Original Article
Prevalence of depression, anxiety, sleep disorders and influencing factors among pregnant women in the second trimester in urban areas of Guangzhou city, Guangdong province, China: a cross-sectional study

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Abstract: Objective: To investigate the prevalence of anxiety, depression symptoms and sleep disorders among pregnant women and evaluate its influencing factors in the second trimester. To evaluate associations among anxiety, depression and sleep disorders. Methods: A total of 553 pregnant women were selected from the First Affiliated Hospital of Jinan University and the questionnaire survey were conducted. The quality of sleep, anxiety and depression in pregnant women assessed using Pittsbrugh Sleep Quality Index Questionnaire (PSQI), Generalized Anxiety Disorder-7 (GAD-7) and Patient Health Questionnaire-9 (PHQ-9) assessment scales. Exploratory and confirmatory factor analysis, correlations and logistic regression were used. Results: Among the 553 pregnant women, 68.9% (381) of them were classified as good sleepers, 31.1% (172) were classified as poor sleepers. The prevalence of depression symptoms among pregnant women in the second trimester was 9.0%, and the prevalence of anxiety symptoms was 7.2%. There was a positively correlated between the total scores of PSQI with GAD-7 and PHQ-9 (r = 0.514 and r = 0.356, P<0.001). Minority ethnicity (OR = 4.049, 95% CI: 1.586-10.338), negative events (OR = 2.489, 95% CI: 1.048-5.913), history of abortions (OR = 1.687, 95% CI: 1.117-2.549), intimate partner smoking (OR = 1.510, 95% CI: 1.012, 2.251) were risk factors of sleep quality. There was a positively correlated between the total scores of GAD-7 with PHQ-9 (r = 0.656, P<0.001). Took medicine during pregnancy (OR = 3.587, 95% CI: 1.377-9.347) and poor sleep quality (OR = 8.977, 95% CI: 3.744-21.048) were risk factors of depression. Intimate partner drinking (OR = 2.860, 95% CI = 1.136-7.202) was risk factor of anxiety. Conclusions: The prevalence of depression and anxiety symptoms are lower than developing countries. Sleep quality is closely correlated to anxiety and depression in pregnant women, early screening for mental disorders, promotion of healthy lifestyles and improve partner support, relieve symptoms of depression and anxiety may help improve sleep quality among pregnant women.

Keywords: Pregnant women, second trimester, PSQI, GAD-7, PHQ-9, factor analysis

Introduction

Pregnancy is an important stage in a woman's life. In the process of gestating a new life, it will not only have physical changes, but also bring a series of psychological reactions and changes [1], such as anxiety, depression, sleep disorders. Sleep quality starts to decline in the first trimester. The frequent occurrence of the symptoms of anxiety and depression is linked to sociodemographic factors, family background, economic status, personality characteristics, psychosocial factors and pregnancy characteristics [2, 3]. Both anxiety and depression are independent and interrelated risk factors for adverse outcomes, but the mechanisms for the association between anxiety, depression and adverse outcomes in pregnancy are yet to be clarified. Anxiety and depression are important factors affecting sleep duration and efficiency [4, 5], and gestational insomnia can also increase the risk of post-partum depression (PPD) [6]. Post-partum depression (PPD) and impairment of the mother-infant relationship may also be considered as secondary effects deriving from poor sleep during pregnancy [7].

Anxiety is a kind of uneasiness or fear lacking of obvious objective reasons, which not only affects the mental health of pregnant women,

but also has indirect effects on the mothers' body and the fetus. Depression is a type of emotional disorder characterized by low mood, disappointment, sadness, crying, decreased activity ability, delayed thinking and cognitive abilities or loss of interest or pleasure. Perinatal depression is one of the common complications of pregnancy. Anxiety and depression during pregnancy can increase the risks of hypertension, premature birth, low birth weight infants, and miscarriage [8, 9]. Studies [10-15] have shown that the incidence of anxiety during pregnancy is 10-29.1%, and the incidence of depression is 11-27%. Almost two-thirds had comorbid anxiety disorders [14] and they are more likely to suffer severe symptoms of anxiety and depression than that isolated anxiety or depression [3].

Physiological, psychological and hormonal alterations will affect sleep during pregnancy. Sleep disorders are highly prevalent among pregnant women, the reasons including lower back pain, gastroesophageal reflux disorder (GERD), increased micturition and repositioning difficulties at night [7]. A study found that nearly 27.9% of pregnant women sleep less than 7 hours a night in the second trimester [16]. Poor sleep quality has become an important risk factor for maternal health and adverse pregnancy outcomes. Sleep disorders during pregnancy can not only lead to increased blood pressure and BMI but also increase the risk of gestational diabetes mellitus [17, 18], gestational hypertension, cesarean section, emergency cesarean section, premature delivery, prolonged labor time and stillbirth [19, 20].

Domestic and foreign studies have shown that if women are often in a state of anxiety and depression during in pregnancy and childbirth [6, 9], this kind of bad mood will have a negative impact on immunity, leading to a decline in resistance and prone to infectious diseases [20]. Two-thirds of patients with depression have had suicidal thoughts and behaviors, and 15%-25% of patients with depression eventually died by suicide [14]. A British study pointed out that suicide has become an important cause of maternal death in the UK. Excessive anxiety and depression during pregnancy can cause vasospasm and reduce renal blood flow [8, 21], thereby affecting maternal endocrine and fetal blood circulation. It is confirmed that bad mood can cause the occurrence of hexadechenic acid derivatives in blood, thus affecting fetal development [22]. Interpersonal tension during the perinatal is closely related to children's congenital malformations, convulsions, weight loss, delayed development of walking or speech skills, and hyperactivity [23]. It shows that the fetus can be stimulated by the outside world and affected by the mother's psychological activities. Common clinical manifestations of harm to children include: mother-infant connection disorder, organic damage, psychological disorder, and adolescent violence.

The whole process of pregnancy is 40 weeks, a total of 280 days, from the beginning of amenorrhea to the 12th weekend is the first trimester, the 13-27 weekend is the second trimester, and the 28-40 weekend is the late pregnancy. Women will go through three psychological processes: intolerance period, adaptation period, and excessive load period. Around the world, studies on sleep quality, anxiety and depression in different stages of pregnancy have become more specific and quantitative, and individual observations and interventions in different stages of pregnancy has become a research hotpot. In this study, the sleep quality, anxiety and depression symptoms of the selected pregnant women (13-28 weeks of pregnancy) were investigated to understand the relationship between sleep quality and anxiety and depression symptoms in the second trimester, and to provide a theoretical basis for improving the physical and mental health of pregnant women.

Methods and methods

Design and participants

Chart 1 is our study flowchart, and it shows every step pf our study. Cluster sampling method was adopted to select pregnant women who received antenatal examination in the First Affiliated Hospital of Jinan University from June 2020 to October 2020 as the investigation objects. In the end, 571 questionnaires were distributed, 553 were valid. Before sending the questionnaire, explain to the respondents the purpose of the survey, the methods and requirements, instruct pregnant women to fill out the questionnaire in person. All the selected subjects voluntarily participated in this survey with
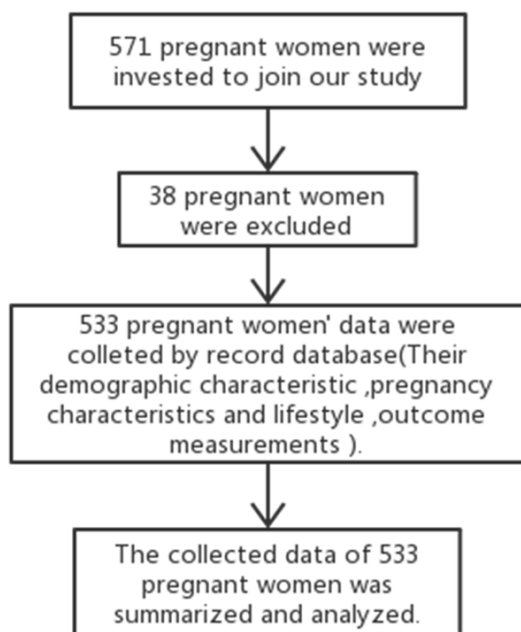
Chart 1. Study flow.

informed consent. The pregnant women in the second trimester were the research objects, the inclusion criteria were as follows: ① All are elementary school or above; ② No cognitive dysfunction, communication disorder, or reading disorder. Exclusion criteria; ① Patients with severe physical disorders and neuropsychiatric diseases; ② Twin or multiple pregnancies; ③ Test results show that the fetus has obvious malformations in the abdomen; ④ With pregnancy complications and complication.

Measurement

Pittsburgh Sleep Quality Index (PSQI): The Pittsburgh Sleep Quality Index (PSQI) was used to evaluate sleep quality over the past month in clinical populations. This questionnaire was compiled by sleep experts from the Department of Psychiatry and Biorhythm Research Center, University of Pittsburgh Medical Center, USA. It is simple and reliable with high validity, it has become a commonly used scale for sleep disorder research and clinical evaluation. The PSQI is a 19-item, the 19 items are grouped into 7 components, including (1) overall sleep quality, (2) sleep duration, (3) sleep efficiency, (4) sleep latency, (5) sleep disturbance, (6) sleep medication use, (7) daytime dysfunction due to sleepiness. Each component yields a score ranging from 0-3 (with 0 indicating the best

function, 1 indicating the better, 2 indicating the poor, and 3 indicating the greatest dysfunction). Sleep component scores were summed to yield a total score ranging from 0 to 21 with the higher total score indicating worse quality. In this study, the total scores ≥7, indicating sleep disorders, and the Chinese version of the PSQI questionnaire has been widely accepted as a sleep quality assessment method in mainland China with good reliability and validity [15].

Patient health questionnaire-9 (PHQ-9): The PHQ-9 is a 9-item questionnaire, diagnostic and severity measure for current depression using criteria from the DSM-IV. The 9 items include: (1) anhedonia, (2) depression mood, (3) insomnia or hyersomnia, (4) fatigue or loss of energy, (5) appetite disturbance, (6) guilt or worthlessness, (7) diminished ability to think or concentrate, (8) psychomotor agitation or tetardation, (9) suicidal thoughts. The PHQ-9 asks how often people have suffered from the nine core symptoms of PHQ within the last two weeks with the response options being 'not at all', 'on some days', 'on more than half of the days' and 'almost every day' (scored 0-3, with a total score ranging from 0 to 27), total scores of 5-9, 10-14, 15-19, and 20-27 corresponded to mild, moderate, moderately severe, and severe depression symptoms, respectively. The PHQ-9 was shown to work well in pregnant women with good reliability and construct. Studies have shown that using a cut-of score of 10 is a good way to distinguish depression and non-depressions [24]. In this study, the total scores ≥10, indicating depressive symptoms.

Generalized anxiety disorder-7 (GAD-7): The GAD-7 is a 7-item questionnaire describe the most important diagnostic criteria for GAD according to DSM-IV (Diagnostic and Statistical Manual of Mental Disorders, American Psychiatric Association, forth edition). The GAD-7 items include: (1) nervousness, (2) inability to stop worrying, (3) excessive worried, (4) restlessness, (5) difficulty in relaxing, (6) easy irritation, (7) fear of something awful happening. The GAD-7 asks how often people have suffered from the seven core symptoms of generalised anxiety disorder (GAD) within the last two weeks with the response options being 'not at all', 'on some days', 'on more than half of the days' and 'almost every day' (scored 0-3, with a total score ranging from 0 to 21), total scores of 5-9,

Table 1. Demographic information of pregnant women and distribution of depression and anxiety symptoms and sleep disorders (n = 553)

Characteristic		Total	Depression (PHQ-9≥10)	P value	Anxiety (GAD-7≥7)	P value	Sleep disorders (PSQI≥7)	P value
		n (%)	n (%)		n (%)		n (%)	
n		553 (100.0)	50 (9.0)		40 (7.2)		172 (31.1)	
Age	<30	301 (54.4)	31 (10.3)	0.490	28 (9.3)	0.122	92 (30.6)	0.437
	30-34	168 (30.4)	14 (8.3)		8 (4.8)		49 (29.2)	
	≥35	84 (15.2)	5 (6.0)		4 (4.8)		31 (36.9)	
Education level	High school or below	110 (19.9)	10 (9.1)	0.989	10 (9.1)	0.655	42 (38.2)	0.199
	College	373 (67.5)	34 (9.1)		26 (7.0)		109 (29.2)	
	Graduate or above	70 (12.7)	6 (8.6)		4 (5.7)		21 (30.0)	
Ethnicity	Han ethnicity	531 (96.0)	47 (8.9)	0.443	39 (7.3)	0.939	158 (29.8)	0.001
	Minority	22 (4.0)	3 (13.6)		1 (4.5)		14 (63.6)	
Occupation	Employed	396 (71.6)	37 (9.3)	0.906	28 (7.1)	0.768	114 (28.8)	0.119
	Self-employed	80 (14.5)	7 (8.7)		5 (6.3)		27 (33.8)	
	Unemployed	77 (13.9)	6 (7.8)		7 (9.1)		31 (40.3)	
Per-capita monthly income,¥	<4500	79 (14.3)	6 (7.6)	0.628	6 (7.6)	0.893	22 (27.8)	0.500
	≥4500	474 (85.7)	44 (9.3)		34 (7.2)		150 (31.6)	
Marital status	Married	536 (96.4)	49 (9.1)	0.975	38 (7.1)	0.596	163 (30.4)	0.048
	Unmarried	17 (3.1)	1 (5.9)		2 (11.8)		9 (52.9)	
Type of residents	Guangdong	460 (83.2)	42 (9.1)	0.871	32 (7.0)	0.576	146 (31.7)	0.472
	Others	93 (16.8)	8 (8.6)		8 (8.6)		26 (28.0)	
Household registration	Urban	519 (93.9)	45 (8.7)	0.235	36 (6.9)	0.477	161 (31.0)	0.871
	Rural	34 (6.1)	5 (14.7)		4 (11.8)		11 (32.4)	
Medical expenses	Medical insurance	440 (79.6)	38 (8.6)	0.512	28 (6.4)	0.119	133 (30.2)	0.380
Payment methods	Out-of-pocket	113 (20.4)	12 (10.6)		12 (10.4)		39 (34.5)	
Negative events	No	527 (95.3)	46 (8.7)	0.421	36 (6.8)	0.209	158 (30.0)	0.010
(nearly three months)	Yes	26 (4.7)	4 (15.4)		4 (15.4)		14 (53.8)	

10-14, and 15-21 corresponded to mild, moderate, and severe anxiety symptoms, respectively. Studies have shown that using a cut-of score of 7 is a good way to distinguish anxiety and non-anxiety [15]. In this study, the total scores ≥7, indicating anxiety symptoms.

Data analysis

SPSS 23 was used to collate and analyse the data. Categorical data are presented as frequency and percentage, and differences in proportions were examined using the Chi-square test. Binary regression logistic regression models to calculate odds ratios (OR) and 95% confidence intervals (CI). Cronbach's alpha values were calculated to test the internal reliability of PSQI questionnaire. *P* value <0.05 was considered statistically significant.

Results

Characteristics of participants

All pregnant women were aged 21-42 years (mean = 29.66±4.22), and 15.2% of the preg-nant women ≥35 years old. Most of the pregnant women had college and above as their highest education (81.1%). Most of them were ethnic Han (96.0%). Most of the pregnant women were local residents (83.2%). Most of the were working (71.6%). The per-capita monthly income was above ¥4500 for 85.7% of household. Most were in the state of marriage (96.9%). The majority of pregnant women (79.6%) covered by medical insurance. A total of 44.5% were pregnant for the first time, 59.5% was primiparous, 31.1% had abortion history. Pre-pregnancy body mass index (BMI) was normal for 68.4%, 11.4% were overweight or obesity. 40% of their husbands were smokers and 42.7% were alcoholism. More than half (66.0%) were in a planned pregnant. Most of the pregnant women received regular prenatal examinations (80.1%). 16.3% of pregnant women had taken medicines due to illness before pregnancy, and 10.3% of pregnant women had taken medicines due to illness during pregnancy. A total of 18.8% were diagnosed with threatened abortion during pregnancy. The results are shown in **Tables 1** and **2**.

Table 2. Pregnancy characteristics of pregnant women and distribution of depression and anxiety symptoms and sleep disorders (n = 553)

Characteristic		Total	Depression (PHQ-9≥10)	P value	Anxiety (GAD-7≥7)	P value	Sleep disorders (PSQI≥7)	P value
		n (%)	n (%)		n (%)		n (%)	
n		553 (100.0)	50 (9.0)		40 (7.2%)		172 (31.1)	
Parity	0	246 (44.5)	23 (9.3)	0.832	17 (6.9)	0.683	69 (28.0)	0.094
	1	189 (34.2)	18 (9.5)		16 (8.5)		70 (37.0)	
	≥2	118 (21.3)	9 (7.6)		7 (5.9)		33 (28.0)	
Primiparous	Yes	329 (59.5)	28 (8.5)	0.598	23 (7.0)	0.790	106 (32.2)	0.492
	No	224 (40.5)	22 (9.8)		17 (7.6)		66 (29.5)	
Method of pregnancy	Spontaneous pregnancy	528 (95.5)	50 (9.5)	0.209	39 (7.4)	0.808	163 (30.9)	0.588
	Artificial pregnancy	25 (4.5)	0 (0)		1 (4.0)		9 (36.0)	
Abortions	0	381 (68.9)	37 (9.7)	0.414	27 (7.1)	0.843	105 (27.6)	0.007
	≥1	172 (31.1)	13 (7.6)		13 (7.6)		67 (39.0)	
Prepregnancy BMI (kg/m²)	<18.5 (Thin)	112 (20.2)	7 (6.3)	0.307	6 (5.4)	0.625	30 (26.8)	0.132
	18.5~23.99 (Normal)	378 (68.4)	39 (10.3)		30 (7.9)		116 (30.7)	
	≥24 (Overweight/obesity)	63 (11.4)	4 (6.3)		4 (6.3)		26 (41.3)	
Intimate partner drinking	Yes	317 (57.3)	27 (8.5)	0.618	15 (4.7)	0.008	92 (29.0)	0.221
	No	236 (42.7)	23 (9.7)		25 (10.6)		80 (33.9)	
Intimate partner smoking	Yes	332 (60.0)	30 (9.0)	0.996	18 (5.4)	0.044	92 (27.7)	0.035
	No	221 (40.0)	20 (9.0)		22 (10.0)		80 (36.2)	
Pregnancy was planned	Yes	365 (66.0)	27 (7.4)	0.060	20 (5.5)	0.027	110 (30.1)	0.494
	No	188 (34.0)	23 (12.2)		20 (10.6)		62 (33.0)	
Took medicine before pregnancy	Yes	90 (16.3)	12 (13.3)	0.121	12 (13.3)	0.015	32 (35.6)	0.319
	No	463 (83.7)	38 (8.2)		28 (6.0)		140 (30.2)	
Took medicine during pregnancy	Yes	57 (10.3)	12 (21.1)	0.001	8 (14.0)	0.036	20 (35.1)	0.493
	No	496 (89.7)	38 (7.7)		32 (6.5)		152 (30.6)	
Regular antenatal examination	Yes	443 (80.1)	39 (8.8)	0.695	34 (7.7)	0.421	134 (30.2)	0.384
	No	110 (19.9)	11 (10.0)		6 (5.5)		38 (34.5)	
Threatened abortion during pregnancy	Yes	104 (18.8)	14 (13.5)	0.081	13 (12.5)	0.021	38 (36.5)	0.184
	No	449 (81.2)	36 (8.0)		27 (6.0)		134 (29.8)	
Pittsburgh Sleep Quality Index, mean ± SD		5.7±2.3	6.8±4.0	<0.001	3.5±3.2	<0.001	8.4±1.9	<0.001
Patient Health Questionnaire 9-item, mean ± SD		4.3±3.6	12.6±2.3	<0.001	6.7±4.3	<0.001	8.4±3.1	<0.001
Generalized Anxiety Disorder 7-item, mean ± SD		2.2±2.7	11.6±3.7	0.035	9.3±2.6	<0.001	7.0±2.9	0.022

Table 3. Factors associated with depression symptoms in second trimester

Variables	β	Wald	*P* value	OR (95% CI)
Took medicine during pregnancy				
No				Reference
Yes	1.277	6.834	0.009	3.587 (1.377-9.347)
Sleep disorders				
No				Reference
Yes	2.183	24.573	0.001	8.977 (3.744-21.048)
Anxiety symptoms				
No				Reference
Yes	3.930	69.733	0.001	50.910 (20.240-128.058)

Influence factors of depression and anxiety symptoms in the second trimeter

The prevalence of depression symptom among 553 pregnant women in the second trimester was 9.0%. Risk factors: poor sleep quality (OR = 8.977, 95% CI: 3.744-21.048), existence of anxiety symptoms (OR = 50.910, 95% CI: 20.240-128.058), took medicine during pregnancy (OR = 3.587, 95% CI: 1.377-9.347). Pregnant women who took medication during this pregnancy have more worry and excessive tension than those who didn't take medication. When pregnant women took medicine for various reasons during pregnancy, pregnant women will become anxious about the side effects of the drugs and the adverse effects on the fetus [25] (**Table 3**).

The prevalence of anxiety symptom among 553 pregnant women in the second trimester was 7.2%. The husband's bad habits of smoking and drinking will increase the risk of anxiety for pregnant women, low partner support was also related to anxiety [26]. Partner support may be an important and potentially modifiable target for interventions to improve pregnancy outcomes [27]. Planned pregnancy was a protective factor of anxiety symptoms, after pregnancy, they gladly accepted the fact of being a mother-to-be, they were more likely had more knowledge and skills about pregnancy and childbirth. Our study included a total of 553 pregnant women, 104 pregnant women who were definitely diagnosed as threatened abortion by a doctor, they were more likely have anxiety symptoms (**Table 4**), women who had previous adverse antenatal record have poor quality of life, and higher degree of anxiety,

depression and stress in subsequent pregnancy [28, 29].

*Influence factors of sleep disorders in the second trimeter*

Figure 1 shows the distribution of the PSQI score. Among the 553 pregnant women, the global PSQI score ranged from 1 to 17, the average score was 5.72±2.31, and the median score was 5. An overall Gronbach's alpha was 0.60. The correlations between the seven component scores of the global score ranged from 0.053 to 0.489 (**Table 6**). Among the 553 pregnant women only 8 women (1.4%) took medicine to help sleep over the past month.

A total of 68.9% (381) of pregnant women had good sleep quality in the second trimester, and 31.1% (172) was poor. Compared with good sleepers, poor sleepers were more likely to be minority ethnicity and experience intimate partner smoking, poor sleepers were more likely has experienced negative events (over the last three months) and abortions history. The details are shown in **Table 5**. Compared with good sleepers, poor sleepers had significantly higher mean total scores on PHQ-9 and GAD-7 (these results were statistically significant P<0.001), are presented in **Table 2**. In this study, while sleep disorders was not associated with prepregnant BMI, but other studies have shown that women who were obese (BMI≥35) at screening had and a long sleep latency, low sleep efficiency, high sleep fragmentation, obese women had a median sleep duration that was 36 minutes less than the lowest BMI group [16]. Psychosocial factors such as socioeconomic status, social support and life events

Table 4. Factors associated with anxiety symptoms in second trimester

Variables	β	Wald	P value	OR (95% CI)
Intimate partner drinking				
No				Reference
Yes	1.051	0.471	0.026	2.860 (1.136-7.202)
Intimate partner smoking				
No				Reference
Yes	0.895	0.471	0.057	2.448 (0.972-6.161)
Pregnancy was planned				
Yes				Reference
No	0.247	0.453	0.586	1.280 (0.527-3.111)
Took medicine before pregnancy				
No				Reference
Yes	0.433	0.574	0.450	1.542 (0.500-4.754)
Took medicine during pregnancy				
No				Reference
Yes	-0.048	0.631	0.940	0.953 (0.277-3.286)
Threatened abortion during pregnancy				
No				Reference
Yes	0.641	0.513	0.211	1.899 (0.695-5.187)
Sleep disorders				
No				Reference
Yes	0.158	0.500	0.752	1.171 (0.440-3.120)
Depression symptoms				
No				Reference
Yes	4.246	0.539	0.001	69.853 (24.303-200.773)
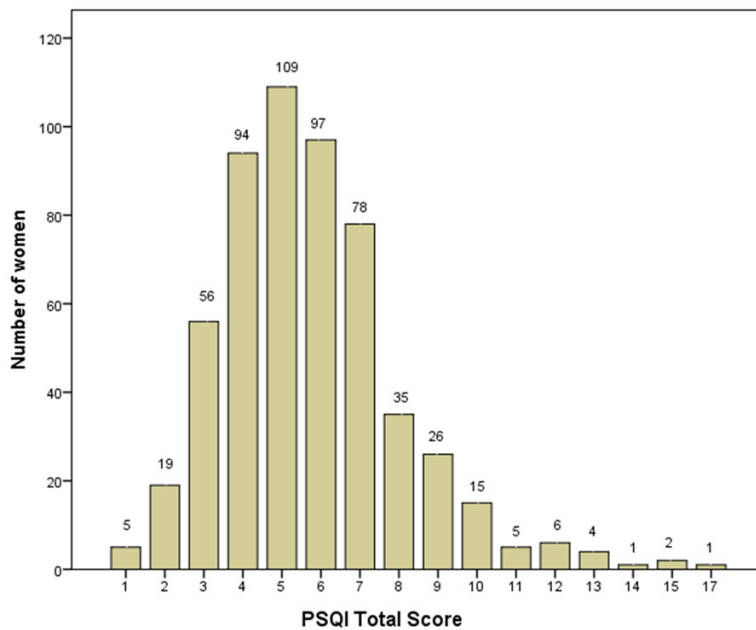
Figure 1. Distribution of the global score of the Pittsburgh Sleep Quality Index among pregnant women (n = 553).

were associated with sleep quality during pregnancy [15].

The correlation between sleep quality and GAD-7 and PHQ-9 in pregnant women

We next completed multivariable logistic regression analyses to assess associations of poor sleep quality (PSQI score >7) with depression (PHQ-9<10) and anxiety (GAD-7≥7). After adjusting for possible confounding by maternal ethnicity, marital status and has experienced negative events over the last three months, we found that poor sleepers was associated with a 10.161-fold increased odds (95% CI: 5.013-20.595) of depression, and a 5.338-fold

Table 5. Factors associated with sleep disorders in second trimester

Variables	β	Wald	P value	OR (95% CI)
Ethnicity				
Han ethnicity				Reference
Minority	1.399	8.552	0.003	4.049 (1.586-10.338)
Marital status				
Married				Reference
Unmarried	0.882	2.746	0.097	2.417 (0.851-6.863)
Negative events				
No				Reference
Yes	0.912	4.268	0.039	2.489 (1.048-5.913)
Abortions				
No				Reference
Yes	0.523	6.167	0.013	1.687 (1.117-2.549)
Intimate partner smoking				
No				Reference
Yes	0.412	4.083	0.043	1.510 (1.012-2.251)
Depression symptoms				
No				Reference
Yes	2.285	26.967	0.001	9.830 (4.149-23.291)
Anxiety symptoms				
No				Reference
Yes	0.216	0.199	0.655	1.241 (0.481-3.199)

Table 6. Item components, corrected item-total correlation, Cronbach's alpha if item deleted from PSQI

Components	Mean	SD	Corrected item-total correlation	Cronbach's alpha if item deleted
Overall sleep quality	1.13	0.513	0.489	0.510
Sleep duration	0.13	0.408	0.380	0.553
Sleep efficiency	0.27	0.599	0.452	0.512
Sleep latency	1.37	0.875	0.325	0.574
Sleep disturbance	1.33	0.542	0.376	0.543
Sleep medication use	0.03	0.250	0.053	0.617
Daytime dysfunction due to sleepiness	1.46	0.805	0.232	0.608
Global PSQI score	5.72	2.312		

increased odds (95% CI: 2.654-10.739) of anxiety. Furthermore, after adjusting for possible confounding by history of abortions and experience partner smoking, as compared with good sleepers, we noted that poor sleepers and a 10.995-fold increased odds (95% CI: 5.372-22.502) of depression (PHQ-9<10), and a 5.179-fold increased odds (95% CI: 2.561-10.472) of anxiety (GAD-7≥7). The details are shown in **Table 7**.

Conclusion

Sleep disorder is common in pregnancy. This study found that the incidence of sleep disorders in the second trimester is high. Based on the PSQI global score, 31.1% have sleep disorders (PSQI global score >7). Sleep disorders are mainly manifested in overall sleep quality, sleep latency, sleep disturbance and daytime dysfunction due to sleepiness. Experimental studies showed that sleep disorder adversely affects hormones, insulin sensitivity, and autonomic regulation and function, short sleep duration is related to the increased risk of obesity, diabetes, hypertension, and mortality [18]. Risk factors include age, body mass index, race/ethnicity, and socioeconomic status, unhealthy behaviors such as smoking, alcohol use, and poor diet [1, 5]. This study found that pregnant women who are ethnic minorities, have a history of miscarriage, experience negative events and intimate partner smoking are more likely to have sleep disorders. Our study revealed that, after adjustment for several risk factors for sleep disorders, mid-pregnancy sleep quality was significantly associated with depression and anxiety, which is consistent with the results of previous studies [4, 5].

Our study reported that the prevalence rate of depression and anxiety symptoms were 9.0% and 7.2% in pregnant women in Guangzhou

Table 7. Association between the PSQI and GAD-7 and PHQ-9

	Poor sleep quality (PSQI≥7) n = 172 n (%)	Good sleep quality (PSQI<7) n = 381 n (%)	Unadjusted OR (95% CI)	Adjusted[1] OR (95% CI)	Adjusted[2] OR (95% CI)
PHQ-9					
PHQ-9<10	133 (26.4)	370 (73.6)	9.863 (4.909-19.819)	10.161 (5.013-20.595)	10.995 (5.372-22.502)
PHQ-9≥10	39 (78.0)	11 (22.0)			
GAD-7					
GAD-7<7	145 (28.3)	368 (71.7)	5.271 (2.647-10.498)	5.338 (2.654-10.739)	5.179 (2.561-10.472)
GAD-7≥7	27 (67.5)	13 (32.5)			

[1]Adjusted for ethnicity (Han/Minority), marital (married/unmarried), negative evens (no vs. yes). [2]Further adjusted for for history of abortions (no vs. yes), smoking in the partner (no vs. yes).

city. The influence factors were smoking/alcoholism in intimate partner, sleep disorders and previous adverse antenatal record, coupled with the pregnant woman' concern about the health of the baby, was likely to continue to affect the pregnant woman's mood and produce depression and anxiety symptoms. Low partner support negatively impacted maternal depression, anxiety, sleep quality. Although previous studies have not examined the relationship between partner support and risk factors beyond perinatal outcomes, but positive household support made people feel concerned and loved, which could prevent depression and anxiety symptoms and promote their mental health.

Provide targeted health care knowledge based on the cultural differences of pregnant women, encourage pregnant women to participate in prenatal health care activities, strengthen prenatal checkups, attach importance to mental health education, improve lifestyle, maintain a cheerful mood, reduce anxiety and depression, and improve sleep quality. The social and health departments need a multi-level approach that includes [19]: (1) education of maternal health professionals; (2) to inform the public about the importance of sleep and mood for maternal/infant outcomes, including types of delivery; (3) development of clinical guidelines to achieve standardisation; (4) development of referral pathways for women with clinically significant symptoms; (5) funding for treatment and monitoring of women throughout their pregnancy and postpartum period to improve pregnancy outcomes to facilitate normal fetal development.

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Disclosure of conflict of interest

None.

Abbreviations

PSQI, Pittsburgh Sleep Quality Index Questionnaire; GAD-7, Generalized Anxiety Disorder-7; PHQ-9, Patient Health Questionnaire-9; BMI, body mass index.

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