Impact of the COVID-19 pandemic on mental health in pregnancy women: results from two cohort studies in China

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Research article

Keywords: COVID-19, anxiety, depression, stress, pregnant women

Posted Date: August 19th, 2020

DOI: <https://doi.org/10.21203/rs.3.rs-42153/v1>

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Abstract

Background

The COVID-19 pandemic led to a global atmosphere of anxiety and depression. However, the impact of this disaster on mental health in pregnancy women was not clear.

Methods

Based on two cohort study, the Novel Coronavirus Disease Influenced Pregnant Cohort Study (NCP) set up during the COVID-19 epidemic and the Healthy Baby Cohort Study (HBC) set up in 2012, we compared the anxiety, depression and stress levels of pregnant women who did not or did go through the COVID-19 pandemic and analyzed the risk factors for mental health in pregnancy women.

Results

There were 784 and 2448 participants in the CNP and HBC studies involved in the analysis, respectively. We found that there were 23.09% and 4.72% pregnant women suffering for mild and moderate-to-several anxieties for those in the NCP study, and 21.53% and 3.06% in the HBC study. The mild and moderate-to-several depression rate was 25.89% and 11.35% for those in the NCP study, and 19.81% and 0.51% for those in the HBC study, respectively. No significant difference was found for anxiety, depression and stress levels was found at each gestational trimester ($p > 0.05$). The pandemic of COVID-19 was significantly associated with maternal depression and stress ($p < 0.05$), with the co-efficient and 95%CI as 0.37 (0.18, 0.55) and -0.12 ($-0.09, -0.32$), respectively. Pregnant women with pre-pregnancy obesity, higher educational level or good sleep quality might have lower risks for anxiety, depression and stress compared with the referenced groups.

conclusions

The pandemic had a huge impact on depression, especially moderate-to-sever level, in pregnant women at whatever gestational week; and that pre-pregnancy obesity, highly educated and sleep well ones had less anxiety and depression risks. The society, especially the family members, should pay more attention to pregnant ones and give more social support to them.

Background

On 31st December 2019, 27 cases of the 2019 Novel Coronavirus Disease (COVID-19, named by WHO on Feb 11, 2020) was identified in Wuhan City^[1]. Then on January 23 the day before the Chinese New Year eve, the Wuhan City was locked down with around 60, 000, 000 people inside^[2]. Thereafter for the whole month in February, both the confirmed cases and the dead cases of COVID-19 kept increasing. At last, the pandemic weaken in March and new confirmed cases firstly turned zero on 24th May 2020. Wuhan City was rebooted on 6th April 2020. However, the situation outside China was emergency as there was a rapid surge in the number of COVID-19 cases observed since March on, and now the number of COVID-19 cases was more than 5,400, 000 with more than 340, 000 deaths^[3, 4].

The increasing menace of the COVID-19 epidemic and the global public health emergencies led to a global atmosphere of anxiety and depression, especially in China^[5]. It is reported that there was a relatively high prevalence of mental health problems for people in all situations under the COVID-19 epidemic^[6–12]. A recent study in 1738 respondents from 190 Chinese cities found a high moderate-to-severe stress (8.1%), anxiety (28.8%) and depression (16.5%) in the general population during the pandemic^[13]; and another study reported that the general public may suffer a higher mental health problem than the front-line nurses as the vicarious traumatization scores higher in the former^[14]; one another, although no difference of mental health problem score was found between people with or without quarantine managements, but the screening-positive rate of the mental health scales were high in both groups^[11].

All these reports imply that concerns should be paid to mental health for publics and timely mental health inventions need to be developed urgently. Recent mental health studies on COVID-19 mostly focused on the epidemiology and health professionals of mental health^[15–18]. Little was known about the impact of the rising mental health problem rates, except for impact on life quality^[19], and previous studies did not consider the mental health problem rates before COVID-19 epidemics when analyzing the prevalence of mental

health problem during COVID-19. Mood, anxiety and depression disorder are frequently observed in pregnant women^[20], it's not clear whether mental health problem became more serious for pregnant women who have been suffering from the COVID-19 pandemic.

In this study, we used data from two studies. The first study is the Healthy Baby Cohort Study (HBC), which was established in 2012; the second study is the Novel Coronavirus Disease Influenced Pregnant Cohort Study (NCP), which was set up during the pandemic of COVID-19. Based on the two studies, firstly we aimed to find if the mental health status of pregnant women was different between those underwent and those did not undergo the COVID-19 pandemic; secondly, we wanted to discuss if the mental health status was different for women in different pregnancy trimesters under the influence of COVID-19; the last aim was to explore risk factors for maternal mental health problems together with the COVID-19 pandemic.

Methods

Study design and study population

The NCP study was set up at May 30, 2020, and recruited pregnancy women who went to the Wuhan Maternal and Child Healthcare Hospital for routine pregnancy examination or delivery or postnatal check during May 30 and April 30 in 2020, local residents in Wuhan and agreed to participant to the cohort study. A total of 810 participants fulfilled the mental health assessment, with 26 invalid assessments (not logical: 10; vacancy options: 16) dropped, there were 784 participants included in the final analysis.

The HBC study is an ongoing birth cohort study, which was set up in 2012 and included more than 20,000 pregnant women. In this study, we included 2448 pregnancy women, who did mental health assessment during pregnancy from February 2017 to December 2018, from the HBC study.

Data collection

Participants included in the NCP study ranged from 5 weeks gestation to 2 months after delivery. The basic characteristics of the participants, such as maternal age, educational level, maternal pre-pregnancy weight and height, number of pregnancy, parity, pre-pregnancy drinking and smoking status and disease history were collected when enrolled in the study. We used Center for Epidemiologic Study Depression Scale (CES-D)^[21] and Patient Health Questionnaire version 9 (PHQ-9)^[22] to evaluate depression status in HBC study and NCP study, respectively. Generalized Anxiety Disorder version 7 (GAD-7) for anxiety assessment^[22] and Perceived Stress Scale (PSS)^[23] for pressure analysis were adopted in both studies. A self-reported sleep quality questionnaire was used in the HBC study and insomnia Severity Index (ISI)^[24] were used to assess sleep quality in the NCP study.

In the HBC study, participants were recruited in the first trimester of pregnancy when doing the first pregnancy examination. The basic characteristics of the participants, such as maternal age, educational level, maternal pre-pregnancy weight and height, number of pregnancy, parity, pre-pregnancy drinking and smoking status and disease history, were collected before 16 weeks gestation when recruitment. Anxiety, depression, pressure and sleep status were evaluated at the second trimester of pregnancy (from 16 gestational weeks to less than 28 gestational weeks). Data of drinking and smoking status during pregnancy were collected at the third trimesters (from 28 gestational weeks to delivery).

None of the measures or scales used in the study were developed specifically or under license.

Variables

Outcome variables

Scale scores were calculated and were divided to different health level according to the standard calculating formula and standards. In the CES-D scale, scores < 10 was normal, scores between 10 and 20 was mild depression, and scores ≥ 20 was moderate-to-severe depression. In the PHQ-9 and GAD-7, scores < 5 was normal, scores between 5 and 10 was mild depression or anxiety, and scores ≥ 10 was moderate to severe depression or anxiety. In PSS, scores < 5 was low pressure and scores ≥ 5 was moderate to high pressure. In the self-reported sleep quality questionnaire, we combined very good quality and good quality to good quality, and merged low quality and very low quality to low quality.

Independent variables

In both study, maternal age was set as a continuous variable; educational level was categorized as middle school or less, high school and college or above. Maternal pre-pregnancy body mass index (BMI) = pre-pregnant weight/height². Pre-pregnancy low weight was BMI < 18.5 kg/m², pre-pregnancy normal weight was BMI between 18.5 kg/m² and 24 kg/m², and pre-pregnancy overweight/obesity was BMI ≥ 24 kg/m². Drinking and smoking status was set as yes or no.

Statistical analysis

Basic characteristics were set as mean and standard deviation (SD) for continuous variables and frequency and percentage for category variables. The Pearson *chi-square* test and Student *t* test were used to compare categorical and continuous outcomes, respectively, between the two studies and their sub-groups. Multiple logistic regressions were used to assess the association between the pandemic of COVID-19 and other independent variables and maternal depression, anxiety, stress and sleep quality during pregnancy.

Results

Basic characteristics of the HBC study and the CNP study

There were 784 and 2448 participants in the CNP and HBC studies involved in the analysis, respectively. The average age of the participated women was around 30 years old, and the maternal pre-pregnancy overweight and obesity rate was higher than that in HBC, saying overweight and obesity as 15.29% and 4.80% in the CNP study and 13.93% and 3.49% in the HBC study. In the CNP study, there were 409 (52.17%) women who had college or above education level; almost 60% women were pregnancy for the first time and 71.94% were the first time to give birth to a baby; the virginal bleeding rate was much higher than in the HBC study, saying 36.99% V.S. 9.13%. The mental health assessment was mainly conducted at the second trimester of pregnancy in the HBC study, while mostly was assessed at the perinatal period in the CNP study. In the HBC study, most women had high educational level; almost half of the participants were pregnancy for the first time and 31.48% women were the second time to give birth to a baby; among the 2448 participants, 196 (9.13%) women had virginal bleeding during pregnancy.

Comparison of anxiety, depression and stress between participants in the two studies

Significant difference in anxiety, depression, and stress was found between participants in the two studies. The depression and anxiety rates were much higher in the participants from the CNP study than from the HBC study, and participants in the HBC reported a higher rate of stress than in the CNP study. However, the mean score difference was somewhat different from the rates. Except for anxiety score, scores of depression and stress were higher in the HBC study than in the CNP study. Details were shown in Figure 1.

Comparison of anxiety, depression and stress between participants in different trimester during pregnancy in the two studies

As table 2 shown, there was no significant difference of anxiety, depression or stress rate between each trimester ($p > 0.05$).

Associations between co-variables and depression, anxiety and stress

As its shown in Table 3, the pandemic of COVID-19 was significantly associated with maternal depression and stress ($p < 0.05$), with the co-efficient and 95%CI as 0.37 (0.18, 0.55) and -0.12 (-0.09, -0.32), respectively. Maternal age was negatively associated with maternal stress only in the HBC study with the co-efficient and 95%CI as -0.04 (-0.07, -0.02) ($p < 0.05$). There was a trend that maternal weight status and educational levels were negatively associated with depression and anxiety. Vaginal bleeding during pregnancy and poor sleep quality were associated with higher maternal depression, anxiety and stress risks ($p < 0.05$). No significant difference was found between the number of pregnancy, parity and mental health assessment weeks and depression, anxiety and stress.

Discussions

This is the first mental health investigation aims, in part, to evaluate risk factors for mental health problem of pregnancy women with and without the pandemic of COVID-19 in Wuhan, China. Firstly, we found that rates for anxiety, depression and stress were high, especially for these suffered from the pandemic of COVID-19. There was no difference in the rate of adverse mental health outcomes between each pregnancy trimester. Secondly, the COVID-19 pandemic had significant adverse impacts on maternal moderate-to-several anxieties and depression. We also found that pregnant women with pre-pregnancy obesity, higher educational level or good sleep quality might have lower risks for anxiety, depression and stress compared with the referenced groups.

In our study, there were 23.09% and 4.72% pregnant women suffering for mild or moderate-to-several anxieties under the pandemic of COVID-19, while the percentage were 21.53% and 3.06% for those who did not go through the COVID-19 outbreaks; the moderate-to-several depression rate was 11.35% and 0.51% with or without the pandemic of COVID-19, respectively. Recent studies reported that the outbreak of COVID-19 had impacts on mental health for different kind of populations with impacts on different degrees^[6, 9, 13]. For instance, Wang et al. conducted a longitudinal study on the general population during the COVID-19 in China found that the moderate-to-severe anxiety, depression and stress were noted in 28.8%, 16.5%, and 8.1%, respectively^[13]; while Cao et al. announced that the 0.9% of the medical college students were experiencing severe anxiety, 2.7% moderate anxiety, and 21.3% mild anxiety^[12]. Obviously, the anxiety and depression rates were much higher in our population than in the general ones and medical college students^[12]. This may for one part is caused by the global emergency of COVID-19 outbreaks^[1, 25, 26]; for another, higher virginal bleeding rate and insomnia rate could also contribute to the high anxiety and depression rates as reported in previous studies^[27, 28]. Interestingly, the stress level for those going through the COVID-19 pandemic was much lower than the non-epidemic ones. This might be because, firstly, participants in our study were not infected by the COVID-19 and most families had no members infected; secondly, during the COVID-19 outbreaks, among the 784 participants in our study, only 2 women did not have accompany, the others had at least one companion, mostly their husband, which may make they feel easier^[29]; thirdly, they did not need to work during this period, while in the general time, most women keep working during pregnancy (in the HBC study, 66.12% women went to work during pregnancy).

Our study confirmed that anxiety, depression and stress levels had no significant difference during the whole pregnancy and perinatal periods, which was in accordance with results from those populations that did not go through the COVID-19 pandemic^[30, 31]. We also found that these with higher educational level had less anxiety and depression problems. This result could be explained in two aspects. Firstly, higher educational level usually correlated with higher family income, which make the pregnant women less worries about the economic foundations, as there is an expenditure caused by pregnancy, delivery and rising the child. Secondly, women with higher educational level could had a better understanding of the process of pregnancy, delivery and rising child, and better respond to emergencies. Interestingly, results from our study shown that maternal pre-pregnancy obesity was a protective effect for anxiety, depression and stress during pregnancy both with and without the COVID-19 pandemic, which was opposite from the results of 1621 women involved in the Australian Longitudinal Study of Women's Health^[32]. The difference in the outcome may contribute to the difference in culture. In China, well goes a saying "laugh and grow fat", which means that fat people tend to be more broad-minded, or there is a high rate that broad-minded ones are fat. According to this theory, the obesity women may be easier to accept the emergency of the COVID-19 pandemic and be less anxiety and depression.

Our study highlights some public health implications. Firstly, the pandemic of COVID-19 could increase the anxiety and depression risks for pregnant women. Public health policies and clinical interventions should be made to help these who had been suffered from or being suffering from this crisis. What's more, participants in our study were not infected, these infected ones should have a higher anxiety and depression rate and more attentions should be paid. Secondly, the stress level for these going through the pandemic was lower than before. Although reason for this is not investigated in our study, according to the characteristics of this pandemic, we inferred that family accompany and out of work may be benefit for pregnant women and advocated that family members take more time with pregnant women. Thirdly, we found that the obesity and with high educational level ones had lower anxiety and depression risks, which indicated that holding more knowledge, supports and self-confidence could make a one better and stronger, especially during pregnancy. There are several limitations in our study. Firstly, sleep quality assessment was not in accordance in the two studies. To serve these problem, we merged sleep quality in the two studies into good or bad sleep quality, which could, from a large distance, make it comparable in the analysis. Secondly, in the HBC study, most investigation about mental health were done during 20 to 28 weeks gestation; while in the NCP study, mostly were conducted during perinatal periods. This may make our comparison powerless. However, we analyzed the correlation between the investigation gestational week and mental health problem, no significant difference was found, which suggested that our comparison was feasible.

Conclusions

By comparing mental health of pregnant women going through with or without the COVID-19 pandemic, we found that the pandemic had a huge impact on depression, especially moderate-to-sever level, in pregnant women at whatever gestational week; and that pre-pregnancy obesity, highly educated and sleep well ones had less anxiety and depression risks. The public should make policies on preventing and protecting pregnant women for the mental health outcome of the COVID-19 pandemic disaster. The society, especially the family members, should pay more attention to pregnant ones and give more social support to them.

Abbreviations

COVID-19

the 2019 Novel Coronavirus Disease

NCP

the Novel Coronavirus Disease Influenced Pregnant Cohort Study

HBC

the Healthy Baby Cohort Study

CES-D

Center for Epidemiologic Study Depression Scale

PHQ-9

Patient Health Questionnaire version 9

GAD-7

Generalized Anxiety Disorder version 7

PSS

Perceived Stress Scale

ISI

insomnia Severity Index

BMI

body mass index

SD

standard deviation

Declarations

Ethics approval and consent to participate

This study was approved by the Ethics Committee of Wuhan Children's Hospital (Wuhan Maternal and Child Healthcare Hospital), Tongji Medical College, Huazhong University of Science & Technology. Written informed consents were obtained from all participants.

Consent for publication

All the authors were consent for publication of the manuscript in *BMC Public Health*.

Availability of data and materials

For data and materials of this study, please email Prof. Ai'fen Zhou, april1972@163.com.

Competing interests

All the authors declared no potential conflict of interests relevant to this study.

Funding

No funding support is available in this study.

Authors' contributions

HM wrote the draft manuscript and did the analysis; NL conducted the investigation and wrote the manuscript; JWL, DZ, ZQC, and YJZ associated with the investigation, the data analysis and modified the manuscript; JXC and AFZ designed the study and supervised the study and the manuscript writing. All authors have read and approved the manuscript.

Acknowledgements

Great thanks to the assistant workers who helped doing the face-to-face investigation. Great thanks to the participants for supporting us to fulfil the questionnaires.

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Tables

Table 1 Basic characteristics of the participants

	CNP study		HBC study	
	Means (SD)	N (%)	Means (SD)	N (%)
Maternal age (year)	30.36 (11.05)		29.95 (5.52)	
Pre-pregnant BMI (kg/m ²)	21.52 (3.18)		21.46 (5.92)	
Underweight		106 (15.89)		374 (15.94)
Normal weight		427 (64.02)		1564 (66.64)
Overweight		102 (15.29)		327 (13.93)
Obesity		32 (4.80)		82 (3.49)
Maternal educational level				
Middle school or less		98 (12.50)		366 (15.53)
High school		277 (35.33)		135 (5.73)
College or above		409 (52.17)		1856 (78.74)
Number of pregnancy				
1		468 (59.69)		1149 (49.96)
2		214 (27.30)		618 (26.87)
≥ 3		102 (13.01)		533 (23.17)
parity				
0		564 (71.94)		1576 (68.52)
≥ 1		220 (28.06)		724 (31.48)
Vaginal bleeding		290 (36.99)		196 (9.13)
Pre-pregnancy smoking		33 (4.25)		12 (1.04)
Pregnant smoking		2 (0.25)		1 (0.09)
Pre-pregnant drinking		74 (9.54)		54 (4.70)
Pregnant drinking		12 (1.55)		4 (0.35)
Assessment weeks (week)				
0-20		122 (15.58)		29 (1.19)
20-28		82 (10.47)		2269 (92.80)
≥ 28		579 (73.95)		147 (6.01)
Sleep quality	9.80 (0.66)		9.86 (0.52)	
Good		599 (76.40)		1839 (85.65)
Bad		185 (23.59)		308 (14.35)

Table 2 Comparison of anxiety, depression and stress between each trimester in the two studies

	CNP study (weeks)			HBC study		
	0-20	20-28	≥ 28	0-20	20-28	≥ 28
Anxiety						
Normal	93 (76.23)	55 (67.07)	417 (72.02)	23 (79.31)	1713 (75.50)	107 (72.79)
Mild	26 (21.31)	20 (24.39)	135 (23.32)	5 (17.24)	488 (21.51)	34 (23.13)
Moderate-to-severe	3 (2.46)	7 (8.54)	27 (4.66)	1 (3.45)	68 (3.00)	6 (4.08)
Depression						
Normal	72 (59.02)	52 (63.41)	367 (63.39)	23 (79.31)	1819 (80.17)	105 (71.43)
Mild	35 (28.69)	19 (23.17)	149 (25.73)	6 (20.69)	439 (19.35)	40 (27.21)
Moderate-to-severe	15 (12.30)	11 (13.41)	63 (10.88)	0 (0.00)	11 (0.48)	2 (1.36)
Stress	73 (59.84)	54 (65.85)	357 (73.95)	20 (68.97)	1568 (69.11)	106 (72.11)

Table 3 Associations between co-variables and depression, anxiety, and stress

	Depression			Anxiety			Stress		
	CNP study & HBC study	CNP study	HBC study	CNP study & HBC study	CNP study	HBC study	CNP study & HBC study	CNP study	HBC study
The COVID pandemic									
No	Reference			Reference			Reference		
Yes	0.37 (0.18, 0.55)*			-0.03 (-0.21, 0.16)			-0.12 (-0.09, -0.32)*		
Maternal age (year)	-0.02 (-0.04, 0.01)	-0.01 (-0.04, 0.03)	-0.01 (-0.05, 0.02)	-0.01 (-0.03, 0.02)	-0.01 (-0.05, 0.04)	-0.01 (-0.03, 0.03)	-0.01 (-0.22, 0.19)	0.02 (-0.02, 0.06)	-0.04 (-0.07, -0.02)*
Maternal weight status									
Underweight	0.27 (0.03, 0.50)*	0.08 (-0.30, 0.46)	0.48 (0.15, 0.82)*	0.26 (0.04, 0.48)*	-0.05 (-0.48, 0.37)	0.40 (0.13, 0.67)*	0.12 (-0.09, 0.32)	-0.03 (-0.42, 0.35)	0.15 (-0.10, 0.39)
Normal weight	Reference	Reference	Reference	Reference	Reference	Reference	Reference	Reference	Reference
Overweight	0.12 (-0.13, 0.36)	0.18 (-0.20, 0.56)	0.21 (-0.14, 0.57)	-0.04 (-0.28, 0.20)	-0.05 (-0.49, 0.39)	0.01 (-0.29, 0.30)	-0.01 (-0.22, 0.19)	0.18 (-0.21, 0.57)	-0.04 (-0.29, 0.21)
Obesity	-0.52 (-0.95, -0.09)*	-0.13 (-0.72, 0.46)	-1.08 (-1.85, -0.30)*	-0.35 (-0.76, -0.05)*	0.07 (-0.58, 0.71)	-0.60 (-1.15, -0.06)*	-0.14 (-0.46, 0.19)	-0.12 (-0.71, 0.47)	-0.15 (-0.54, 0.24)
Maternal educational level									
Middle school or less	-0.11 (-0.30, 0.07)	0.10 (-0.22, 0.42)	-0.21 (-0.46, 0.04)	-0.08 (-0.26, 0.10)	-0.04 (-0.40, 0.33)	-0.03 (-0.26, 0.20)	0.04 (-0.14, 0.22)	0.17 (-0.17, 0.51)	-0.06 (-0.31, 0.19)
High school	0.21 (0.03, 0.40)*	0.16 (-0.09, 0.40)	0.23 (-0.08, 0.54)	0.19 (0.01, 0.38)*	0.25 (-0.02, 0.53)	0.04 (-0.26, 0.35)	0.26 (0.07, 0.46)*	0.21 (-0.05, 0.47)	0.37 (0.02, 0.72)*
College or above	Reference	Reference	Reference	Reference	Reference	Reference	Reference	Reference	Reference
Number of pregnancy									
1	Reference	Reference	Reference	Reference	Reference	Reference	Reference	Reference	Reference
2	-0.02 (-0.17, 0.11)	-0.16 (-0.46, 0.13)	0.03 (-0.14, 0.21)	0.02 (-0.12, 0.16)	0.02 (-0.32, 0.36)	0.03 (-0.13, 0.19)	0.10 (-0.04, 0.23)	-0.10 (-0.38, 0.19)	0.15 (-0.01, 0.31)
≥ 3	-0.13 (-0.33, 0.06)	-0.24 (-0.62, 0.14)	-0.09 (-0.32, 0.13)	-0.07 (-0.25, 0.11)	-0.67 (-1.13, -0.20)*	0.06 (-0.15, 0.26)	-0.02 (-0.20, 0.15)	-0.01 (-0.38, 0.37)	0.02 (-0.18, 0.22)
parity									
0	Reference	Reference	Reference	Reference	Reference	Reference	Reference	Reference	Reference
≥ 1	0.12	0.26	0.06	0.05	0.32	-0.02	-0.03	0.09	-0.01

	(-0.03, 0.27)	(-0.02, 0.54)	(-0.11, 0.24)	(-0.09, 0.19)	(-0.01, 0.65)	(-0.18, 0.14)	(-0.20, 0.15)	(-0.19, 0.36)	(-0.17, 0.15)
Vaginal bleeding									
No	Reference	Reference	Reference	Reference	Reference	Reference	Reference	Reference	Reference
Yes	0.12 (-0.01, 0.24)	0.13 (-0.03, 0.30)*	0.04 (-0.16, 0.23)	0.16 (0.04, 0.28)*	0.23 (0.05, 0.42)*	0.07 (-0.10, 0.25)	0.11 (-0.01, 0.23)	-0.03 (-0.20, 0.15)	0.28 (0.09, 0.48)*
Assessment weeks (week)									
0-20	-0.02 (-0.31, 0.27)	-0.16 (-0.50, 0.18)	0.29 (-0.44, 1.01)	-0.29 (-0.62, 0.05)	-0.44 (-0.84, -0.04)*	-0.11 (-0.87, 0.65)	-0.14 (-0.42, 0.14)	-0.33 (-0.68, 0.01)	0.42 (-0.43, 1.27)
20-28	0.01 (-0.25, 0.26)	0.22 (-0.14, 0.58)	-0.26 (-0.65, 0.14)	0.15 (-0.12, 0.41)	0.45 (-0.06, 0.84)	-0.07 (-0.48, 0.34)	0.01 (-0.23, 0.26)	0.30 (-0.08, 0.67)	-0.33 (-0.79, 0.12)
≥ 28	Reference	Reference	Reference	Reference	Reference	Reference	Reference	Reference	Reference
Sleep quality									
Good	Reference	Reference	Reference	Reference	Reference	Reference	Reference	Reference	Reference
Bad	1.51 (1.29, 1.73)*	1.89 (1.52, 2.25)*	1.18 (0.90, 1.46)*	1.32 (1.11, 1.54)*	1.81 (1.42, 2.19)*	1.09 (0.82, 1.35)*	1.00 (0.72, 1.28)*	1.36 (0.90, 1.81)*	0.81 (0.45, 1.16)*

Figures

Figure 1

Anxiety, depression and stress levels of the participants in the two studies.