

## Research Article

# Mental and Physical Symptoms and Perceived Health Risks of Pregnant and Postpartum Women following the Significant Shift in COVID-19 Management in China: A Cross-Sectional Survey

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Received 23 November 2023; Revised 31 January 2024; Accepted 5 February 2024; Published 6 March 2024

Academic Editor: Bao-Liang Zhong

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**Background.** There was a remarkable downgrade in China's COVID-19 response strategies in January 2023. The COVID-19 infection rate grew rapidly in the early stages following the management policy shift. This study attempted to explore the associations between SARS-CoV-2 infection and mental or physical health status in pregnant and postpartum women and the role of perceived health risks and family members' SARS-CoV-2 infection status on these associations by capturing the impact of policy shifts in a short period of time. **Methods.** This cross-sectional study with a random sample from a convenience sample of hospitals was conducted in pregnant and postpartum women in January 2023. Standardized assessment tools were employed to assess anxiety, depressive and physical symptoms, and feelings of hopelessness. Hierarchical multiple logistic regressions were conducted to examine the mechanisms of associations of interests by including a range of sociodemographic factors, self-perceived health, SARS-CoV-2 infection status, and perceived health risks as covariates. **Results.** Of the 1,013 pregnant and postpartum women aged  $32.0 \pm 0.3$  years, 58.2% ( $n = 590$ ) were diagnosed with COVID-19, and 49.4% ( $n = 500$ ) had family members who were infected with SARS-CoV-2. Nearly 98% of the included participants took measures to prevent SARS-CoV-2 infection. A COVID-19 diagnosis was positively associated with feelings of hopelessness (OR = 1.68, 95% CI: 1.20–2.35), probable anxiety (OR = 6.42, 95% CI: 2.18–24.61), possible depression (OR = 2.56, 95% CI: 1.07–6.70), and physical symptoms (OR = 6.28, 95% CI: 1.63–42.03) after adjusting for sociodemographic and health characteristics, while the associations presented no statistical significance when family members' SARS-CoV-2 infection status and perceived health risks were introduced into the models. **Conclusions.** Our results suggested that pregnant and postpartum women may experience physical and mental health challenges when they or their family members contracted COVID-19 in the context of a considerable shift in COVID-19 management. Early detection of poor health status and its risk factors for vulnerable groups during shifts in health policy and administrative practice is very necessary, and health services, including easy access to psychosocial support and obstetric counselling, should be prioritized.

## 1. Introduction

After implementing the national “dynamic zero COVID” policy for nearly three years, China began to adjust its COVID-19 response strategies with the attenuated pathogenicity of the omicron subvariants and increasing vaccination coverage [1]. On January 8, 2023, the COVID-19 management policy was downgraded from Class A to Class B in accordance with the country’s law on the prevention and treatment of infectious disease. Authorities dropped quarantine measures against people infected with SARS-CoV-2 and discontinued identifying close contacts and designating high-risk and low-risk areas. In addition, disease control measures targeting inbound tourists and imported cargo were lifted. Furthermore, COVID-19 testing and centralized isolation for all overseas tourists entering China was cancelled. After the shift of the policy, no measures were taken to isolate the source of infection and identify the close contacts, resulting in the rapid rise of the infection rate of COVID-19 [1]. At the beginning of the shift, the rapid rise of the COVID-19 infection rate combined with concerns about being infected and the complications following with SARS-CoV-2 infection may lead to residents presenting adverse mental health response, such as panic disorder, stress, anxiety, and depression. Adverse mental health consequences in residents due to concerns about COVID-19 infection and postinfection health were demonstrated in the early stages of the pandemic [2].

Pregnant and postpartum women are one of the most physically and psychologically vulnerable groups, especially during the pandemic. Pregnancy is a state of compromised immunity, and biological adaptations during pregnancy may make women more susceptible to viral respiratory infections [3–5]. During pregnancy and puerperium, women need better health protection measures to protect them from the virus to reduce or prevent adverse maternal and fetal outcomes, and the downgrading of response policies may expose them to more health risks. Studies have shown that pregnant individuals with a COVID-19 diagnosis have higher rates of adverse outcomes, including maternal mortality, preeclampsia, and preterm birth than pregnant individuals without a COVID-19 diagnosis [6, 7].

Pregnant and postpartum women, who face with a series of changes in the physiological-psychological-social environment, are more likely to suffer from psychological problems after experiencing emergencies, which will increase the risk of mental illness [8]. Several studies have supported greater mental health concerns (e.g., anxiety, self-harm, or suicidality) of pregnant and postpartum women during the pandemic the mental health during the COVID-19 pandemic [9–11]. However, there are few studies targeting pregnant and postpartum women’s mental and physical health in the context of substantial COVID-19 response policy shifts. Therefore, this study explored the mental and physical symptoms of pregnant and postpartum women, the associations between SARS-CoV-2 infection and mental or physical symptoms, and the role of perceived health risks and family members’ SARS-CoV-2

infection status on these relationships by capturing the impact of policy changes in a short period of time. Based on previous studies, we hypothesized that there would be differences in mental and physical symptoms between SARS-CoV-2-infected and noninfected pregnant and postpartum women, and the associations between SARS-CoV-2 infection and mental and physical symptoms would be influenced by the infection status of family members and perceived health risks. The threat of pandemics is never over [12, 13], and the current study aims to enrich the evidence on the impact of health shocks from the pandemic on mental and physical health, and to provide evidence for mental health maintenance in the crisis response activities for pregnant and postpartum women.

## 2. Methods

**2.1. Study Design and Participants.** This was a cross-sectional study conducted among Chinese pregnant and postpartum women by using an online questionnaire in January 2023. Two large tertiary hospitals, i.e., the Shaanxi Provincial People’s Hospital and the Second Affiliated Hospital of Xi’an Medical University, were among the contacted hospitals that were available to participate in the study. Therefore, the recruited participant was a random sample from two convenience hospitals among outpatients visiting the department of obstetrics. We included women who (1) were 18 years old or above, and (2) were pregnant during the survey period or had given birth within the past 12 months. Participants were informed of the principle of voluntary participation in this survey and were also reassured of the anonymity and confidentiality. Those who agreed to participate could scan the QR code to access the questionnaire, and informed consent was provided by the participants completing the survey. The Research Ethics Committee of Xi’an Jiaotong University approved the study protocol (No. 2023-1628). We followed the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) guidelines to report this study [14].

**2.2. Assessment Tools.** Self-designed questionnaires were used in this study, including the following parts.

**2.2.1. Sociodemographic and Self-Perceived Health Characteristics.** Information was collected for the following: age (years), pregnancy and childbirth status (pregnant (36 weeks or less)/pregnant (more than 36 weeks)/postpartum (42 days or less)/postpartum (more than 42 days)), number of children (one/two/three), weight (kg), monthly family income level (<5,000 CNY/5,000–10,000/20,000 CNY or more), educational level (primary school or below/middle school/college or above), employment status (unemployed/other), partner’s educational level (primary school or below/middle school/college or above), partner’s employment status (unemployed/other), relationship with partner (good/general/poor), and self-perceived health status (good/general/poor).

**2.2.2. SARS-CoV-2 Infection Status.** The SARS-CoV-2 infection status of the participants, their babies (those who were in the prenatal period were classified as “not infected”), and their family members was determined by asking “whether you (your baby/other family member, separately) have got SARS-CoV-2 infection with a positive laboratory test or self-test result (yes/no)?” Notably, during our survey period, 2019-nCoV Kits was widely used for self-testing due to the widespread infection.

**2.2.3. Perceived Health Risks.** Four questions were asked to evaluate the participants’ self-perceived health risks, i.e., (1) Are you concerned about the impact of the SARS-CoV-2 on your or your family members’ health (No/Yes)? (2) Are you concerned about the crowding out of health care resources due to SARS-CoV-2 infection (No/Yes)? (3) Have you prepared medication related to the SARS-CoV-2 in advance (No/Yes)? (4) Have you taken any of the following measures to prevent SARS-CoV-2 infection? (1 = wearing a mask, 2 = washing hands frequently, 3 = disinfecting belongings, 4 = reducing visits to crowded places, 5 = maintaining social distancing, 6 = no measures taken; multiple choice)?

#### 2.2.4. Mental Health and Physical Symptoms

**(1) Anxiety Symptoms.** The Chinese version of the Generalized Anxiety Disorder-7 (GAD-7) (Cronbach’s alpha: 0.89) was used to assess the anxiety symptoms over the last two weeks [15]. It consists of seven items, and each item is scored from 0 to 3. The total score ranges from 0 to 21 with the higher the total score, the more serious the level of anxiety symptoms [16]. A score of 10 or greater is an indicator of probable anxiety [17].

**(2) Depressive Symptoms.** Depression symptoms over the past two weeks were collected using the validated Chinese version of the Patient Health Questionnaire-9 (PHQ-9) [18–21], with a Cronbach alpha coefficient of 0.86 [20]. Participants indicate how often they have been bothered by each symptom using a four-point Likert scale ranging from 0 (not at all) to 3 (nearly every day), with an overall score ranging from 0 to 27. Those with a score of 10 or greater are considered to have moderate or severe depression symptoms (possible depression) [18].

**(3) Physical Symptoms.** We used the validated Chinese version of the Patient Health Questionnaire-15 items (PHQ-15, Cronbach’s alpha: 0.83) to measure the severity of undifferentiated physical symptoms commonly recognized during the previous 4 weeks, scored on a 3-point scale as 0 (“not bothered at all”), 1 (“bothered a little”), or 2 (“bothered a lot”) [22, 23]. The PHQ-15 is widely used and had a total symptom severity score ranging from 0 to 30. A score of 10 represented the cutoff point for medium or high somatic symptom severity in our study [23].

**(4) Feelings of Hopelessness.** We used the validated Chinese version of the Beck Hopelessness Scale to evaluate the participants’ perceived level of hopelessness (BHS,

Cronbach’s alpha: 0.85), which includes 20 true-false items [24, 25]. The total score ranges from 0 to 20; a higher score indicates a greater level of hopelessness. We considered participants with a score of 9 or greater as having a moderate or severe level of hopelessness (hereafter referred to as hopelessness) [26]. The scale helps to assess three aspects of hopelessness: feelings about the future, loss of motivation, and future expectations [24, 25]. In addition, the predictive validity of the BHS for suicide attempts and suicide has been demonstrated [27].

**2.3. Statistical Analyses.** To explore the associations between the SARS-CoV-2 infection and the four health aspects (anxiety symptoms, depressive symptoms, hopelessness, and physical symptoms) and the contribution of the SARS-CoV-2 infection status of all family members (the baby and other family members) and perceived health risks to these associations, hierarchical multiple logistic regression models were fitted for each health indicator and the model helps to capture the unique contribution of each part of the independent variables of interest on explaining the potential source of mental health and physical symptoms.

Model 1 was fitted by setting one of the four health indicators as the dependent variable and SARS-CoV-2 infection as the independent variable, adjusted for socio-demographic and health characteristics including age (years), weight (kg), number of children, monthly family income (CNY), educational level, employment status, partner’s educational level, partner’s employment status, relationship with the partner, and self-perceived health status. In Model 2, adjustments were made by adding SARS-CoV-2 infection status of all family members on the basis of adjustments for Model 1. In Model 3, perceived health risks, including concerns about the impact of COVID-19 infection on health, concerns about the crowding out in health care resources, preparing medication related to the SARS-CoV-2 infection in advance and taking measures to prevent SARS-CoV-2 infection (yes/no measures taken), were added on the basis of adjustments for Model 1. We adjusted for all the aforementioned variables in the last model. For each model, the  $R$ -square change ( $\Delta R^2$ ) was used to indicate the predictive power of each group of predictor(s) when adjustments were made for previous predictor(s). The results are expressed with odds ratios (ORs) and their 95% confidence intervals (CIs). All data were analysed in R version 4.0.0 [28] via RStudio [29], with a significant  $\alpha$  threshold of 0.05 (two-tailed).

### 3. Results

This study included 1,013 pregnant and postpartum women with an average age of 32.0 (SD = 0.3) years, 58.2% (590) of whom were diagnosed with COVID-19 infection, 68.8% (697) were in the prenatal period, and 65.4% (662) were primiparas. A total of 49.4% ( $n = 500$ ) of the participants had family members infected with SARS-CoV-2. Table 1 shows the basic characteristics and self-perceived health status of the included participants.

TABLE 1: Demographic characteristics of the participants ( $N = 1,013$ ).

Variables	No COVID-19 diagnosis ( $N = 423$ ) $M \pm SD$	COVID-19 diagnosis ( $N = 590$ ) $M \pm SD$	Overall $M \pm SD$
Age (years)	$32.0 \pm 0.1$	$32.0 \pm 0.4$	$32.0 \pm 0.3$
Weight (kg)	$61.1 \pm 7.8$	$63.1 \pm 9.0$	$62.3 \pm 8.6$
	$n$ (%)	$n$ (%)	$n$ (%)
<i>Pregnancy and childbirth status</i>			
Pregnant (36 weeks or less)	217 (51.3%)	274 (46.4%)	491 (48.5%)
Pregnant (>36 weeks)	69 (16.3%)	137 (23.2%)	206 (20.3%)
Postpartum (42 days or less)	61 (14.4%)	71 (12.0%)	132 (13.0%)
Postpartum (>42 days)	76 (18.0%)	108 (18.3%)	184 (18.2%)
<i>Number of child(ren)</i>			
One	311 (73.5%)	351 (59.5%)	662 (65.4%)
Two	104 (24.6%)	231 (39.2%)	335 (33.1%)
Three	8 (1.9%)	8 (1.4%)	16 (1.6%)
<i>Monthly family income (CNY)</i>			
<5,000	167 (39.5%)	72 (12.2%)	239 (23.6%)
5,000–10,000	184 (43.5%)	256 (43.4%)	440 (43.4%)
>10,000	72 (17.0%)	262 (44.4%)	334 (33.0%)
<i>Educational level</i>			
Primary school or below	41 (9.7%)	6 (1.0%)	47 (4.6%)
Middle school	116 (27.4%)	75 (12.7%)	191 (18.9%)
College or above	266 (62.9%)	509 (86.3%)	775 (76.5%)
<i>Employment status</i>			
Unemployed	37 (8.7%)	78 (13.2%)	115 (11.4%)
Other	386 (91.3%)	512 (86.8%)	898 (88.6%)
<i>Partner's educational level</i>			
Primary school or below	47 (11.1%)	6 (1.0%)	53 (5.2%)
Middle school	113 (26.7%)	70 (11.9%)	183 (18.1%)
College or above	263 (62.2%)	514 (87.1%)	777 (76.7%)
<i>Partner's employment status</i>			
Unemployed	17 (4.0%)	10 (1.7%)	27 (2.7%)
Other	406 (96.0%)	580 (98.3%)	986 (97.3%)
<i>Relationship with the partner</i>			
Good	409 (96.7%)	550 (93.2%)	959 (94.7%)
General	14 (3.3%)	37 (6.3%)	51 (5.0%)
Poor	0 (0%)	3 (0.5%)	3 (0.3%)
<i>Self-perceived health status</i>			
Good	385 (91.0%)	428 (72.5%)	813 (80.3%)
General	32 (7.6%)	154 (26.1%)	186 (18.4%)
Poor	6 (1.4%)	8 (1.4%)	14 (1.4%)
<i>Family members' SARS-CoV-2 infection status</i>			
No	395 (93.4%)	141 (23.9%)	536 (52.9%)
Yes	28 (6.6%)	449 (76.1%)	477 (47.1%)
<i>Baby with SARS-CoV-2 infection</i>			
No	415 (98.1%)	421 (71.4%)	836 (82.5%)
Yes	8 (1.9%)	169 (28.6%)	177 (17.5%)

CNY: Chinese Yuan.

The corresponding prevalence and scores of the four health aspects stratified by SARS-CoV-2 infection are shown in Figure 1. A total of 30.7% (95% CI: 27.9%–33.6%), 3.8% (95% CI: 2.8%–5.2%), 3.8% (95% CI: 2.8%–5.2%), and 2.6% (95% CI: 1.7%–3.7%) of the participants reported having a moderate or severe level of feelings of hopelessness, probable anxiety, possible depression, and physical symptoms, respectively. Participants with a COVID-19 diagnosis had higher mental health and physical symptoms scores, and

were more likely to have mental health and physical symptoms than those without a COVID-19 diagnosis.

Regarding the perceived health risks since the declaration of the new COVID-19 management policy in China, 54.2% of the included participants reported concerns about the impact of COVID-19 infection on health, 48.0% reported concerns about the crowding out in health care resources, and 51.6% reported preparing medication related to the SARS-CoV-2 infection in advance. Only 1.9% of the

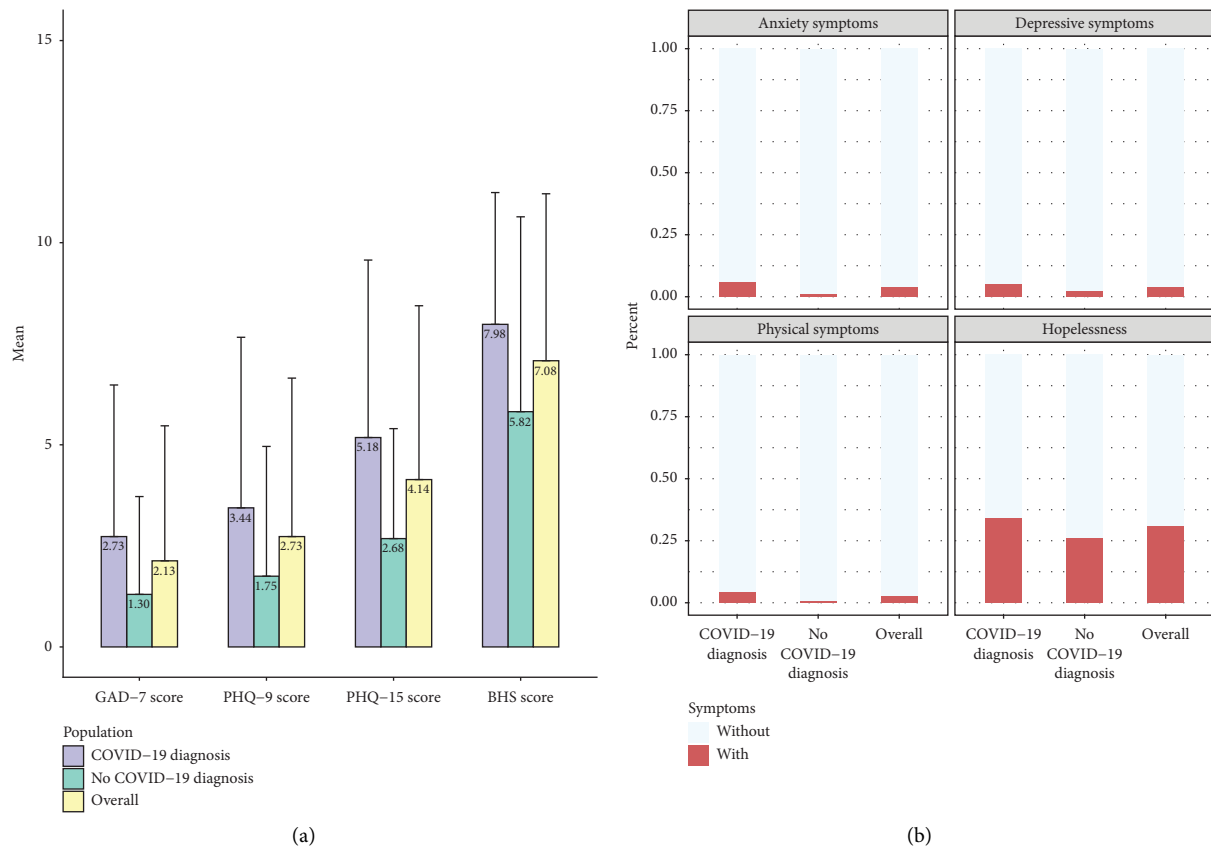


FIGURE 1: Mental and physical symptoms stratified by SARS-CoV-2 infection ( $N=1,013$ ). *Note.* BHS, beck hopelessness scale; GAD-7, generalized anxiety disorder scale-7; PHQ-9, patient health questionnaire-9; PHQ-15, patient health questionnaire-15.

participants took no measures to prevent the SARS-CoV-2 infection. Table 2 presents the participants' perceived health risks from COVID-19 infection stratified by SARS-CoV-2 infection. Participants with a COVID-19 diagnosis were more likely to report perceived health risks.

A COVID-19 diagnosis was positively associated with feelings of hopelessness (OR = 1.68, 95% CI: 1.20–2.35), probable anxiety (OR = 6.42, 95% CI: 2.18–24.61), possible depression (OR = 2.56, 95% CI: 1.07–6.70), and physical symptoms (OR = 6.28, 95% CI: 1.63–42.03) by adjusting for sociodemographic and health characteristics in Model 1. The associations between COVID-19 diagnosis and hopelessness, probable anxiety, possible depression, and physical symptoms did not present statistical significance ( $P > 0.05$ ) in the fully adjusted models (Model 4) and Model 2 and Model 3, i.e., family members' SARS-CoV-2 infection status and perceived health risks were separately added to the models based on the adjustments of Model 1. The only exception was that COVID-19 diagnosis was positively associated with probable anxiety (OR = 3.54, 95% CI: 1.11–14.50) in Model 3, i.e., after adjusting for sociodemographic and self-perceived health status and perceived health risks. Figure 2 presents the associations between COVID-19 diagnosis, family members' SARS-CoV-2 infection status, perceived health risks, and mental health status and physical symptoms.

In addition, we also found that participants whose family members had been diagnosed with COVID-19 infection were more likely to exhibit feelings of hopelessness (Model 2, OR = 2.08, 95% CI: 1.37–3.20; Model 4: OR = 2.06, 95% CI: 1.35–3.16). Please see Supplemental Tables 1–4 for the details of all the results of each model. The relationship between perceived health risks and mental and physical symptoms did not show statistical significance.

#### 4. Discussion

This study provides evidence regarding the mental and physical responses of pregnant and postpartum women in the context of the initial phase of the considerable downgrade of COVID-19 response strategies in China. Ninety-eight percent of the participants took relevant measures to prevent SARS-CoV-2 infection. The prevalence of feelings of hopelessness, probable anxiety, possible depression, and physical symptoms was 30.7%, 3.8%, 3.8%, and 2.6%, respectively, in our sample. Compared to pregnant and postpartum women without a COVID-19 diagnosis, those with a confirmed COVID-19 diagnosis were more likely to report hopelessness, anxiety symptoms, depressive symptoms, and physical symptoms after adjusting for sociodemographic and self-perceived health characteristics. The

TABLE 2: Perceived health risks from the COVID-19 infection (N = 1,013).

Variables	No COVID-19 diagnosis (N = 423) n (%)	COVID-19 diagnosis (N = 590) n (%)	Overall n (%)
<i>Concerned about the impact of COVID-19 infection on health</i>			
No	330 (78.0%)	134 (22.7%)	464 (45.8%)
Yes	93 (22.0%)	456 (77.3%)	549 (54.2%)
<i>Concerned about the crowding out in health care resources</i>			
No	341 (80.6%)	186 (31.5%)	527 (52.0%)
Yes	82 (19.4%)	404 (68.5%)	486 (48.0%)
<i>Prepared medication related to the SARS-CoV-2 infection in advance</i>			
No	321 (75.9%)	169 (28.6%)	490 (48.4%)
Yes	102 (24.1%)	421 (71.4%)	523 (51.6%)
<i>Measures taken to prevent the SARS-CoV-2 infection</i>			
Wearing a mask	405 (95.7%)	580 (98.3%)	985 (97.2%)
Washing hands frequently	368 (87.0%)	567 (96.1%)	935 (92.3%)
Disinfecting belongings	328 (77.5%)	523 (88.6%)	851 (84.0%)
Reducing visits to crowded places	266 (62.9%)	534 (90.5%)	800 (79.0%)
Maintaining social isolation	213 (50.4%)	485 (82.2%)	698 (68.9%)
No measures taken	11 (2.6%)	8 (1.4%)	19 (1.9%)

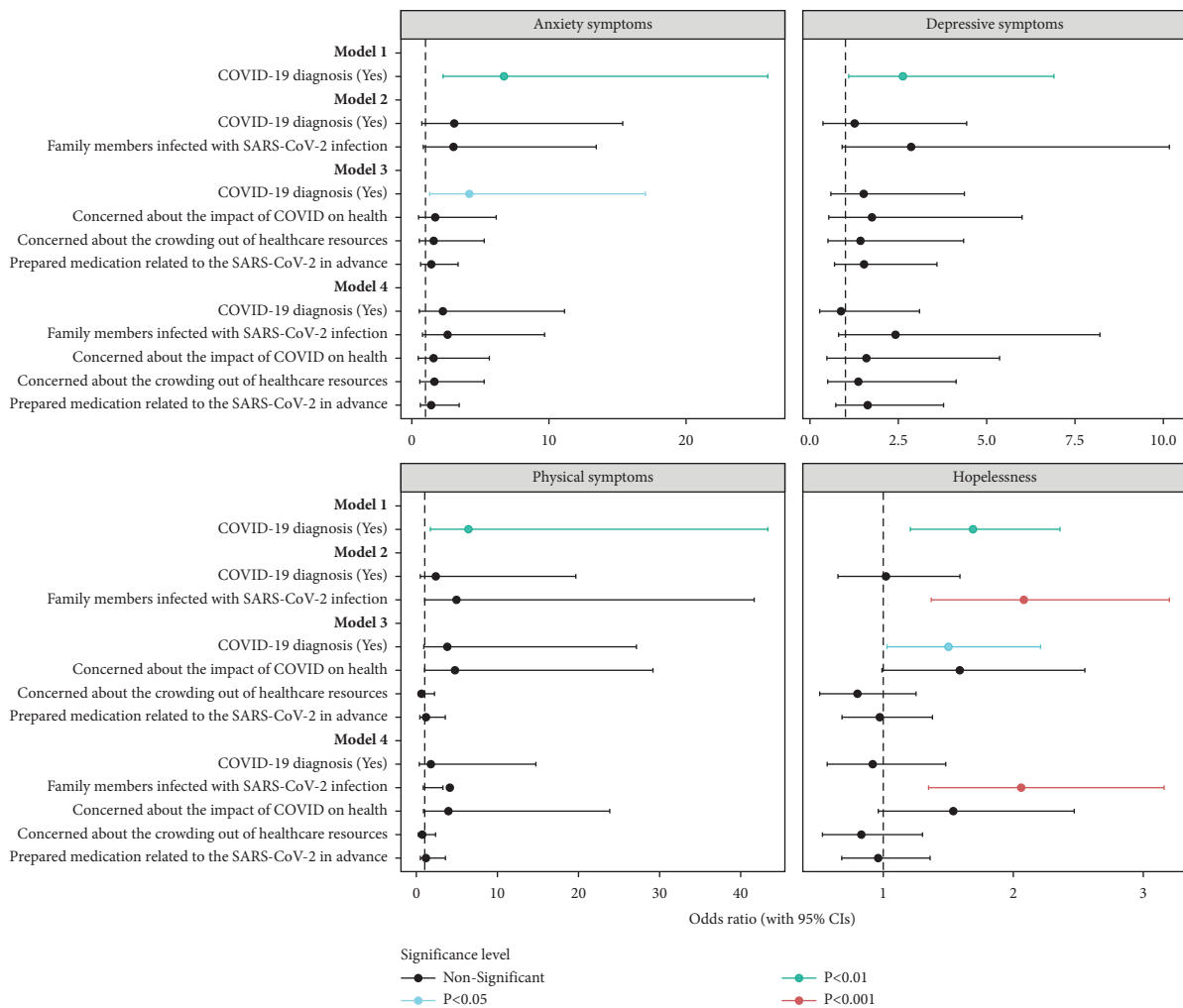


FIGURE 2: The associations between COVID-19 diagnosis, SARS-CoV-2 infection status of family members, perceived health risks, and mental and physical symptoms (N = 1,013). *Note.* Models were adjusted for age (years), weight, pregnancy and childbirth status, number of child (ren), monthly family income, educational level, employment status, partner's educational level, partner's employment status, relationship with the partner, and self-perceived health status.

associations between COVID-19 diagnosis and mental and physical symptoms did not present statistical significance when family members' SARS-CoV-2 infection status and perceived health risks were introduced into the models. In addition, we also found that pregnant and postpartum women with family members diagnosed with COVID-19 infection were more likely to exhibit hopelessness.

Concerningly elevated anxiety and depression symptoms among maternal and perinatal individuals during the COVID-19 pandemic were previously reported [30, 31]. For example, one study of pregnant women and new mothers in China conducted during the early stages of the COVID-19 pandemic [32] observed a prevalence of possible depression of 17.2% (PHQ-9 score  $\geq 10$ ). Another multinational cross-sectional study in Europe reported that moderate to severe anxiety symptoms (GAD-7 score  $\geq 10$ ) were shown among 11% and 10% of pregnant and breastfeeding women [33], which was all greater than the figure in our results evaluated by using the same widely used assessment tools and cutoff values (i.e., a PHQ-9 score  $\geq 10$  and a GAD-7 score  $\geq 10$ , respectively) [34]. A meta-analysis also reported a higher prevalence of anxiety levels in pregnant women during the pandemic, ranging from 45.9% to 62% [35]. The discrepancies regarding the prevalence of anxiety and depression symptoms among pregnant and postpartum women during the COVID-19 pandemic among the existing studies could be partially explained by studies that performed evaluations at different stages of the pandemic and the various control and prevention measures in each region [35]. However, one study with pilot data suggested that maternal levels of anxiety and depression appeared low at the tail end of the COVID-19 pandemic [34], which was verified by our findings. Notably, only one study in Turkey studied hopelessness in pregnant women with a prevalence of 58.1% [36], which was greater than our figure. Interestingly, one previous study indicated that pregnant individuals had fewer psychiatric symptoms including anxiety, depression, PTSD, and insomnia than nonpregnant individuals, but there was no significant difference in somatic symptoms between the two groups, which was not available for comparison by our data [37].

Nearly 98.0% of the included participants took measures to prevent the SARS-CoV-2 infection, which was consistent with findings of study conducted in Wuhan, China, at the beginning of the COVID-19 outbreak [38]. Among the interviewed pregnant and postpartum women, 54.2% and 48.0%, respectively, expressed concerns about the impact of COVID-19 infection on health and crowding out in health care resources, appropriately incarnating the grade of perceived health risks. Earlier studies have shown that levels of concern about COVID-19 infection were associated with elevated symptoms of depression/anxiety [39, 40], which was not consistent with our findings. The impact of perceived risk on mental health could be weakened by an increase in available information and reassurance from social media, health care professionals and primary care providers, increased confidence in society, and reduced mortality due to COVID-19 infection [34, 39, 41], which were also reported by findings for previous outbreaks, demonstrating

the fact that adequate information, public awareness of illness severity, and protective behaviours could alleviate mental health symptoms [42]. In addition, psychological resilience, adaptation, and pandemic fatigue [43] could also comprehensively play a role. In agreement with a study indicating that engaging in hygiene-related COVID-19 prevention behaviours (washing hands, wearing face masks, and disinfecting surfaces) was not related to mental health symptoms [44], we found that measures such as stocking up on COVID-19-related essential medicines were not significantly associated with mental health symptoms.

The association between SARS-CoV-2 infection and the deterioration of mental health has been widely reported [41, 45], while interestingly, the statistical significance of the associations between feelings of hopelessness, anxiety symptoms, depressive symptoms, and physical symptoms no longer existed after factors including family members' SARS-CoV-2 infection status and perceived health risks were introduced in the models, which was not attempting to be explored in the existing studies. Pregnant women were more anxious about the health of their elderly relatives, followed by worrying about their other children or the unborn baby and worried about themselves last [46]. They had concerns about their delivery plans, especially about birth companion support for women during childbirth [44], which helped explain the effects of family members' SARS-CoV-2 infection status on maternal mental health, as we identified, and compromised the association between an individual's SARS-CoV-2 infection status and their mental health status.

Several commonly reported individual demographic and socioeconomic characteristics that were negatively associated with poor mental health status during the COVID-19 pandemic were also identified, such as higher income levels [47, 48] and better self-perceived health status [11]. Previous studies also revealed that a good partner relationship or a satisfactory and good relationship could be protective factors against mental health problems [49–51], which were found by our data.

The Chinese government implemented a new COVID-19 management shift nearly three years after implementing the national “dynamic zero COVID” policy. Over the past three years, the government has maintained timely information disclosure, increased the stock of medical supplies, launched health literacy promotion campaigns, and improved urban and rural infrastructure and public sanitation. Although the number of infections increased rapidly in the early stages of the policy change, the influence of these contextual conditions is not the same as that in the early days of the COVID-19 pandemic in 2019. Our findings have several policy implications. First, the impact of an individual's COVID-19 risk perception on mental health seems to be less serious than expected, which may be related to the long-term adaptation and improved understanding of the virus. Information related to the COVID-19 pandemic should continue to be disclosed in the future. Second, pregnant and postpartum women should be provided with up-to-date and accurate information on how to prevent infection for themselves and their children or other family members, help them understand the steps

being taken by the health care system to prevent the infection of patients, and provide necessary pre- and postnatal care and fertility-support policies support to alleviate the adverse mental health outcomes associated with the infection of their family members. Third, in responding to the impact of the pandemic, policies should prioritize the mental health of women who are economically and physically vulnerable and provide additional mental health services.

This study extends the literature by providing useful evidence on the possible spectrum of mental and physical health challenges that pregnant and postpartum women faced following the significant shift in COVID-19 management in China. This information would help in designing preventative measures and coping strategies to mitigate challenges to maternal health during possible health crises in the future. Limitations of our study, however, should be acknowledged. First, we used convenience sampling to recruit hospitals, and the study did not enroll pregnant and postpartum women from primary and secondary health care facilities, which may result in sampling bias and limit the generalizability since women in remote areas and economically disadvantaged women could not be included, although the participants were from large tertiary hospitals serving a large number of patients. Second, prepandemic data and data from earlier stages of the pandemic were not available, making it impossible to make comparisons with results from data of a control period which could lower the power of our findings, and longitudinal studies should be therefore further conducted. Finally, it is difficult to determine causality due to the cross-sectional design.

## 5. Conclusion

It is of great importance to understand the extent of consequences on the mental health and physical symptoms of pregnant and postpartum women when there is a significant downgrade of COVID-19 response strategies. SARS-CoV-2 infection of pregnant and postpartum women was no longer statistically associated with mental health symptoms after family members' SARS-CoV-2 infection status and perceived health risks were introduced in the model. Early detection of inadequate social support, economic difficulties, and poor health status of vulnerable groups during remarkable shifts in health policy and administrative practice is very necessary, and health services such as easily accessible psychosocial support and obstetric counselling should be prioritized.

## Data Availability

The observed data used to support the findings of this study are restricted by the Research Ethics Committee of Xi'an Jiaotong University in order to protect patient privacy. Data are available from Dr. Li Lu, [liser@outlook.com](mailto:liser@outlook.com), for researchers who meet the criteria for access to confidential data.

## Ethical Approval

The study was approved by the Research Ethics Committee of Xi'an Jiaotong University (No. 2023-1628).

## Conflicts of Interest

All authors declare that there are no conflicts of interest regarding the publication of this paper.

## Authors' Contributions

LL, SL, YH, and DMR designed the study. LL, SL, NYW, BCM, SL, TTZ YQS, YH, and DMR conducted the data collection. LL, SL, and CC analysed, and interpreted the data. LL, SL, YZY, QS, and ZLZ drafted the manuscript. LL, SL, QS, and YH critically revised the manuscript. All authors read and approved the final manuscript.

## Acknowledgments

We thank all the participants and researchers who made contribution to the study. This study was supported by the Philosophy and Social Science Research Program of Shaanxi Province (2023HZ1696). Dr. Li Lu is supported by the Young Talent Support Plan from Xi'an Jiaotong University (GG6J010).

## Supplementary Materials

Supplemental Tables 1–4 show the details of the results of hierarchical regression analyses for hopelessness, anxiety symptoms, depressive symptoms, and physical symptoms. (*Supplementary Materials*)

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