality in pregnant women, further research should incorporate these variables into a supportive model of sleep-related prenatal care.

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## Authorship

Ying Yang completed the work of writing the manuscript as well as data analysis. Jie Li was responsible for study design and final edit of the manuscript. Jing Mao, Zhiying Ye, Huimin Zhao and Yueting Liu conducted the data collection.

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## Competing interest

The authors declare that there is no conflict of interest.

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