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Depression, anxiety, and stress symptoms in pregnant women before and during the COVID-19 pandemic

Hong Mei [a,1], Na Li [a,1], Junwei Li [a], Dan Zhang [a], Zhongqiang Cao [a], Yongjie Zhou [b,c], Jiangxia Cao [a,*], Ai'fen Zhou [a,*]

[a] Wuhan Children's Hospital (Wuhan Maternal and Child Healthcare Hospital), Tongji Medical College, Huazhong University of Science & Technology, 100 Hongkong Road, Jiang'an District, Wuhan 430016, China
[b] Affiliated Wuhan Mental Health Center, Tongji Medical College of Huazhong University of Science & Technology, 70 Youyi Road, Qiaokou District, Wuhan 430000, China
[c] Research Center for Psychological and Health Sciences, China University of Geosciences, Wuhan 430074, China

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ABSTRACT

Objective: This study evaluates depression, anxiety, and stress symptoms in pregnant women before and during COVID-19 pandemic and analyzes their risk factors.
Methods: This was a cross-sectional analyses included pregnant women with depression, anxiety, and stress levels evaluated both in the Novel Coronavirus-Pregnancy Cohort study (NCP) and the Healthy Baby Cohort study (HBC). NCP was conducted during COVID-19 pandemic, while HBC was performed before the pandemic. Multiple logistic regressions were employed to evaluate the associations between COVID-19 pandemic and other covariables and maternal mental health.
Results: NCP and HBC studies respectively included 531 and 2352 participants. Depression rates differed significantly between the two studies ($p < 0.05$). The mild and moderate-to-severe depression rates in NCP study were 25.8% and 10.36%, respectively, and 19.94% and 0.55% in HBC study. The stress rate of participants was higher in HBC study (69.39%) than in NCP study (60.45%) ($p < 0.05$). COVID-19 pandemic was correlated with higher depression but lower stress risks ($p < 0.05$) in pregnant women, with *OR* and 95% *CI* as 1.68 (1.16, 2.44) and 0.42 (0.29, 0.61), respectively. Pregnant women with pre-pregnancy obesity and high educational levels might have lower risks for depression, anxiety, and stress than those with normal weight and low educational levels.
Conclusions: Depression among pregnant women was impacted by the pandemic. Apart from COVID-19 pandemic impact, pre-pregnant weight status and educational level might also influence depression, anxiety and stress statuses in pregnant women.

1. Background

On December 31, 2019, 27 cases of 2019 Novel Coronavirus Disease (COVID-19, named by WHO on February 11, 2020) have been identified in Wuhan city [1]. Subsequently, on January 23, the day before the Chinese New Year's Eve, Wuhan City has been locked down with a population of 60 million people [2]. After that, confirmed cases and fatalities of COVID-19 continued to rise during February. Finally, thanks to the country's and people's collaborative efforts, the pandemic weakened in March, and new confirmed cases returned to zero on May 24, 2020. Wuhan city returned to normalcy on April 6, 2020. However, there has been fast growth outside China in the number of COVID-19 cases observed since March, and this number has surpassed 90 million by the end of December.

The growing threat of COVID-19 pandemic and global public health emergencies lead to anxiety, depression, and stress [3–5] and increase risks of suicides [6]. During COVID-19 pandemic, a relatively high prevalence of mental health problems was observed among all people [2,7–10]. In particular, pregnant women, whose peptide and steroid hormone levels fluctuate frequently, might be more susceptible to

* Corresponding authors at: 100 Hongkong Road, Wuhan 430016, China.
E-mail addresses: whcaojiangxia@163.com (J. Cao), april1972@163.com (A. Zhou).
[1] Contribute equally to the manuscript.

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mental health problems during COVID-19 pandemic [11]. A study assessed depression and anxiety levels in the same pregnant women before and during COVID-19, indicating that COVID-19 outbreak negatively impacts depression and anxiety levels [12]. Another multicenter, cross-sectional study conducted during COVID-19 epidemic in China demonstrates that COVID-19 outbreak increases mental illness risk among pregnant women, including thoughts of self-harm [13]; however, there are opposite results concerning this topic. For instance, a cross-sectional study with 156 participants conducted in China manifested that anxiety rates of pregnant women are the same as those before the pandemic, while depression rates are significantly higher; pregnant women who lived in Wuhan are not more anxious or depressed than pregnant women in other regions during the pandemic [14].

During pregnancy, mental health problems are associated with numerous adverse birth outcomes and may increase the risk of developing childhood mental health problems and suicidal behavior [15,16]. COVID-19 pandemic is a disaster for people worldwide, which may significantly impact mental health in pregnant women. However, COVID-19 pandemic impact on health consequences in pregnant women is not fully elucidated. Moreover, recent research is mostly cross-sectional studies with small sample sizes and lacks a consistent conclusion.

Herein, we used data from two cohort studies. The first study is Novel Coronavirus Disease Influenced Pregnant Cohort study (NCP), developed during COVID-19 pandemic and assessed depression, anxiety, and stress (mental health assessment) in March and April 2020. The second study is Healthy Baby Cohort study (HBC) [17,18], established in 2012 with mental health assessment and was conducted between 2017 and 2018. Using cross-sectional data from the two studies, we sought to determine if depression, anxiety, and stress were different in pregnant women who experienced the pandemic versus those who did not. We also sought to identify risk factors for maternal mental health problems together with COVID-19 pandemic.

2. Methods

2.1. Study design and study population

This is a cross-sectional analyses based on data from the NCP study and the HBC study.

The NCP study started on May 30, 2020, with recruited pregnant women who accepted to participate in the study and visited Wuhan Maternal and Child Healthcare Hospital for routine pregnant examination or delivery between May 30 and April 30 in 2020. A total of 557 participants fulfilled the mental health assessment. With 26 invalid assessments (not logical: 10; vacancy options: 16), 531 participants with gestational ages ranging from 5 weeks to delivery were included in the final analyses.

The HBC study was a birth cohort study established in 2012. Participants were recruited when they came to Wuhan Maternal and Children Healthcare Hospital for an initial pregnant exam and followed up during pregnancy. Between February 2017 and December 2018, a mental health assessment was included in HBC and was administered to pregnant women during the assessment period. We included 2352 participants in our analyses until we finished this comparison study, after excluding invalid mental health assessments.

The NCP study was approved by the Institutional Review Board of the Institute of Psychology, Chinese Academy of Sciences. The HBC 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 (ID: 2010009). All participants provided the informed consent before participating in the studies.

2.2. Data collection

When participants agreed to participate in the study at the hospital, trained nurses collected basic participant characteristics such as maternal pre-pregnancy weight and height, pre-pregnancy drinking and smoking status, health status during pregnancy, and mental health assessment scores via face-to-face questionnaire. Other information, like maternal age, educational level, number of pregnancies, and parity, were collected through Outpatient Information System.

In HBC study, participants were recruited in the first trimester of pregnancy when completing their initial pregnant exam. Participants' basic characteristics, such as maternal age, educational level, maternal pre-pregnancy weight and height, number of pregnancies, parity, pre-pregnancy drinking and smoking status, and health status during pregnancy, were collected before 16-week gestation upon recruitment. Depression, anxiety, and stress levels were mainly evaluated between 16 and 28 gestational weeks. During pregnancy, data on drinking and smoking status were collected during the third trimesters (from 28 gestational weeks to delivery).

For mental health assessment, we utilized the 10 items Center for Epidemiologic Study Depression Scale (CES-D) [19] and the 9 items Patient Health Questionnaire version 9 (PHQ-9) [20] to evaluate depression in HBC and NCP studies, respectively. Both studies utilized 7 items Generalized Anxiety Disorder version 7 (GAD-7) for anxiety assessment [20] and the 10 items Perceived Stress Scale (PSS) [21] for stress analysis. Standard cutoff scores for depression levels were 10 and 20 in CES-D and 5 and 10 in PHQ-9. Standard cutoff scores for anxiety levels were 5 and 10 in GAD-7, and for stress levels were 5 in PSS.

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

2.3. Variables

2.3.1. Outcome variables

Depression, anxiety, and stress levels were the category variables in this study. Scale scores were calculated and divided into different health levels according to the standard calculating formula and standards. Details for definitions of mental health levels were as follows: For depression levels on CES-D scale, scores$<$10 were normal, scores between 10 and 20 were mild depression, scores $\geq$20 were moderate-to-severe depression, whereas scores$<$5 were normal, scores between 5 and 10 were mild depression, and scores$\geq$10 were moderate-to-severe depression on PHQ-9 scale. For anxiety levels on GAD-7 scale, scores$<$5 were normal, scores between 5 and 10 were mild anxiety, and scores$\geq$10 were moderate-to-severe anxiety. In PSS, scores$<$5 were low stress, and scores$\geq$5 were moderate-to-high stress.

2.3.2. Independent variables

In both studies, maternal age was set as a continuous variable, and 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/height [2]. Pre-pregnant low weight was defined as BMI $<$ 18.5 kg/m^2, pre-pregnant normal weight was defined as BMI between 18.5 kg/m^2 and 24 kg/m^2, and pre-pregnant overweight/obesity was defined as BMI $\geq$ 24 kg/m^2. Whether there was vaginal bleeding was set as the variable for health status during pregnancy. Drinking and smoking statuses were set to either yes or no.

2.4. Statistical analysis

For continuous variables, the basic characteristics were set as mean and standard deviation (SD), whereas the basic characteristics were frequency and percentage for categorical variables. The Pearson chi-square test and Student *t*-test were employed to compare categorical and continuous outcomes, respectively, between the two studies and their sub-groups. Multiple logistic regressions were utilized to assess the

association between COVID-19 pandemic and other independent variables and maternal depression, anxiety, and stress during pregnancy.

3. Results

3.1. Basic characteristics of NCP and HBC studies

There were 531 and 2352 participants involved in the analysis of NCP and HBC studies, respectively, with average age of around 30 years old in both. The maternal pre-pregnancy overweight and obesity rates were higher in NCP than in HBC, resulting in overweight and obesity as 18.64% and 6.81%, respectively, in NCP study and 13.95% and 3.39% in HBC study. In NCP study, 284 (53.48%) women had at least a college education level, while the rate for college or above was 78.97% in HBC study. Almost 60% of women were pregnant for the first time in NCP study, while only 50% were observed in HBC study. Most participants were pregnant and giving birth for the first time in both cohorts; the vaginal bleeding rate was much higher in NCP study than in HBC study, 35.59% vs. 9.18%, respectively. The mental health assessment was mainly conducted at the perinatal period in NCP study, while it was mostly assessed at the second trimester of pregnancy in HBC study. The pre-pregnant smoking/drinking rate and smoking/drinking rate during pregnancy were low in both studies, so we did not consider smoking/drinking in multiple logistic regression analyses (Table 1).

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

Significant differences in depression and stress were found between participants in the two studies ($p < 0.001$). No significant difference was found for anxiety between the two groups ($p = 0.22$). The depression rates were much higher in participants from NCP study than those from HBC study, especially moderate-to-severe depression rates (10.36% vs. 0.55%). Participants in HBC reported a higher stress rate than in NCP study (69.39% vs. 60.45%). Same trends in depression, anxiety, and stress scores were found between the two studies. Details are displayed in Table 2.

We also compared depression, anxiety, and stress rates among participants at different trimesters during pregnancy in each study. As shown in Fig. 1, no significant difference in depression, anxiety, or stress rates was observed among the three trimesters in each study ($p > 0.05$).

3.3. Associations between co-variables and depression, anxiety, and stress

As presented in Table 3, COVID-19 pandemic was significantly linked to maternal depression and stress ($p < 0.05$), with odds ratio (OR) and 95% CI of 1.68 (1.16, 2.44) and 0.42 (0.29, 0.61), respectively. There was a trend that maternal weight status and educational levels were negatively associated with depression and anxiety. Vaginal bleeding during pregnancy was associated with higher maternal depression, anxiety, and stress risks ($p < 0.05$). No significant difference was found between maternal age, number of pregnancies, parity and mental health assessment trimesters, depression, anxiety, and stress rates ($p > 0.05$).

4. Discussions

In this study, we first found that compared to participants evaluated one year before COVID-19 pandemic, depression rate was higher, and stress rate was lower in those under COVID-19 pandemic. The depression rates were much higher in participants from NCP study than from HBC study. The stress rate was higher in HBC study than in NCP study. No significant difference in anxiety rate for pregnant women who experienced COVID-19 pandemic or not. No significant difference was found in depression, anxiety, and stress rates between the three trimesters in each study. We also found that COVID-19 pandemic, together with maternal pre-pregnancy weight status, educational level, and vaginal bleeding during pregnancy, were associated with depression and stress rates.

The mild and moderate-to-severe depression rates were 25.8% and 10.36%, respectively, in NCP study and 19.94% and 0.55% in HBC study. Compared to depression rates before COVID-19, our results demonstrated a higher depression risk during COVID-19 epidemic, consistent with some results from other studies worldwide [12,13]. The higher depression rate during COVID-19 may be caused by the sudden change in lifestyle after lock-down policies, implying that pregnant women had to stay at home almost all the time before April 6 [22]. However, compared to results from the general population during COVID-19, the depression rate in pregnant women in NCP study was low [9,23]. For instance, Wang et al. conducted a longitudinal study on the general population during COVID-19 in China and found that moderate-to-severe depression rates were 16.5% [7]. The results were reasonable, as pregnant women would receive more attention and better care from family members, lowering their depression symptoms.

Table 1
Basic characteristics of the participants.

	NCP study ($n = 531$)		HBC study ($n = 2352$)	
	Means (SD)	N (%)	Means (SD)	N (%)
Maternal age (year)	30.54 (13.18)		29.96 (3.88)	
Pre-pregnant BMI (kg/m^2)	22.24 (3.34)		21.44 (5.50)	
Pre-pregnancy weight status				
Underweight		47 (9.42)		362 (15.93)
Normal weight		325 (65.13)		1516 (66.73)
Overweight		93 (18.64)		317 (13.95)
Obesity		34 (6.81)		77 (3.39)
Maternal educational level				
Middle school or less		64 (12.05)		351 (15.38)
High school		183 (34.46)		129 (5.65)
College or above		284 (53.48)		1802 (78.97)
Number of pregnancies				
1		317 (59.70)		1135 (49.93)
2		145 (27.31)		610 (26.84)
≥3		69 (12.99)		528 (23.23)
Parity				
0		393 (74.01)		1555 (68.41)
≥1		138 (25.99)		718 (31.59)
Vaginal bleeding		189 (35.59)		190 (9.18)
Pre-pregnancy smoking		7 (1.32)		12 (0.51)
Smoking during pregnancy		0 (0.00)		1 (0.01)
Pre-pregnant drinking		13 (2.44)		47 (2.00)
Drinking during pregnancy		8 (1.51)		8 (0.34)
Assessment trimesters (week)				
0–20		44 (8.29)		26 (1.11)
20–28		61 (11.49)		2185 (92.90)
≥28		426 (80.23)		141 (5.99)

*$p < 0.05$.

Table 2
Comparison of depression, anxiety, and stress between participants in the two studies.

	NCP study		HBC study	
	Means (SD)	N (%)	Means (SD)	N (%)
Depression score	4.22 (4.19)*		6.42 (3.95)*	
Normal		339 (63.84)*		1870 (79.51)*
Mild		137 (25.80)*		469 (19.94)*
Moderate-to-severe		55 (10.36)*		13 (0.55)*
Anxiety score	2.93 (3.53)		2.97 (2.91)	
Normal		388 (73.07)		1772 (75.34)
Mild		119 (22.41)		507 (21.56)
Moderate-to-severe		24 (4.52)		73 (3.10)
Stress score	14.34 (5.60)*		16.06 (5.41)*	
Yes		321 (60.45)*		1632 (69.39)*
No		210 (39.55)*		720 (30.61)*

Interestingly, the anxiety rate in NCP study has no statistical difference from that in HBC study, and the stress rate for those experiencing COVID-19 pandemic was much lower than non-epidemic ones. This could be due to some reasons. Firstly, participants in our study were not infected with coronavirus, and most families had no infected members. Secondly, during COVID-19 outbreak, all pregnant women in our study had at least one companion, most of whom were their husbands, which may make them feel more at ease [24]. Thirdly, most women keep working during pregnancy (in HBC study, 66.12% of women went to work during pregnancy). During the pandemic, they did not need to work, which could reduce work-related stress.

Our study found that the gestational trimester had no correlation with depression, anxiety, and stress rates, following results from other previous studies [25,26]. We also found that women with higher educational levels had less depression and anxiety problems. This result could be explained in two aspects. Firstly, a higher educational level is usually correlated with higher family income, making pregnant women less concerned about financial foundations, while there is an expense caused by pregnancy, delivery, and growing child. Secondly, women with higher educational levels could better understand pregnancy, delivery, and growing child and better respond to emergencies. Interestingly, our results indicated that maternal pre-pregnancy obesity was a protective effect for depression, anxiety, and stress during pregnancy with and without COVID-19 pandemic. According to a Chinese saying, "laugh and grow fat," obese people tend to be more broad-minded, or there is a high rate that broad-minded ones are obese people. According to this theory, obese women may be easier to accept emergency of COVID-19 pandemic and be less depressed and anxious.

There are several limitations in our study. Firstly, in NCP study, most investigations were conducted during perinatal periods, while in HBC study, most mental health investigations were done during 20 to 28 week-gestation. This may reduce our comparison capacity. No significant difference was found by analyzing the correlation between investigation gestational weeks and depression, anxiety, and stress rates. This suggested that comparisons between mental health status of the second trimester in HBC and the third trimester in NCP study were feasible. The other limitation is using different scales to evaluate depression status in NCP and HBC studies. A comparison of CES-D and PHQ-9 depression scales in systemic sclerosis by Katherine Milette indicates that the two scales performed similarly in depression symptom assessment [27]. As participants in both studies were healthy pregnant women, we believe that our comparison of depression between NCP and HBC studies is reliable. One another limitation was that as shown in Table 1, there were significant differences in some characteristics, like maternal educational level and vaginal bleeding, between the two studies. We introduced the propensity score matching (PSM) approach to balancing the participants in the two groups and confirmed that the two studies were comparable (Supplemental).

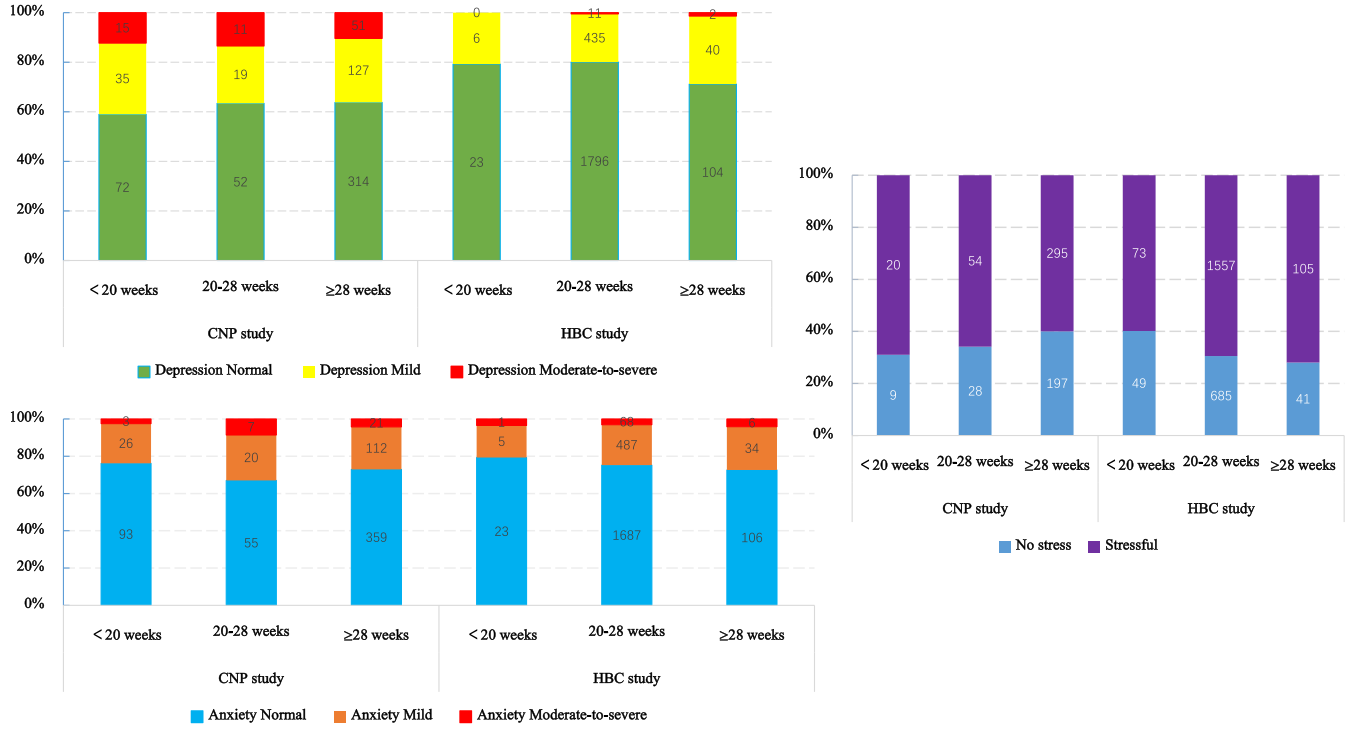

Fig. 1. Comparison of anxiety, depression, and stress between participants in different trimesters during pregnancy in the two studies.

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

	Depression	Anxiety	Stress
COVID pandemic			
No	Reference	Reference	Reference
Yes	1.68 (1.16, 2.44)*	0.88 (0.60, 1.29)	0.42 (0.29, 0.61)*
Maternal age (year)	0.99 (0.97, 1.01)	1.00 (0.98, 1.01)	1.00 (0.99, 1.01)
Maternal weight status			
Underweight	1.17 (0.90, 1.01)	1.23 (0.96, 1.58)	1.16 (0.90, 1.50)
Normal weight	Reference	Reference	Reference
Overweight	0.93 (0.71, 1.21)	0.85 (0.65, 1.11)	0.99(0.78, 1.27)
Obesity	0.39 (0.22, 0.71)*	0.42 (0.23, 0.74)*	0.80 (0.53, 1.22)
Maternal educational level			
Middle school or less	0.97 (0.74, 1.28)	1.02 (0.79, 1.33)	1.39 (1.07, 1.81)*
High school	1.48 (1.11, 1.97)*	1.39 (1.04, 1.86)*	1.67 (1.23, 2.27)*
College or above	Reference	Reference	Reference
Number of pregnancies			
1	Reference	Reference	Reference
2	0.89 (0.68, 1.18)	1.05 (0.81, 1.36)	1.31 (1.01, 1.69)*
≥3	0.84 (0.60, 1.19)	1.02 (0.74, 1.41)	1.20 (0.87, 1.65)
Parity			
0	Reference	Reference	Reference
≥1	1.25 (0.93, 1.69)	1.08 (0.82, 1.43)	0.91 (0.69, 1.20)
Vaginal bleeding			
No	Reference	Reference	Reference
Yes	1.32 (1.02, 1.71)*	1.41 (1.09, 1.81)*	1.51 (1.16, 1.98)*
Assessment trimesters (week)			
0–20	0.90 (0.51, 1.57)	0.50 (0.25, 0.98)*	0.76 (0.44, 1.31)
20–28	0.72 (0.51, 1.03)	0.80 (0.56, 1.14)	0.84 (0.59, 1.20)
≥28	Reference	Reference	Reference

*$p < 0.05$.

Our study highlights some public health implications. We found that COVID-19 pandemic could increase depression risks for pregnant women. The participants in our study were not infected, and those infected ones should have a higher depression rate. As a result, timely mental health evaluation and assistance are needed for the public, particularly COVID-19 infected ones. Secondly, the stress rate for those who experienced the pandemic was lower than those who did not. Although we did not investigate the reason for this, according to pandemic characteristics, we inferred that family accompanies [28] and reduced working load [29] may benefit pregnant women. Thirdly, we found that obesity and high educational level had lower depression and anxiety risks in pregnant women, indicating that higher education levels, supports, and self-confidence could make one better and stronger, especially during pregnancy.

5. Conclusions

By comparing mental health of pregnant women who experienced COVID-19 pandemic or who did not, we found that COVID-19 negatively affected depression risk in pregnant women and that pre-pregnancy obesity and highly educated ones had less depression and anxiety risks. The public should take timely evaluation and assistance policies to protect the mental health of pregnant women who experienced COVID-19 pandemic. Society, especially family members, should pay more attention to pregnant women and provide them more psychological supports.

Consent for publication

All authors were consent for publication of the manuscript in *J of Psychosomatic Research*.

Data availability

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

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Declaration of Competing Interest

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

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Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.jpsychores.2021.110586.

References

[1] C. Wang, P.W. Horby, F.G. Hayden, et al., A novel coronavirus outbreak of global health concern, Lancet 395 (10223) (2020) 470–473.
[2] D.L. Heymann, N. Shindo, COVID-19: what is next for public health? Lancet 395 (10224) (2020) 542–545.
[3] Y.T. Xiang, Y. Yang, W. Li, et al., Timely mental health care for the 2019 novel coronavirus outbreak is urgently needed, Lancet Psychiatry 7 (3) (2020) 228–229.
[4] J. Xiong, O. Lipsitz, F. Nasri, et al., Impact of COVID-19 pandemic on mental health in the general population: a systematic review, J. Affect. Disord. 277 (2020) 55–64.
[5] M. Momoi, M. Murakami, N. Horikoshi, et al., Dealing with community mental health post the Fukushima disaster: lessons learnt for the COVID-19 pandemic, QJM 113 (11) (2020) 787–788.
[6] L. Sher, The impact of the COVID-19 pandemic on suicide rates, QJM 113 (10) (2020) 707–712.
[7] C. Wang, R. Pan, X. Wan, et al., A longitudinal study on the mental health of general population during the COVID-19 epidemic in China, Brain Behav. Immun. 87 (2020) 40–48.
[8] E.A. Troyer, J.N. Kohn, S. Hong, Are we facing a crashing wave of neuropsychiatric sequelae of COVID-19? Neuropsychiatric symptoms and potential immunologic mechanisms, Brain Behav. Immun. 87 (2020) 34–39.
[9] S. Pappa, V. Ntella, T. Giannakas, et al., Prevalence of depression, anxiety, and insomnia among healthcare workers during the COVID-19 pandemic: a systematic review and meta-analysis, Brain Behav. Immun. 88 (2020) 901–907.
[10] Q. Li, Psychosocial and coping responses toward 2019 coronavirus diseases (COVID-19): a cross-sectional study within the Chinese general population, QJM 113 (10) (2020) 731–738.
[11] S.H. Goodman, Depression in mothers, Annu. Rev. Clin. Psychol. 3 (2007) 107–135.
[12] R. Ayaz, M. Hocaoğlu, T. Günay, et al., Anxiety and depression symptoms in the same pregnant women before and during the COVID-19 pandemic, J. Perinat. Med. 48 (9) (2020) 965–970.
[13] Y. Wu, C. Zhang, H. Liu, et al., Perinatal depressive and anxiety symptoms of pregnant women during the coronavirus disease 2019 outbreak in China, Am. J. Obstet. Gynecol. 223 (2) (2020) 240–241.
[14] H. Dong, R. Hu, C. Lu, et al., Investigation on the mental health status of pregnant women in China during the pandemic of COVID-19, Arch. Gynecol. Obstet. (2020) 1–7.
[15] A.F. Dadi, E.R. Miller, T.A. Bisetegn, et al., Global burden of antenatal depression and its association with adverse birth outcomes: an umbrella review, BMC Public Health 20 (1) (2020) 173.
[16] M. Pompili, M. Innamorati, D.A. Lamis, et al., The associations among childhood maltreatment, "male depression" and suicide risk in psychiatric patients, Psychiatry Res. 220 (1–2) (2014) 571–578.
[17] L. Song, L. Shen, H. Li, et al., Afternoon napping during pregnancy and low birth weight: the healthy baby cohort study, Sleep Med. 48 (2018) 35–41.
[18] H. Li, L. Song, L. Shen, et al., Age at menarche and prevalence of preterm birth: results from the healthy baby cohort study, Sci. Rep. 7 (1) (2017) 12594.

[19] T.C. Fong, C.L. Chan, R.T. Ho, et al., Dimensionality of the center for epidemiologic studies depression scale: an exploratory bi-factor analytic study, Qual. Life Res. 25 (3) (2016) 731–737.
[20] K. Kroenke, R.L. Spitzer, J.B. Williams, et al., The patient health questionnaire somatic, anxiety, and depressive symptom scales: a systematic review, Gen. Hosp. Psychiatry 32 (4) (2010) 345–359.
[21] M.G. Nielsen, E. Ørnbøl, M. Vestergaard, et al., The construct validity of the perceived stress scale, J. Psychosom. Res. 84 (2016) 22–30.
[22] P. Hiremath, K.C. Suhas, M. Manjunath, et al., COVID 19: impact of lock-down on mental health and tips to overcome, Asian J. Psychiatr. 51 (2020) 102088.
[23] N. Salari, A. Hosseinian-Far, R. Jalali, et al., Prevalence of stress, anxiety, depression among the general population during the COVID-19 pandemic: a systematic review and meta-analysis, Glob. Health 16 (1) (2020) 57.
[24] Z. Alipour, A. Kazemi, G. Kheirabadi, et al., Relationship between marital quality, social support and mental health during pregnancy, Community Ment. Health J. 55 (6) (2019) 1064–1070.
[25] K. van de Loo, R. Vlenterie, S.J. Nikkels, et al., Depression and anxiety during pregnancy: the influence of maternal characteristics, Birth 45 (4) (2018) 478–489.
[26] H. Skouteris, E.H. Wertheim, S. Rallis, et al., Depression and anxiety through pregnancy and the early postpartum: an examination of prospective relationships, J. Affect. Disord. 113 (3) (2009) 303–308.
[27] K. Milette, M. Hudson, M. Baron, et al., Comparison of the PHQ-9 and CES-D depression scales in systemic sclerosis: internal consistency reliability, convergent validity and clinical correlates, Rheumatology (Oxford) 49 (4) (2010) 789–796.
[28] V.C. Sousa, J. Vital, A.R. Costenla, et al., Maternal separation impairs long term-potentiation in CA1-CA3 synapses and hippocampal-dependent memory in old rats, Neurobiol. Aging 35 (7) (2014) 1680–1685.
[29] V.L. Katz, Work and work-related stress in pregnancy, Clin. Obstet. Gynecol. 55 (3) (2012) 765–773.