

Prenatal anxiety and obstetrical choices among pregnant women in Wuhan and Chongqing during the COVID-19 outbreak: a cross-sectional study

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Abstract

Objectives: To investigate the mental status of pregnant women and to describe their obstetrical choices during the outbreak of COVID-19. **Design:** A cross-sectional study. **Setting:** Wuhan and Chongqing, two different epidemic areas. **Population:** A total of 1947 valid questionnaires were received. **Methods:** We collected information on demographic, pregnancy, and epidemic, along with their attitudes towards the epidemic, anxiety status and obstetrical choices. We described and compared the city-based distribution of all above factors, aiming to explain how anxiety and obstetrical choices existed and differed. **Main Outcome Measures:** To explore why differences existed, we estimated the impact of the epidemic on women's anxiety by multivariable analysis. **Results:** Distribution differences could be seen between cities in employment status, household income, gestational age, fetal number, and exposure history. Women's attitudes towards COVID-19 in Wuhan were more extreme than that in Chongqing. The anxiety rate was more than double in Wuhan (24.47%) compared to that in Chongqing (10.44%). Generally speaking, obstetrical choices were similar among the 1947 participants, but more obvious in Wuhan. **Conclusions:** Our study found that the outbreak aggravated prenatal anxiety, and the influence factors could be targets of mental care. Synchronously, vital obstetrical choices changed, followed by pertinent professional advice to prevent irreversible adverse pregnancy outcomes. Online platforms may play crucial roles to address patients' needs in future PHEs. **Funding:** National Natural Science Foundation of China (No. 81771614 and No. 81771613), and the National Key Research and Development Program of China (No. 2016YFC1000407). **Keywords:** COVID-19; Pregnancy; Prenatal Anxiety; Obstetrical Choices.

Tweetable abstract: The outbreak aggravated prenatal anxiety and vital obstetrical choices changed, the associated factors of which could be targets of mental and prenatal care.

Introduction

In late December 2019, China reported a cluster of pneumonia caused by a novel coronavirus (2019-nCoV).¹ This pathogen was eventually named SARS-CoV-2 by WHO,² with its associated disease named COVID-19.³ As of 3 April 2020, 81,620 cases of infection have been confirmed in China, especially in Hubei Province

(N=67,802),⁴ however, SARS-CoV-2 has spread to at least 151 countries/territories/areas with over 800,000 cases outside of China,⁵ leading to the successive WHO announcements of "public enemy number one" and "a very high level of global risk".^{6,7}

The rapid transmission and life-threatening characteristics of COVID-19 have been reported transparently in China currently. The public, influenced by both accurate and erroneous news, are stressed.⁸ All provinces in mainland China with confirmed cases of COVID-19 have adopted the first-level PHE responses, including travel bans and executive orders on daily life.⁹ Consequently, the Chinese New Year holiday was seriously disrupted and public anxiety was aggravated about life-convenience and established arrangements.

Pregnant women, as a vulnerable population,¹⁰ may be of a particular concern, as anxiety itself has already been documented as a common psychological problem during pregnancy.¹¹ Recently, the discussion on COVID-19 complicated pregnancy mainly focused on the therapeutic aspect¹²⁻¹⁴ while little is known regarding their mental status and psychological needs during the epidemic.

Prenatal care is vital to a healthy pregnancy.¹⁵ Recently, the emergency traffic bans have made some medical resources inaccessible and the anxiety may deter women to attend routine prenatal care,¹⁶ all of which could eventually threaten pregnancy outcomes. Of particular importance are ectopic pregnancy, first-trimester spontaneous abortion, delayed detection of fetal congenital anomalies, uncontrolled hypertension and preeclampsia (which may develop into heart failure), post-term delivery and dystocia.¹⁷⁻¹⁹ These obstetrical adverse events may have more devastating consequences than COVID-19 infection itself.^{8,20,21} Certainly, professional advice on choosing obstetrical care was desired²², but we know little about women's decisions during the COVID-19 and other PHEs.

We conducted a survey in pregnant women in Wuhan (the hardest-hit area) and Chongqing (a neighboring city) during the COVID-19 outbreak, to investigate anxiety status and its influence factors, to demonstrate and explain the vital prenatal choices, and finally to guide social and medical practice.

Methods

Study design and participants

This is a cross-sectional study through a self-administered questionnaire. The anonymous survey questionnaire was designed with four modules to collect a wide range of data regarding: (1) background information of demographic, pregnancy and COVID-19 epidemic; (2) attitudes towards COVID-19; (3) anxiety status, by using Self-Rating Anxiety Scale (SAS)^{23,24}, which is widely used and demonstrated to have excellent reliability and validity among pregnant mothers^{25,26}; (4) various obstetrical choices. The content of the questionnaire was reviewed and pretested by professors in Psychiatry (Xinyu Zhou and his colleagues) and Obstetrics (Hongbo Qi and Xin Luo). Eventually, the validity was proved following appropriate revision. The main content of the questionnaire is shown in Figure 1 and the translated version of the full questionnaire (from Chinese to English) in the Appendix.

From February 3 to 9, 2020, the questionnaires were distributed, mainly through a widely-used big data platform for pregnant mothers (YunYiTong²⁷, covering more than 250,000 WeChat users nationwide) to those registered for prenatal care in hospitals in Wuhan and Chongqing only. Two distribution strategies, namely, one-by-one WeChat message and advertising on the official accounts, were applied. Additional questionnaires were distributed by obstetricians in both cities to those referred for outpatient services. Of note, through backstage set, each participant could only fill in this questionnaire once and only completed questionnaires could be submitted.

We followed relevant guidelines to ensure that the study was voluntary and confidential. The study was approved by the ethics committee of the First Affiliated Hospital of Chongqing Medical University (20200501), and an electronic informed consent was obtained before completing the questionnaire.

Procedures

Data collection and input were automatically conducted. All data from the questionnaires were reviewed and the following questionnaires were excluded: (1) maternal age <14 or >60 years; (2) non-pregnant, with the answer of "already delivered" or "<0 or >45 weeks of gestational age"; (3) answers with wrong format; (4) illogical answers, choosing two options that contradict each other in multiple-choice questions. Figure 2 shows the flow chart of our study sample selection.

The residency was based on both the city they registered for check-up (Wuhan or Chongqing) and the region they actually in at the time of survey. As a result of the Chinese Festival travel rush, these two addresses may not be exactly the same sometimes. The registration area was used as the residency for the following analyses. As a reference, a map of the actual area is included in the study sample flow chart (Figure 2).

We classified those aged [?]35 years as elder gravida. Participants were assigned into three gestational age (GA) groups: (1) the first trimester: GA <14 complete weeks, (2) the second trimester: GA from 14 to 27⁺⁶ weeks, (3) the third trimester: GA [?]28 weeks. Parity was divided into nullipara and multipara. Other grouping standards are in accordance with the categorical options in the questionnaire.

Items measuring attitudes towards COVID-19 were designed on a five-point scale from "totally disagree" to "strongly agree". Though this part was on the basis of three sections (Appendix), these 11 questions were analyzed separately.

The anxiety status was assessed using the Chinese version of the SAS scale ²⁵, and the responses to the scale were summed as a standard score and a degree of anxiety by an established method^{24,25}: the scores from 20 items were calculated to obtain a raw score ranging from 20 to 80, and the standard score was calculated using the raw score multiplied by 1.25; the standard score [?]50 indicates anxiety status; specifically, the standard score 50-59, 60-69 and [?]70 were considered mild, moderate and severe anxiety respectively.

The obstetrical choices included: (1) online consultation; (2) hospital preference; (3) prenatal visit or delivery schedule; (4) decision on the mode of delivery, child-feeding and postnatal resting; (5) the five-degree subjective impact on pregnancy of the items including changing schedule, reducing activities, and possible screening examination (e.g., chest CT scan). These unstructured questions were analyzed one-by-one.

Statistical analysis

We calculated the exact numbers and proportions for all variables in Wuhan, Chongqing, and the total for the two cities. Cronbach's alpha was used to assess the reliability of the anxiety scale. To compare the distribution of background, attitude, anxiety, and obstetrical choices between the two cities, the Chi-squared test, Kruskal-Wallis test and Student's t test were used in accordance with the type of data.

All factors related to pregnant women's background and their attitude towards COVID-19 were selected as independent variables. We used stepwise logistic regression models to estimate the effect of these factors on the anxiety status.

The Statistics Analysis Software version 9.4 (SAS Institute Inc, Cary, NC, USA) was used and a significance level of p-value < 0.05 was applied. Figures we presented were plotted with PRISM version 8.0 for windows (GraphPad Software Inc, San Diego, CA).

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Results

A total of 1947 valid questionnaires were received, of whom 932 and 1015 were from Wuhan and Chongqing, respectively. 866 (92.92%) in Wuhan and 934 (92.02%) in Chongqing stayed at where they were registered

during the study period (Figure 2). Participants reported diverse demographic, pregnancy and epidemic characteristics (Table 1). Firstly, the general situation of their demographic background was a family with middle-level income and a working pregnant mother, though distribution difference existed between cities. Secondly, most pregnant women we surveyed were on their second (32.82%) or third trimester (62.92%). Women in Wuhan had more advanced gestational age (79.83% in Wuhan vs 47.39% in Chongqing on third trimester). The majority of participants in both areas were nullipara and experienced a process of spontaneous singleton conception without comorbidity or complication, though Chongqing had a higher proportion of multiple pregnancy. Detailed distribution of comorbidity and complication was supplied in Table 1S. Thirdly, information on COVID-19 from official media were widely accepted during this period in both cities. The proportions of self-reported symptoms were statistically the same in both cities, but the exposure history to diagnosed or suspected cases was more severe in Wuhan.

Attitudes toward COVID-19 were more extreme in Wuhan (Figure 3). In general, four fifths of mothers felt nervous about the objective impacts of COVID-19, such as epidemic control, outdoor activity and person-to-person contact. Over 90% of our participants considered themselves vulnerable to this epidemic. Women in both cities, especially in Chongqing, held comparatively positive attitudes towards online medical consultation and psychological counselling.

The Cronbach's alpha for the SAS was indicative of moderate-to-good internal reliability: 0.78. Specific details are shown in Figure 4. As shown in Table 2, the mean standard score for anxiety was 43.97 (SD 8.71) for pregnant mothers in Wuhan, with a quarter of them scoring 50 or more. While in Chongqing, an average score of 40.37 (SD 7.15) was reported, among whom about 90% scored lower than 50. The overall prevalence of anxiety during this period was 17.16%. Obviously, pregnant women in the epidemic hardest-hit area were much more anxious, 18.78% and 5.69% of whom underwent mild and moderate or severe anxiety, while 9.36% and 1.08% in Chongqing. The effect of the area on SAS standard score was small-to-medium (ES 0.44).

The participants' obstetrical choices are summarized in Table 3.

Online consultation was requested by more than 70% of the participants, a higher proportion of which was in Wuhan (75.43% vs 69.46%). Absolute differences could be found between the two areas in hospital preference during this period. Of pregnant women in Wuhan, 41.85% reported nearly unconditional refusal of going to hospital recently, compared with 27.68% in Chongqing. Questionnaire responses revealed a general trust in previous (53%) and specialized (29.02%) hospital among mothers, although differences existed in the proportion of that trust between cities.

Inconvenience caused by traffic bans raised significant concern, and as a result, 80.39% and 42.41% of the 1947 participants would put off their appointments for prenatal care and hospitalized delivery. This phenomenon was more common in Wuhan (92.38% vs 72.86% and 47.29% vs 31.03%). Fear of infection was another reason for delaying their plans. With respect to prenatal care, the minority (16.3% in general) reported "as planned". Very few mothers in Wuhan chose to complete their scheduled check online (N=4) or face-to-face (2.61%). In Chongqing, however, 2.76% and 21.61% were willing to do it on time via the Internet and face-to-face. When it came to hospitalized delivery, 27.93% of all participants chose "ahead of time", among whom 15.17% wanted to be hospitalized earlier to wait for the onset of labor while 12.76% wanted to have a caesarean in advance. Only 25.17% of all women reported an "as planned" hospitalized delivery, and this proportion was higher in Chongqing (39.08% vs 19.21%).

The delivery mode seemed to be changed because of this epidemic. 12.66% of pregnant women in Wuhan would change from vaginal delivery to caesarean section, while this proportion in Chongqing was halved (6.01%). However, the reverse change, from caesarean to vaginal delivery, was smaller (Wuhan 5.58%, Chongqing 3.05%). These city-based differences and uneven changes in mode could also be seen in choosing ways of child-feeding and postnatal resting. Overall, there would be more women who preferred caesarean section, bottle feeding and postnatal rest at home during this period than before, especially in Wuhan.

Over 90% of pregnant women, in total, believed in the negative impact of changing schedule and reducing

activities on pregnancy, and these subjective impacts were more significant in Wuhan. Slightly more than half of the women (50.08%) thought the chest CT scan would significantly influence their pregnancy, and it was more severe in Chongqing.

The multivariable analysis (Table 4) showed strong associations between background, attitude, and anxiety. First of all, pregnant women from a middle-level income family were about half as likely to report anxiety than those earning an extremely high or low wage. Secondly, women in Wuhan were about twice likely to develop anxiety. Thirdly, those who had fever, cough, diarrhea or symptoms of suspected infection were five times likely to have anxiety than otherwise healthy women. Furthermore, the attitudes towards COVID-19 were associated with anxiety status. Those with relatively more knowledge about COVID-19 and with rational risk perception (not too nervous about epidemic control or going out), were less likely to be anxious. Additionally, positive attitudes towards online medical consultation demonstrated a protective feature from anxiety, while those towards psychological consultation showed the opposite effect.

Discussion

Main findings

We report the first large cross-sectional study of pregnant women on their anxiety status and obstetrical choices during the outbreak of COVID-19. We focused on the epicenter (Wuhan) and a neighboring city (Chongqing), involving 932 and 1015 participants, respectively.

Previous studies indicate that the global estimated prevalence of anxiety during pregnancy fluctuates at about 14%-24%^{28,29}, and this prevalence was about 15.04% in China.³⁰ Unfortunately, during the study period, the anxiety rate was 17.16% generally, with a much higher rate in Wuhan (24.47%) but within the expected range in Chongqing (10.44%). Such a difference was probably due to the highest exposure and the strictest restrictions in Wuhan. We found out that being the epidemic center had major impact on anxiety, along with household income and important attitudes towards COVID-19 (e.g. outdoor activities). Though previous studies found pregnancy characteristics as influence factors of prenatal anxiety³⁰⁻³², these factors have not been identified through our multivariable analysis, but may be potentially associated with anxiety given our results of univariable analysis (Table 4S). We believe that the mechanism of epidemic to anxiety is unique, so regional differences greatly mask these conventional factors, which further reminds us to pay attention to prenatal anxiety during a PHE.

Similar to anxiety, obstetrical choices revealed an area-based difference. Vital choices changed, including the time of prenatal care or delivery, mode of delivery and child-feeding, etc. Those changes, without guidance, may lead to irreversible adverse events. Although the influence factors of obstetrical issues were hard to describe in a short time (data not shown), our hypothesis (Figure 1) was likely to exist as some evidence already showed that anxiety could change prenatal decisions.^{16,33} A mediation analysis, should be conducted to better understand the pathway of prenatal anxiety to obstetrical choices during a PHE, and is a planned step based on the current data. Here, we hope to get more concern from researchers and call for relevant suggestions.

Strengths and limitations

Our study has several strengths. First, two cities provided a similar sample size. Wuhan as the epidemic center was included. Further, to reduce selection bias, questionnaires were distributed to multi-centers mainly through the nationwide online data platform (YunYiTong). As a result, the representativeness of our participants, for pregnant women in Wuhan and Chongqing, is reliable.

Our study sample is relatively good for pregnant women in other places (especially in emerging epidemic areas around the world). However, appropriate adjustments need to be made before the relevant application. In the comparative results, Chongqing, as a municipality adjacent to Hubei Province (Wuhan is the provincial capital city), is significantly affected than other regions far away from Wuhan, which may weaken the impact gap of COVID-19. Descriptive results were observed cross-region and are likely to be found in other places.

Some limitations should also be considered when interpreting the results. Firstly, the study design suggests the possibility of self-report bias. Secondly, the anxiety level may be underestimated. Pregnant women who are not registered on the Internet platform or not registered in the hospital may not participate, and they may have a lower socio-economic status and a higher level of anxiety.³² In addition, pregnant women in the middle and late stages of their pregnancy accounted for the majority of the subjects, and the highest level of anxiety reported in the past should be early pregnancy.³² Finally, this is a cross-sectional study, so long-term studies such as post-traumatic stress disorder or postpartum mental state are worth following up.

Interpretation

Improving prenatal care to prevent adverse pregnancy outcomes is of global concern. The guideline for prenatal care has been accepted and applied nationwide in China.^{28,29} However, during an unpredictable period such as a PHE, comprehensive updated recommendations are urgently needed. Our findings can serve as a reference for the update in the following aspects:

Psychological intervention

Prenatal anxiety, which may cause great changes in the choice of obstetrical care, and then affect the outcome of pregnancy^{20,21,34,35}, should be paid attention to. Therefore, during the global outbreak of COVID-19, psychological intervention and corresponding public health measures for pregnant women are necessary, which need the close cooperation of psychologists, obstetricians and public health administration.⁸

From the psychological point of view, cognition is easy to be manipulated. Our research results show that if some cognition (reflected in attitude), even if it is reasonable, gets too centralized to control, anxiety is inevitable. Therefore, during this period, some cognitive related interventions should be taken: (1) to push the information of authoritative source; (2) to correctly understand the susceptibility of disease; (3) to perceive the risk rationally (not too extreme).

Medical assistance

From our clinical observation, postponement or cancelation of planned check-up or delivery has already led to recent negative consequences. To prevent irreversible adverse events, we believe that postponing prenatal care visit or delivery should not be applied to everyone. In some circumstances, instead, scheduled check-up and prompt hospitalization were highly recommended: (1) approaching terminal gestational age (beyond 37 completed weeks); (2) complex multiple pregnancy; (3) with severe maternal comorbidity or obstetrical complication; (4) signs of labor (rupture of membrane, severe abdominal pain, etc.); (5) Any of the following signs including abnormal fetal movement, vaginal bleeding, convulsions/fits, severe headaches with blurring vision, fever, severe abdominal pain, fast or difficult breathing.³⁶ It is also suggested that some essential prenatal examinations should not be postponed beyond its opportune gestational age: (1) ultrasound examination for confirming intrauterine pregnancy and Nuchal Translucency (NT) measurement (11⁺⁰ to 13⁺⁶ weeks); (2) screening for fetal aneuploidy; (3) prenatal diagnosis with medical indications; (4) ultrasound screening for fetal structural anomalies; (5) oral glucose tolerance test (24⁺⁰ to 27⁺⁶ weeks). Notably, to avoid cross-infection, designated hospitals for COVID-19 treatment were assigned in all counties in China. Going to hospital, which is not on the list of treatment center, is still relatively safe but reasonable protective measures (wearing masks and hand hygiene) must be taken.

Our findings suggested that caesarean delivery on maternal request (CDMR) and bottle feeding might increase to avoid vertical transmission. For researchers, lessons about vertical transmission could be learnt from other similar PHEs (like SARS and MERS)³⁷⁻³⁹, and as new evidence comes to light^{13,14,40}, such possibility is likely to be rejected. Recently, our group proposed a contingency plan for the 2019-nCoV outbreak in the Neonatal Intensive Care Units, where the possibility of vertical transmission was also discussed.⁴¹ However, more explorations with transparency and solidarity on the mother-to-child transmission are still needed.⁴² For obstetricians, the preparations for increasing caesarean rate and the contingency plan for perinatal infection need to be developed and implemented quickly. Importantly, the authoritative education on delivery and child-feeding during this special period should be available to prenatal mothers. Additionally,

the education about the radiography during pregnancy should focus on its comparative safety and diagnostic necessity, to decrease patients' concerns.

How to conduct education and *consultation: digital healthcare*

In summary, online official media, such as WeChat or application programs, can provide authoritative prevention education and medical consultation updated every day. These means are essential in this period of time and will become a trend afterwards.⁸In our study, more than 70% of participants proposed that advice should be obtained in this way. First of all, booking medical time through online platform helps to avoid overcrowding. Secondly, it is relatively safe and convenient to keep in touch with doctors, especially in the case of a PHE. Thirdly, in the era of big data, under the premise of confidentiality, the research based on network platforms will be very meaningful. At present, our research team is focusing on the detailed medical problems put forward by pregnant women on the Internet. The results can be used to guide obstetric practice and develop into personalized medical and health education in the future.

Social support

Traffic restriction has dual effects in this period, which requires risk balancing, between epidemic prevention and control and mental pressure, as well as between the availability of important medical resources.^{11,30,43} It is worth noting that the inconvenient transportation may change the medical choices, which reminds us of the rationality of opening "green channel" for this special group and the special social support for pregnant women in the quarantine zones.

Conclusion

Our study found that the outbreak aggravated prenatal anxiety, and the influence factors could be targets of mental care. Synchronously, vital obstetrical choices changed, followed by pertinent professional advice to prevent irreversible adverse pregnancy outcomes. Online platforms may play crucial roles to address patients' needs in future PHEs.

Disclosure of Interest

The authors report no conflict of interest.

Contribution to Authorship

HBQ, XL and XYL contributed to the protocol design. MMC and GQS collected data. LS and YW analysed data. JZ, YS, HZ and PB contributed to the interpretation of results. XYL drafted the manuscript and JHW proofread the manuscript. HBQ and XL revised the final version and are guarantors of this manuscript. All authors made substantial contributions to the paper and read and approved the final manuscript.

Details of Ethics Approval

We followed relevant guidelines to ensure that the study was voluntary and confidential. The study was approved by the ethics committee of the First Affiliated Hospital of Chongqing Medical University (20200501), and an electronic informed consent was obtained before completing the questionnaire.

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Data Sharing

The data used and analysed during the current study are available from the corresponding author on reasonable request.

References

1. Wuhan Municipal Health Commission. Report of clustering pneumonia of unknown aetiology in Wuhan City, 2019. <http://wjw.wuhan.gov.cn/front/web/showDetail/2019123108989> (accessed Jan 20, 2020 [in Chinese]).
2. Gorbalenya AE, Baker SC, Baric RS, et al. Severe acute respiratory syndrome-related coronavirus: The species and its viruses – a statement of the Coronavirus Study Group. *bioRxiv* 2020: 2020.02.07.937862. DOI: 10.1101/2020.02.07.937862
3. WHO. WHO Director-General’s remarks at the media briefing on 2019-nCoV on 11 February 2020, <https://www.who.int/dg/director-general-s-remarks-at-the-media-briefing-on-2019-ncov-on-11-february-2020> (accessed 11 Feb, 2020).
4. National Health Commission of the People’s Republic of China. Update on epidemic situation of novel coronavirus-infected pneumonia by 24:00 on 2 Apr, 2020. <http://www.nhc.gov.cn/xcs/yqtb/202004/4786774c1fd84e16b29d87> (accessed 3 Apr, 2020 [in Chinese]).
5. WHO. Coronavirus disease 2019 (COVID-19) situation report - 73. 2 Apr, 2020. https://www.who.int/docs/default-source/coronaviruse/situation-reports/20200402-sitrep-73-covid-19.pdf?sfvrsn=5ae25bc7_2 (accessed 3 Apr, 2020).
6. WHO. WHO Emergencies Press Conference on novel coronavirus - 11 February 2020. <https://www.who.int/docs/default-source/coronaviruse/transcripts/who-audio-emergencies-coronavirus-full-press-conference-11feb2020-final.pdf?sfvrsn=e201912> (accessed 20 Feb, 2020).
7. WHO. WHO Director-General’s opening remarks at the media briefing on COVID-19 - 28 February 2020. <https://www.who.int/director-general-s-opening-remarks-at-the-media-briefing-on-covid-19—28-february-2020> (accessed 3 Mar, 2020).
8. Bao Y, Sun Y, Meng S, Shi J, Lu L. 2019-nCoV epidemic: address mental health care to empower society. *Lancet (London, England)* 2020. DOI: 10.1016/S0140-6736(20)30309-3
9. China Daily. Tibet activates highest-level public health alert. Jan 29, 2020. <https://www.chinadaily.com.cn/a/202001/29/> (accessed 4 Feb, 2020).
10. National Health Commission of the People’s Republic of China. <http://www.nhc.gov.cn/fys/s7902/202002/de2d62a5711c4> (accessed 12 Feb, 2020 [in Chinese]).
11. Yan W, Wang X, Kuang H, et al. Physical activity and blood pressure during pregnancy: Mediation by anxiety symptoms. *J Affect Disord* 2020; **264** : 376-82.
12. National Health Commission of the People’s Republic of China. Notice on strengthening maternal disease treatment and safe midwifery during the prevention and control of new coronavirus pneumonia. <http://www.nhc.gov.cn/xcs/zhengcwj/202002/4f80657b346e4d6ba76e2cfc3888c630.shtml> (accessed 8 Feb, 2020 [in Chinese]).
13. Qiao J. What are the risks of COVID-19 infection in pregnant women? *The Lancet* 2020. DOI: 10.1016/S0140-6736(20)30365-2
14. Chen H, Guo J, Wang C, et al. Clinical characteristics and intrauterine vertical transmission potential of COVID-19 infection in nine pregnant women: a retrospective review of medical records. *The Lancet* 2020. DOI: 10.1016/S0140-6736(20)30360-3
15. Dowswell T, Carroli G, Duley L, et al. Alternative versus standard packages of antenatal care for low-risk pregnancy. *Cochrane Database Syst Rev* 2015; (7): CD000934.

16. Cheng BH, Chen JH, Wang GH. Psychological factors influencing choice of prenatal diagnosis in Chinese multiparous women with advanced maternal age. *J Matern Fetal Neonatal Med* 2019; **32** (14): 2295-301.
17. Chou D, Daelmans B, Jolivet RR, et al. Ending preventable maternal and newborn mortality and stillbirths. *BMJ (Clinical research ed)* 2015; 351: h4255.
18. Obstetrics Subgroup, Chinese Society of Obstetrics and Gynecology, Chinese Medical Association. Guideline of preconception and prenatal care (2018). *Chin J Obstet Gynecol* 2018; **53** (1): 7-13. (in Chinese)
19. Brown MA, Magee LA, Kenny LC, et al. The hypertensive disorders of pregnancy: ISSHP classification, diagnosis & management recommendations for international practice. *Pregnancy hypertension* 2018;**13** : 291-310.
20. Dunkel Schetter C, Tanner L. Anxiety, depression and stress in pregnancy: implications for mothers, children, research, and practice. *Curr Opin Psychiatry* 2012; **25** (2): 141-8.
21. Rose MS, Pana G, Premji S. Prenatal Maternal Anxiety as a Risk Factor for Preterm Birth and the Effects of Heterogeneity on This Relationship: A Systematic Review and Meta-Analysis. *Biomed Res Int* 2016; **2016** : 8312158.
22. Faherty LJ, Rasmussen SA, Lurie N. A call for science preparedness for pregnant women during public health emergencies. *Am J Obstet Gynecol* 2017; **216** (1): 34 e1- e5.
23. Zung WW. A rating instrument for anxiety disorders. *Psychosomatics* 1971; **12** (6): 371-9.
24. Wang ZY. Chinese version of Zung's self-rating anxiety scale. *J Shanghai Psychiatry* 1984; **2** : 73-4. (in Chinese)
25. Ma X, Wang Y, Hu H, Tao XG, Zhang Y, Shi H. The impact of resilience on prenatal anxiety and depression among pregnant women in Shanghai. *J Affect Disord* 2019; **250** : 57-64.
26. Glynn LM, Schetter CD, Hobel CJ, Sandman CA. Pattern of perceived stress and anxiety in pregnancy predicts preterm birth. *Health Psychol* 2008; **27** (1): 43-51.
27. YunYiTong. www.cqyyt.net. version 1.0 (accessed 2 Feb, 2020 [in Chinese]).
28. World Health Organization. Maternal mental health and child health and development in resource-constrained settings: Report of a UNFPA/WHO international expert meeting: the interface between reproductive health and mental health. Geneva: World Health Organization Press; 2009.
29. Bennett HA, Einarson A, Taddio A, Koren G, Einarson TR. Prevalence of depression during pregnancy: systematic review. *Obstet Gynecol* 2004; **103** (4): 698-709.
30. Tang X, Lu Z, Hu D, Zhong X. Influencing factors for prenatal Stress, anxiety and depression in early pregnancy among women in Chongqing, China. *J Affect Disord* 2019; **253** : 292-302.
31. Kang YT, Yao Y, Dou J, et al. Prevalence and Risk Factors of Maternal Anxiety in Late Pregnancy in China. *Int J Environ Res Public Health* 2016; **13** (5).
32. Zhang Y, Muyiduli X, Wang S, et al. Prevalence and relevant factors of anxiety and depression among pregnant women in a cohort study from south-east China. *J Reprod Infant Psychol* 2018; **36** (5): 519-29.
33. Sahin NH, Gungor I. Congenital anomalies: parents' anxiety and women's concerns before prenatal testing and women's opinions towards the risk factors. *J Clin Nurs* 2008; **17** (6): 827-36.
34. Nasreen HE, Kabir ZN, Forsell Y, Edhborg M. Low birth weight in offspring of women with depressive and anxiety symptoms during pregnancy: results from a population based study in Bangladesh. *BMC Public Health* 2010; **10** : 515.

35. Kogan MD, Alexander GR, Kotelchuck M, Nagey DA. Relation of the content of prenatal care to the risk of low birth weight. Maternal reports of health behavior advice and initial prenatal care procedures. *JAMA* 1994; **271** (17): 1340-5.
36. WHO, United Nations Population Fund, UNICEF. Pregnancy, childbirth, postpartum and newborn care: A guide for essential practice (3rd edition). <https://apps.who.int/iris/bitstream/handle/10665/249580/9789241549356-eng.pdf;jsessionid=586E220FF9B5DBFF2DA34C7896836883?sequence=1> (accessed 11 Feb, 2020).
37. Alfaraj SH, Al-Tawfiq JA, Memish ZA. Middle East Respiratory Syndrome Coronavirus (MERS-CoV) infection during pregnancy: Report of two cases & review of the literature. *J Microbiol Immunol Infect* 2019; **52** (3): 501-3.
38. Wong SF, Chow KM, Leung TN, et al. Pregnancy and perinatal outcomes of women with severe acute respiratory syndrome. *Am J Obstet Gynecol* 2004; **191** (1): 292-7.
39. Maxwell C, McGeer A, Tai KFY, Sermer M. No. 225-Management Guidelines for Obstetric Patients and Neonates Born to Mothers With Suspected or Probable Severe Acute Respiratory Syndrome (SARS). *J Obstet Gynaecol Can* 2017; **39** (8): e130-e7.
40. Zheng QL, Duan T, Jin LP. Single-cell RNA expression profiling of ACE2 and AXL in the human maternal-Fetal interface. *Reprod Dev Med* [Epub ahead of print] [cited 2020 Feb 22]. Available from: <http://www.repdevmed.org/preprintarticle.asp?id=278679>
41. Wang J, Qi H, Bao L, Li F, Shi Y. A contingency plan for the management of the 2019 novel coronavirus outbreak in neonatal intensive care units. *Lancet Child Adolesc Health* 2020. DOI: 10.1016/S2352-4642(20)30040-7
42. Calisher C, Carroll D, Colwell R, et al. Statement in support of the scientists, public health professionals, and medical professionals of China combatting COVID-19. *The Lancet* 2020. DOI: 10.1016/S0140-6736(20)30418-9
43. Rubin GJ, Wessely S. The psychological effects of quarantining a city. *BMJ (Clinical research ed)* 2020; **368** : m313.

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Figure 1. The content of questionnaire and the hypothesis of our study

