The relationship among pregnancy-related anxiety, perceived social support, family function and resilience in Chinese pregnant women: a structural equation modeling analysis

Jingui Huang[1†], Lingli Xu[2†], Zhen Xu[1], Yexin Luo[1], Bizhen Liao[3], Yan Li[3] and Yumei Shi[1*]

Abstract

Background: Accumulating evidence suggests that pregnancy-related anxiety (PRA) has adverse impacts on maternity health and infant development. A substantial body of literature has documented the important influence of family function, perceived social support and resilience on PRA. However, research identifying the mediating mechanisms underlying this relationship in China are still lacking. Therefore, the current study aimed to investigate the prevalence of PRA under the three-child policy in China, and also explore the interrelationships among perceived social support, family function, resilience, and PRA.

Methods: In this cross-sectional study, a convenient sampling method was used to select 579 pregnant women who underwent prenatal examination at the maternity outpatient departments of the First Affiliated Hospital of Chongqing Medical University in China from December 2021 to April 2022. Participants were required to complete the following questionnaires: the demographic form, the Chinese Pregnancy-related Anxiety scale, the 10-item Connor-Davidson Resilience Scale, the APGAR Family Care Index Scale, and Multidimensional Scale of Perceived Social Support. Pearson correlation analysis was utilized to examine the rudimentary relationship among the study variables. Bootstrapping analyses in the structural equation modeling were applied to identify the significance of indirect effects.

Results: There were 41.4% of pregnant Chinese women indicating PRA. Correlational analyses indicated that perceived social support, family function and resilience were negatively associated with PRA ($r = -0.47$, $P < 0.01$; $r = -0.43$, $P < 0.01$; $r = -0.37$, $P < 0.01$, respectively). The results of bootstrapping analyses demonstrated significant indirect effects of perceived social support ($\beta = -0.098$, 95% CI [-0.184, -0.021]) and family function ($\beta = -0.049$, 95% CI [-0.103, -0.011]) on PRA via resilience.

Conclusions: Chinese pregnant women are suffering from high levels of PRA. Better family function and perceived social support might reduce the occurrence of PRA, as well as by the mediating effects of resilience. Healthcare providers must be concerned about PRA and perform corresponding actions to reduce it. By strengthening social

†Jingui Huang and Lingli Xu have Contributed equally to this paper and co-first authors

*Correspondence: 515342831@qq.com

¹ Department of Medical Oncology, Chongqing University Cancer Hospital, No.181 Hanyu Road, Shapingba District, Chongqing 400030, China
Full list of author information is available at the end of the article

Huang *et al. BMC Women's Health*   (2022) 22:546

Page 2 of 11

support and improving family function, antenatal care providers could effectively reduce or prevent PRA. And more importantly, implementing resilience-promoting measures are also essential to relieve anxiety and support mental health in pregnant women.

Keywords: Pregnancy-related anxiety, Perceived social support, Family function, Resilience, Mediating effect

Introduction

Pregnancy-related anxiety (PRA) refers to a kind of distinct anxiety or worries particular to pregnancy (e.g., baby's health, mother's health, childbirth fear, and future parenting concerns) [1]. Anxiety during pregnancy was regarded as the potent psychological predictor of child birth and development and to be independent of generalized anxiety [2]. Compared with general anxiety, PRA may correlate more strongly with negative maternal and childbirth outcomes such as hypertension, low birth weight, spontaneous abortion and preterm birth, and predict these outcomes more reliable and accurate [2–4]. In addition, severe PRA has been identified to be concerned with attention-deficit hyperactivity disorder, negative emotion and development retardation of children [5, 6]. Therefore, untreated PRA not only negatively affect women's physical and psychological health but also serious harm of fetus' health.

The worse thing is that PRA is a widespread problem among pregnant women during pregnancy. The prevalence of PRA accounted from 23.6 to 55% in developing countries [7–11], and the magnitude of PRA in developing countries was estimated to be 6% to 29% in international studies [12–14]. In China, the incidence of PRA was about $21-30\%$ under the one-child policy before 2016 [15], and $29-32\%$ under the two-child policy before May 2021 [16, 17]. And in the place of current study, Chongqing municipality, the epidemiology of prenatal anxiety was 15% at early-pregnancy [18]. Significantly, China shifted from the two-child policy to the three-child policy by allowing all couples to have up to three children on 31 May 2021 [19]. In particular, Chinese families have a long-standing preference for sons over daughters in Chinese culture [20]. Under the three-child policy, couples with strong son preference may continue to have more children until they have the desired number of boys in the family, which may potentially increase the risk of anxiety during pregnancy. Currently, there is a lack of studies on PRA among the pregnant women after the introduction of the three-child policy in China, let alone Chongqing municipality.

Previous studies reported the factors that affect PRA among pregnant women include age, education level, parity, gestational week, economic status and partner relationship [16, 21–24]. In addition, it has been established that perceived social support and family function are all important protective factors for PRA [25, 26]. Perceived social support, reflecting individuals' true and subjective feelings, is defined as 'individuals' perception of the support that they receive from their social network', which can enhance their confidence to solve diverse problems more effectively [27]. On the basis of the psychological stress theory, social support plays a major role as a buffer mechanism when people suffer from stressful events and can promote their physical and mental well-being [28]. Family function refers to the degree to which a family performs as a unit to manage activities, conditions, external stimuli, or events that cause stress with external events, which plays a significant part in personal development and social progress [29]. Family function is more crucial for pregnant women in the families from Asia and other countries with a Confucian cultural context [30, 31]. A cross-sectional study in China found that the risk of depression symptoms in pregnant women who had poor family function was 3.67 times as much as that in the better functions group [32].

Apart from perceived social support and family function, a number of studies have justified the fact of resilience in mitigating anxiety during pregnancy [25, 33]. Resilience is the capability to withstand or recover from trauma, threats, adversity, and other significant sources of stressors [34]. Individuals with higher resilience have better psychological adjustment and cope effectively when dealing with periods of intense stress [35]. Previous studies have testified that more resilient nurses are better equipped to deal with obstacles, adverse experiences, and decrease their burnout [36]. Moreover, resilience mediated the relationship between unpleasant conditions and mental health status [37, 38]. The three factors interact with each other to complicate the anxiety during pregnancy. However, little is known about the internal relationships between family function, perceived social support, resilience, and PRA among pregnant women. Previous reports pointed out that external conditions such as social support, family support, and other supports are identified component of resilience resources that can contribute to it [39, 40]. A study of quality of life among migrant older adults found resilience played a mediating role between perceived social support and mental quality of life [41]. So, we speculate that resilience in pregnant women may also regulate the

relationship between family function, perceived social support and PRA.

The Healthy China 2030 Plan requires that healthcare system should screen, evaluate and manage the pregnancy-related risk factors for pregnant women, and ensure maternal and newborn safety [42]. The health facilities did not implement PRA screening program yet in China, meaning that health workers are missing PRA cases under the three-child policy. So, there is an urgent need to investigate PRA among Chinese pregnant women after the transition from the two-child policy to the universal three-child policy in 2021. More importantly, despite a body of evidence showing the connection of PRA with perceived social support, family function and resilience independently, research probing into the relationship that might exist between the four variables is scarce. With due consideration of the analysis above, the first purpose of the current research is to explore the prevalence of PRA among Chinese pregnant women, and fill current gaps in knowledge about the level of PRA under the three-child policy. And the second purpose is to examine the interrelationships among perceived social support, family function, resilience, and PRA via a structural equation modeling analysis. The results of this study could be helpful in offering new insights into analysis of the relationship between the four variables, and also empirical supports and scientific evidence for certain tailored strategies toward at mitigating the risk of PRA.

Present research

On the basis of literature review, we hypothesized a mediator model as shown in Fig. 1, including the following paths: (1) Direct paths: Perceived social support affects resilience positively (β1); Family function affects resilience positively (β2); Resilience affects PRA negatively (β3); Perceived social support affects PRA negatively (β4); Family function affects PRA negatively (β5).

(2) Indirect paths: Resilience serves as a mediating role between perceived social support and PRA (β1β3); Resilience plays a mediating role between family function and PRA (β2β3).
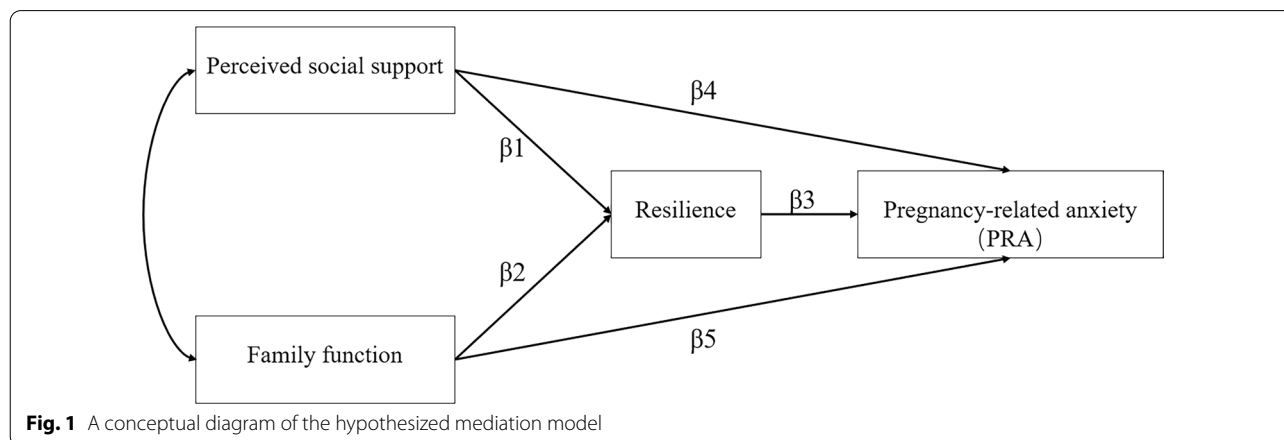
Material and methods

Study setting and design

This is a hospital-based cross-sectional survey. The participants were recruited using convenience sampling method from the maternity outpatient departments of the First Affiliated Hospital of Chongqing Medical University in China from December 2021 to April 2022. Three investigators of our authors, fully trained and certified, used a face-to-face survey to collect the data after signed informed consent was obtained. Specific procedure is as follows: When pregnant women established the health records (gestational week ≥ 11) or attended general maternity examination at Obstetric clinic, investigators would review their health records. Pregnant women who were accorded with the eligibility criteria would be invited to participate in this survey. Then participants filled in the anonymous questionnaires by themselves. For those who did not have a good understanding of the questionnaire content, the research personnel would give corresponding and succinct interpretation instead of biased or instructive suggestions. The investigators were requested to check every questionnaire for accuracy and completeness on the spot. An ethical approval was obtained from the First Affiliated Hospital of Chongqing Medical University for conducting this study.

Sample size calculation

First, this study is to investigate the prevalence of pregnancy-related anxiety. According to the previous literature, the prevalence of pregnancy-related anxiety in Chinese pregnant women was about 30% [16].With a confidence interval of 95% and 4% tolerable margin of

Fig. 1 A conceptual diagram of the hypothesized mediation model

Huang *et al. BMC Women's Health* (2022) 22:546

Page 4 of 11

error ($d = 4\%$), the calculated sample size is $n = \left(\frac{Z_{1-\alpha/2}}{d}\right)^2 p(1-p) = 504$. Then, adding a non-response rate of 10%. Thus, the total sample size is 560.

Second, another purpose of our study is to examine the interrelationships among perceived social support, family function, resilience, and PRA via a structural equation modeling analysis. The minimum sample size requirement of the structural equation was 200 [43]. To sum up, the final sample size required in this study is 560.

Target population
The target population of this research is the pregnant women who underwent prenatal examination at the maternity outpatient departments. Pregnant women were eligible to participate in the study if they met the following criteria: aged 18 or above, singleton pregnancy, being able to read and write Chinese, and volunteering to take part in the survey. The exclusion criteria comprised: age less than 18 years; with pregnancy complications (e.g. gestational diabetes mellitus, hypertension, pre-eclampsia), as well as diagnosed and/or being treated for anxiety or depression; fetal disorders and abnormality.

Variables and measure scales
Demographic form
Information on demographic characteristics was gathered including age, education level, working status, district, monthly income (yuan), trimester, parity, planned pregnancy and prior abortion.

Chinese pregnancy-related anxiety scale (C-PRA)
The PRA was assessed by the Chinese Pregnancy-related Anxiety scale (C-PRA). C-PRA consists of 13 self-rated items, across three dimensions: ① anxiety on self-care (6 items: the worries on how pregnancy would change their life, such as concerns about fetus's sex not satisfying expectations from the family, worries about loss of attractiveness towards husband, worries against how pregnancy would affect their appearance or daily work); ② anxiety related to the health of the fetus (5 items: the worries about the development of fetal and whether their lifestyle such as diet would influence fetal health or not); ③ fear of childbirth (2 items: concerns about labor pain or possible adverse consequence during labor.) [44]. Each item scores 1–4 with 1 meaning never worry, and 2 always worry, with a total score of 13–52. Higher the total score is, higher level of PRA the women have. And when someone's score ≥ the 75th percentile (≥ 24 scores), she will be evaluated as PRA [23, 44]. The test–retest reliability coefficient and Cronbach's α coefficient was 0.79 and 0.81 respectively [44]. The Cronbach's α was 0.825 in the current study.

APGAR family care index scale (APGAR)
Family APGAR originally created by Smilkstein [45] was adopted to measure family function, which was an assessment tool to assess an family member's subjective satisfaction of family functions. The APGAR is composed of 5 items (partnership, adaptability, affection, growth and resolve.) and scored on a Likert-type format with 3 options (0 = hardly ever, 2 = almost always). The total score varies between 0 and 10, with higher scores representing better family function. The APGAR has since been adopted by many Chinese scholars with good internal reliability and validity [46–48]. The Cronbach's α was 0.879 in the current study.

Connor-davidson resilience scale (CD-RISC)
The resilience of pregnant women was tested by the 10-item Connor-Davidson Resilience Scale (CD-RISC-10). Wang and his colleagues translated it into Chinese with excellent validity and reliability (Cronbach's α = 0.91) [49]. The responses of each item are scored on a Likert-type format with 5 options (0 = never, 4 = always). The total score ranges from 0 to 40 with higher scores denoting greater resilience. The Cronbach's α of this whole scale was 0.91 for our study.

Multidimensional scale of perceived social support (MSPSS)
The 12-item Multidimensional Scale of Perceived Social Support (MSPSS) was adopted to measure perceived social support (family, friends, and significant others). Zimet et al. [50] created the original English version of the MSPSS and reported high internal consistency among 265 pregnant women. Huang and Jiang [51] translated it into Chinese and modified it. Participants were asked to fill out the 7-point scale ranging from 1 (strongly disagree) to 7 (strongly agree). Higher total scores are indicative of a higher level of perceived social support. In the present study, the Cronbach's α for MSPSS was 0.92.

Statistical analysis
Epi Data version 3.1 and SPSS version 25 were used to record and analyze data. Categorical data and continuous data were listed as frequency and percentage, and mean and standard deviation (SD), respectively. Harman's single-factor test was used to detect the common method bias. Variance inflation factor (VIF) and Cook's distances were used to test the multicollinearity and outliers, respectively. The relationships between variables was established using Pearson correlation analysis. Statistical significance level was considered as a two-tailed P-value of value less than 0.05.

We implemented a structural equation modeling (SEM) with observed variables using the Maximum

Likelihood estimation method to examine the theoretical model hypothesis. Bootstrapping method of repeat sampling by 2000 times was applied to calculate the 95% confidence interval (*CI*) for the indirect effect, and the indirect effect is considered significant if 95% *CI* without containing zero. SEM was conducted using AMOS 23.0. The SEM model was assessed using the following indexes and recommended limits: $\chi^2/df < 3$; tucker lewis index, TLI > 0.90; normed fit index, NFI > 0.90; root mean square error of approximation, RMSEA < 0.08; goodness of fit index, GFI > 0.90; incremental fit index, IFI > 0.90; comparative fit index, CFI > 0.90 [52].

Results
Common method bias, multicollinearity and outliers
Common method bias (CMB), multicollinearity and outliers should be reviewed before proceeding. A cross-sectional design and self-reported data might lead to CMB [53]. So, we adopted the Harman's single-factor test to detect it, which is widely used in common method bias testing. After the principal component factor analysis, we extracted 8 eigenvalues greater than 1. And the variance explained by the first factor was only 29.47%, which was less than 40% of the critical standard [54]. Thus, no substantial CMB problem exists in the current study. VIF (< 5.0) and Cook's distances (< 1.0) were computed to identify the potential existence of multicollinearity and outliers, respectively. Results indicated that there were no problem of outliers and serious multicollinearity in this study (VIF 1.401–1.612; Cook's distances 0.000–0.883).

Characteristics of the participants
Among the 579 eligible participants who volunteered to take part in the study, 18 participants failed to finish the questionnaires for lack of time or other personal reasons. Thus, 561 participants completed the questionnaires with a response rate of 96.9%. Among them, the age of the participants ranged from 18 to 42 years old, with a mean age of 29.04 ± 3.78 years. Almost four-fifths (82.5%) of the study participants completed a college education. Over One hundred and eighty (82.2%) of them belonged to employed status. As for obstetric characteristics, the mean gestational age of the respondents was 29.66 ± 9.45 weeks, and 379 respondents (67.6%) were in their third trimester. Other basic information is displayed in Table 1.

The correlation between perceived social support, family function, resilience and PRA
The proportion of pregnant women with positive screening results for pregnancy-related anxiety symptoms (C-PRA ≥ 24) was 41.4% (*n* = 232). We calculated the mean value, SD, and correlation coefficients of each

variable, and the results are showed in Table 2. Table 2 showed a positive relationship between perceived social support with resilience (r = 0.58, *P* < 0.01) and family function with resilience (r = 0.47, *P* < 0.01), and analysis also indicated a negative association between perceived social support and PRA (r = − 0.47, *P* < 0.01), resilience and PRA (r = − 0.43, *P* < 0.01), and family function with PRA (r = − 0.37, *P* < 0.01). This preliminarily indicated the relationship between the four variables of Chinese pregnant women, which offered rudimentary support to the hypothetical paths mentioned earlier.

Mediating effect of resilience
The standardized coefficients for all pathways in the mediator model of resilience were shown in Fig. 2. The following indicators showed that the hypothetical model fit the data well: $\chi^2/df = 1.987$, TLI = 0.958, NFI = 0.930, RMSEA = 0.042, GFI = 0.941, IFI = 0.964, CFI = 0.964.

Based on the model, the standardized coefficient of perceived social support, family function, and resilience to PRA was − 0.41, − 0.18 and − 0.19, respectively. And the results of the model indicate that all direct paths were significant (*P* < 0.05). We applied the "bootstrapping method" repeated sampling 2,000 times, and calculated 95% *CI* to test whether resilience should be considered as a mediator for the association among perceived social support and family function with PRA. As proposed, the indirect path of perceived social support on PRA ($\beta_1\beta_3 = − 0.098$, 95% *CI* [− 0.184, − 0.021]) and family function on PRA ($\beta_2\beta_3 = − 0.049$, 95% *CI* [− 0.103, − 0.011]) through resilience was significant because the confidence interval did not include zero. The results are presented in Table 3.

Discussion
The prevalence of PRA
We investigated the prevalence of PRA in Chinese pregnant women and explored the mediating role of resilience. PRA occurred in 41.4% of pregnancies in our study, which is similar to the reported prevalence in south-west Nigeria (43.5%) [10]. And the level of PRA yielded by us is much higher than that reported in the Netherlands (11%) [13], Tanzania (25%) [8], Iran (21%) [55] and Qatar (26.5%) [25], whilst it was lower than what was reported in India (55.7%) [11]. Such discrepancy in the percentages reported could be due to various measuring tools used, as well as the cultural multiplicity and sociodemographic diversity of the target population. A Chinese study showed that the prevalence of PRA was about 30% at mid-pregnancy or late-pregnancy under the two-child policy in China [16], which is much lower than that reported in the current study. For pregnant women, especially older pregnant women and multiparas, they

Huang *et al. BMC Women's Health*   (2022) 22:546

Page 6 of 11

Table 1 Demographics of the participants

Variate	Category	N (%)
Age (years)	18–24	47 (8.4)
	25–34	468 (83.4)
	35–42	46 (8.2)
Education level	High school or below	98 (17.5)
	Undergraduate college or above	463 (82.5)
Working status	Employed	461 (82.2)
	Unemployed	100 (17.8)
Districts	Urban	507 (90.4)
	Rural	54 (9.6)
Monthly income (yuan)	≤ 8000	328 (58.5)
	> 8000	233 (41.5)
Trimester	First	50 (8.9)
	Second	132 (23.5)
	Third	379 (67.6)
First pregnancy	Yes	341 (60.8)
	No	220 (39.2)
Planned pregnancy	Yes	392 (69.9)
	No	169 (30.1)
Prior abortion	Yes	131 (23.4)
	No	430 (76.6)
Conception type	Spontaneous fertilization	534 (95.2)
	Assisted fertilization	27 (4.8)
		Mean (SD)
Age	–	29.04 (3.78)
Gestational week	–	29.66 (9.45)

SD standard deviation

Table 2 Correlation analysis between variables

| Variables	1	2	3	4
1.MSPSS (range: 35–84)	1	–	–	–
2.CD-RISC-10 (range: 7–40)	0.575**	1	–	–
3.APGAR (range: 1–10)	0.480**	0.469**	1	–
4.C-PRA (range: 13–46)	− 0.470**	− 0.433**	− 0.371**	1
Mean	64.83	26.56	8.15	23.42
SD	8.71	5.76	1.92	5.58

** $P < 0.01$

MSPSS Multidimensional Scale of Perceived Social Support; *CD-RISC-10* the 10-item Connor-Davidson Resilience Scale; *APGAR* APGAR Family Care Index Scale; *C-PRA* Chinese Pregnancy-related Anxiety scale; *SD* standard deviation

would have more and multiple worries or pressure, such as own health, work-family conflicts, childrearing pressure and fetal gender under the three-child policy [56], which might lead to an increase of anxiety during pregnancy. Our findings suggested that the occurrence rate of PRA is high among Chinese pregnant women under the three-child policy, and maternal care providers should give full consideration to reduce the prevalence of PRA by taking effective measures.

Direct relations

This study explored the ways by which perceived social support, family function, and resilience affected the PRA of pregnant women. The results indicated that perceived social support could have a direct effect on the PRA, which is in line with the results reported by Naja in Qatar and Brunton in Australia [25, 57]. This finding can be explained in two ways. First, this might be attributed to the 'buffering model' whereby social support serves as a buffer between adverse life events or stress and mental health [58, 59]. The rapid growth of the fetus makes the organs of the mother closer to the maximum functional load in the third trimester. Childbirth fear, worries on the fetal health, and physical discomfort would inevitably bring psychological stress on pregnant women [60]. Adequate social support could protect individuals from deleterious effects of the above stressors, and help pregnant women keep positive emotions and reduce anxiety. Second, social support can practice the coping and

Huang *et al. BMC Women's Health*   (2022) 22:546

Page 7 of 11
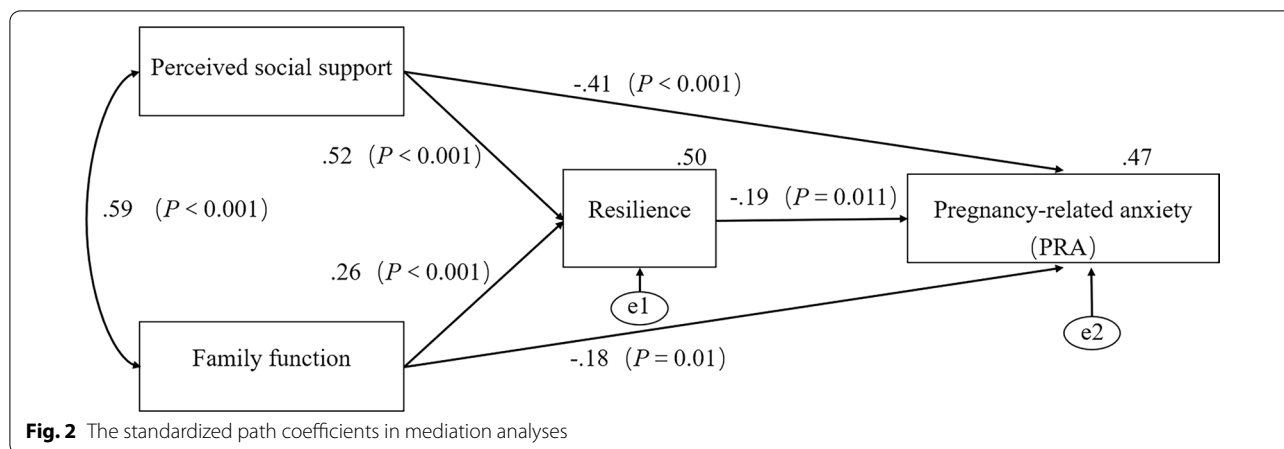
Fig. 2 The standardized path coefficients in mediation analyses

Table 3 The direct and indirect effects of pathways

Effect	Standardized pathway	SE	95% CI		P Value
			Lower	Upper	
Direct effect					
β1: Perceived social support → resilience	0.52	0.011	0.409	0.626	< 0.001
β2: Family function → resilience	0.26	0.088	0.141	0.371	< 0.001
β3: Resilience → PRA	− 0.19	0.195	− 0.332	− 0.029	0.011
β4: Perceived social support → PRA	− 0.41	0.038	− 0.576	− 0.243	< 0.001
β5: Family function → PRA	− 0.18	0.290	− 0.353	− 0.015	0.01
Indirect effect					
β1β3: Perceived social support → resilience → PRA	− 0.098	0.041	− 0.184	− 0.021	0.017
β2β3: Family function → resilience → PRA	− 0.049	0.023	− 0.103	− 0.011	0.012

PRA pregnancy-related anxiety; *CI* confidence interval; *SE* standard error

assessment ability of individuals, reduce the perceived severity of events and thus play an indirect protective role in individuals' negative emotions [61]. The association of perceived social support and PRA suggested that support from families, friends and other sources during pregnancy is a focus field for healthcare professionals to assess and manage. Pregnant schools in many hospitals, mainly reflected in maintaining health during pregnancy and in disseminating healthcare knowledge, are an major source of social support for pregnant women at present [62]. Maternity care staffs should offer formal support including psychological counselling and professional informational support to the entire family, promote the adaption of pregnancy, and reduce the unnecessary anxiety. Significantly, spirituality and spiritual care play an important part in providing effective emotional support for patients [63]. So, it is also suggested that medical staffs should raise the awareness about spirituality and spiritual care to offer more support for pregnant women.

Furthermore, our results verified that family function also had a direct impact on PRA. The study conducted by He in China is consistent with our result [64]. In a healthy family, family members can detect the psychological and physical changes of pregnant women, and provide timely material and spiritual help when women cope with anxiety or stressors [65]. However, dysfunctional families often have the characteristic of lower warmth, lower expressiveness and lower cohesion, and but also higher rigidity, conflict and affectionless control, which may be the source of anxiety [66]. Families with domestic violence against women is the reason of many mental illnesses and physical injuries [67]. It is recommended for maternity care providers to encourage family members, especially spouses, strengthen the deeper emotional communication with perinatal women to understand their inner needs of family support and then develop a detailed care plan according to the needs. Community staffs can even proceed regular family visit to ensure that family members are implementing the family support plan, identify problems in family support critically and make effective recommendations to family members.

Huang *et al. BMC Women's Health*   (2022) 22:546

Page 8 of 11

In line with finding from prior studies [25, 57], resilience had a close negative relationship with PRA in our study. Resilience is a dynamic adaptive process in which individuals respond to adverse events eagerly and make efforts to adapt to the new role or environment [68]. Pregnant women with higher resilience would maintain mental well-being by making full use of available resources to accommodate to the significant changes and learn to cope with pregnancy-related stress or depression effectively [37, 69].

Indirect relations

Another important new discovery of our research was that resilience mediated the effects of perceived social support and family function on PRA, respectively. Similarly, a Japanese study also found that resilience had a partial mediating effect between family function and psychological health in hemodialysis patients [70]. Besides, a Chinese research showed that resilience also significantly mediated the links between perceived social support and mental health in teachers [71]. Excellent family function and higher perceived social support can buffer the negative impacts of stressors and provide favorable external environmental conditions for the enhancement of resilience [72, 73]. In a word, greater perceived social support and better family function contributed higher resilience, thus generate positive emotions and alleviate PRA accordingly. Thankfully, resilience has become recognized less as an innate characteristic and more as a set of learnable skills [74]. Cognitive behavioral therapy, mindfulness based stress reduction, and enhancing social support and optimism are potential intervention that serve to increase an individual's resilience at present [75–77].

The present study had three strengths. First, this is the first work to analyze the interrelationships and potential mechanisms of PRA, perceived social support, family function and resilience of pregnant women by utilizing an SEM, which may have important implications for antenatal care providers and researchers alike. Second, the current study investigated the prevalence of PRA in the context of the three-child policy in China, which provided a reference for developing specific interventions to some extent. Third, a high response rate and the accuracy of the information were guaranteed by face-to-face interviews.

Limitations

However, a few limitations of this study also merit consideration. First, a convenience sampling method was used, and data were collected in single center, which limited the findings generalize to the whole country and may have introduced bias. Second, the cross-sectional design made it difficult to derive causal interpretations of the relationships among these variables and the claim of the mediating effects of resilience to be somewhat questionable. Third, we did not take the confounding factors into consideration in our study, such as epidemic caused by Corona Virus Disease 2019, which appear to be relevant to exacerbation of anxiety or depression in high-risk group such as pregnant women and health care workers [78–80].

Conclusions

In brief, the results of the current study highlighted the necessity for specific antenatal screening of PRA among pregnant Chinese women in the context of the three-child policy. The present study also indicated that resilience served as a mediator between perceived social support and PRA, and family function and PRA through the examination of a quantitative model. Therefore, antenatal care providers can take the following specific measures to minimize the negative impact of PRA for perinatal women: actively mobilize the social support system, bolster family function and build their resilience.

To eliminate the limitations of this study, a wider geographical and national study is suggested to determine PRA among pregnant women in different healthcare areas during the COVID-19 pandemic. It is proposed that future research be carried out by using replications and additional longitudinal study design that focus on changes in relationships among these variables over time. Randomized sampling method is also required.

Huang *et al. BMC Women's Health*   (2022) 22:546

Page 9 of 11

Declarations

Ethics approval and consent to participate
Ethical approval for the study was obtained from the First Affiliated Hospital of Chongqing Medical University after complete description of the study and the expected benefits from the study. All participants signed an informed consent prior to their participation in the study. All methods were performed in accordance with the relevant guidelines and regulations.

Consent for publication
Not applicable.

Competing interests
The authors declare that they have no competing interests.

Author details
[1]Department of Medical Oncology, Chongqing University Cancer Hospital, No.181 Hanyu Road, Shapingba District, Chongqing 400030, China. [2]Department of Human Resources, Chongqing University Cancer Hospital, Chongqing 400030, China. [3]Department of Obstetrics, The First Affiliated Hospital of Chongqing Medical University, Chongqing 400016, China.

References

1. Bayrampour H, Ali E, McNeil DA, Benzies K, MacQueen G, Tough S. Pregnancy-related anxiety: a concept analysis. Int J Nurs Stud. 2016;55:115–30. https://doi.org/10.1016/j.ijnurstu.2015.10.023.
2. 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. https://doi.org/10.1097/YCO.0b013e3283503680.
3. Blair MM, Glynn LM, Sandman CA, Davis EP. Prenatal maternal anxiety and early childhood temperament. Stress. 2011;14(6):644–51. https://doi.org/10.3109/10253890.2011.594121.
4. Kramer MS, Lydon J, Séguin L, Goulet L, Kahn SR, McNamara H, et al. Stress pathways to spontaneous preterm birth: the role of stressors, psychological distress, and stress hormones. Am J Epidemiol. 2009;169(11):1319–26. https://doi.org/10.1093/aje/kwp061.
5. Ayers S, Bond R, Bertullies S, Wijma K. The aetiology of post-traumatic stress following childbirth: a meta-analysis and theoretical framework. Psychol Med. 2016;46(6):1121–34. https://doi.org/10.1017/s0033291715002706.
6. Van den Bergh BR, Mennes M, Oosterlaan J, Stevens V, Stiers P, Marcoen A, et al. High antenatal maternal anxiety is related to impulsivity during performance on cognitive tasks in 14- and 15-year-olds. Neurosci Biobehav Rev. 2005;29(2):259–69. https://doi.org/10.1016/j.neubiorev.2004.10.010.
7. Alqahtani AH, Al Khedair K, Al-Jeheiman R, Al-Turki HA, Al Qahtani NH. Anxiety and depression during pregnancy in women attending clinics in a University Hospital in Eastern province of Saudi Arabia: prevalence and associated factors. Int J Womens Health. 2018;10:101–8. https://doi.org/10.2147/ijwh.S153273.
8. Wall V, Premji SS, Letourneau N, McCaffrey G, Nyanza EC. Factors associated with pregnancy-related anxiety in Tanzanian women: a cross sectional study. BMJ Open. 2018;8(6):e020056. https://doi.org/10.1136/bmjopen-2017-020056.
9. Tarafa H, Alemayehu Y, Nigussie M. Factors associated with pregnancy-related anxiety among pregnant women attending antenatal care follow-up at Bedelle general hospital and Metu Karl comprehensive specialized hospital Southwest Ethiopia. Front Psychiatry. 2022;13:938277. https://doi.org/10.3389/fpsyt.2022.938277.
10. Akinsulore A, Temidayo AM, Oloniniyi IO, Olalekan BO, Yetunde OB. Pregnancy-related anxiety symptoms and associated factors amongst pregnant women attending a tertiary hospital in south-west Nigeria. S Afr J Psychiatry. 2021;27:1616. https://doi.org/10.4102/sajpsychiatry.v27i0.1616.
11. Nath A, Venkatesh S, Balan S, Metgud CS, Krishna M, Murthy GVS. The prevalence and determinants of pregnancy-related anxiety amongst pregnant women at less than 24 weeks of pregnancy in Bangalore. Southern India Int J Womens Health. 2019;11:241–8. https://doi.org/10.2147/ijwh.S193306.
12. Fleuriet KJ, Sunil TS. Perceived social stress, pregnancy-related anxiety, depression and subjective social status among pregnant Mexican and Mexican American women in south Texas. J Health Care Poor Underserved. 2014;25(2):546–61. https://doi.org/10.1353/hpu.2014.0092.
13. Koelewijn JM, Sluijs AM, Vrijkotte TGM. Possible relationship between general and pregnancy-related anxiety during the first half of pregnancy and the birth process: a prospective cohort study. BMJ Open. 2017;7(5):e013413. https://doi.org/10.1136/bmjopen-2016-013413.
14. Westerneng M, Witteveen AB, Warmelink JC, Spelten E, Honig A, de Cock P. Pregnancy-specific anxiety and its association with background characteristics and health-related behaviors in a low-risk population. Compr Psychiatry. 2017;75:6–13. https://doi.org/10.1016/j.comppsych.2017.02.002.
15. Kang YT, Yao Y, Dou J, Guo X, Li SY, Zhao CN, et al. Prevalence and risk factors of maternal anxiety in late pregnancy in China. Int J Environ Res Public Health. 2016. https://doi.org/10.3390/ijerph13050468.
16. Zhou C, Weng J, Tan F, Wu S, Ma J, Zhang B, et al. Pregnancy-related anxiety among Chinese pregnant women in mid-late pregnancy under the two-child policy and its significant correlates. J Affect Disord. 2020;276:272–8. https://doi.org/10.1016/j.jad.2020.07.099.
17. Wang X, Xie J, Wu Y, Wu X, Yan S, Xu Y, et al. Gender-specific effect of pregnancy-related anxiety on preschooler's emotional and behavioral development: a population-based cohort study. J Affect Disord. 2021;279:368–76. https://doi.org/10.1016/j.jad.2020.10.014.
18. 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. https://doi.org/10.1016/j.jad.2019.05.003.
19. Tatum M. China's three-child policy. Lancet. 2021;397(10291):2238. https://doi.org/10.1016/s0140-6736(21)01295-2.
20. Lung FW, Shu BC, Chiang TL, Lin SJ. Recalled parental gender preference in Chinese culture: a Taiwan birth cohort study. Arch Sex Behav. 2021;50(3):853–62. https://doi.org/10.1007/s10508-020-01879-5.
21. Brunton R, Simpson N, Dryer R. Pregnancy-related anxiety, perceived parental self-efficacy and the influence of parity and age. Int J Environ Res Public Health. 2020. https://doi.org/10.3390/ijerph17186709.
22. Rosario MK, Premji SS, Nyanza EC, Bouchal SR, Este D. A qualitative study of pregnancy-related anxiety among women in Tanzania. BMJ Open. 2017;7(8):e016072. https://doi.org/10.1136/bmjopen-2017-016072.
23. Fu F, Yan P, You S, Mao X, Qiao T, Fu L, et al. The pregnancy-related anxiety characteristics in women with gestational diabetes mellitus: why should we care? BMC Pregnancy Childbirth. 2021;21(1):424. https://doi.org/10.1186/s12884-021-03887-2.
24. Yeşilçınar İ, Acavut G, Güvenç G. Anxiety during the pregnancy and affecting factors: a cross-sectional study. Arch Gynecol Obstet. 2022. https://doi.org/10.1007/s00404-022-06590-5.
25. Naja S, Al Kubaisi N, Singh R, Bougmiza I. Generalized and pregnancy-related anxiety prevalence and predictors among pregnant women attending primary health care in Qatar, 2018–2019. Heliyon. 2020;6(10):e05264. https://doi.org/10.1016/j.heliyon.2020.e05264.
26. Shi Y, Liu H, Feng Y, Liu M. Analysis of pregnancy-related anxiety and its influencing factors in late pregnancy women in Wuxi City. Chin Nurs Res. 2019;33(1):87–91.
27. Kong LN, Zhu WF, Hu P, Yao HY. Perceived social support, resilience and health self-efficacy among migrant older adults: a moderated mediation analysis. Geriatr Nurs. 2021;42(6):1577–82. https://doi.org/10.1016/j.gerinurse.2021.10.021.
28. Ozbay F, Johnson DC, Dimoulas E, Morgan CA, Charney D, Southwick S. Social support and resilience to stress: from neurobiology to clinical practice. Psychiatry. 2007;4(5):35–40.
29. Cao X, Jiang X, Li X, Hui Lo MC, Li R. Family functioning and its predictors among disaster bereaved individuals in China: eighteen months after the Wenchuan Earthquake. PLoS ONE. 2013;8(4):e60738. https://doi.org/10.1371/journal.pone.0060738.

Huang *et al. BMC Women's Health*   (2022) 22:546

Page 10 of 11

30. Chang L, Basnyat I. Exploring family support for older Chinese singaporean women in a confucian society. Health Commun. 2017;32(5):603–11. https://doi.org/10.1080/10410236.2016.1146568.

31. Cheng Y, Zhang L, Wang F, Zhang P, Ye B, Liang Y. The effects of family structure and function on mental health during China's transition: a cross-sectional analysis. BMC Fam Pract. 2017;18(1):59. https://doi.org/10.1186/s12875-017-0630-4.

32. Zheng B, Yu Y, Zhu X, Hu Z, Zhou W, Yin S, et al. Association between family functions and antenatal depression symptoms: a cross-sectional study among pregnant women in urban communities of Hengyang city, China. BMJ Open. 2020;10(8):e036557. https://doi.org/10.1136/bmjopen-2019-036557.

33. Puertas-Gonzalez JA, Mariño-Narvaez C, Romero-Gonzalez B, Vilar-López R, Peralta-Ramirez MI. Resilience, stress and anxiety in pregnancy before and throughout the pandemic: a structural equation modelling approach. Curr Psychol. 2022. https://doi.org/10.1007/s12144-022-03305-6.

34. Richardson GE. The metatheory of resilience and resiliency. J Clin Psychol. 2002;58(3):307–21. https://doi.org/10.1002/jclp.10020.

35. Norris FH, Stevens SP, Pfefferbaum B, Wyche KF, Pfefferbaum RL. Community resilience as a metaphor, theory, set of capacities, and strategy for disaster readiness. Am J Community Psychol. 2008;41(1–2):127–50. https://doi.org/10.1007/s10464-007-9156-6.

36. Jamebozorgi MH, Karamoozian A, Bardsiri TI, Sheikhbardsiri H. Nurses burnout, resilience, and its association with socio-demographic factors during COVID-19 pandemic. Front Psychiatry. 2022;12:803506. https://doi.org/10.3389/fpsyt.2021.803506.

37. Howell KH, Miller-Graff LE, Schaefer LM, Scrafford KE. Relational resilience as a potential mediator between adverse childhood experiences and prenatal depression. J Health Psychol. 2020;25(4):545–57. https://doi.org/10.1177/1359105317723450.

38. Wang L, Xu B, Gu Y, Zhu J, Liang Y. The mediating and moderating effects of resilience on the relationship between perceived stress and depression in heroin addicts. J Community Psychol. 2019;47(3):495–503. https://doi.org/10.1002/jcop.22133.

39. Martínez-Martí ML, Ruch W. Character strengths predict resilience over and above positive affect, self-efficacy, optimism, social support, self-esteem, and life satisfaction. J Posit Psychol. 2017;12(2):110–9.

40. Wen J, Yeh TP, Xie H, Yu X, Tang J, Chen Y. Resilience, self-esteem, self-efficacy, social support, depression and ART adherence among people living with HIV in Sichuan. China AIDS Care. 2021;33(11):1414–21. https://doi.org/10.1080/09540121.2020.1828800.

41. Kong LN, Zhang N, Yuan C, Yu ZY, Yuan W, Zhang GL. Relationship of social support and health-related quality of life among migrant older adults: the mediating role of psychological resilience. Geriatr Nurs. 2021;42(1):1–7. https://doi.org/10.1016/j.gerinurse.2020.10.019.

42. Liu J, Jing W, Liu M. Risk management of pregnant women and the associated low maternal mortality from 2008–2017 in China: a national longitude study. BMC Health Serv Res. 2022;22(1):335. https://doi.org/10.1186/s12913-022-07721-z.

43. Tomarken AJ, Waller NG. Structural equation modeling: strengths, limitations, and misconceptions. Annu Rev Clin Psychol. 2005;1:31–65. https://doi.org/10.1146/annurev.clinpsy.1.102803.144239.

44. Xiao L, Tao F, Zhang J. Development and reliability evaluation of a pregnancy-related anxiety questionnaire. Chin J Public Health. 2012;28(3):80.

45. Smilkstein G, Ashworth C, Montano D. Validity and reliability of the family APGAR as a test of family function. J Fam Pract. 1982;15(2):303–11.

46. Zhang M, Zhang W, Liu Y, Wu M, Zhou J, Mao Z. Relationship between family function, anxiety, and quality of life for older adults with hypertension in low-income communities. Int J Hypertens. 2021;2021:5547190. https://doi.org/10.1155/2021/5547190.

47. Huang Y, Liu Y, Wang Y, Liu D. Family function fully mediates the relationship between social support and perinatal depression in rural Southwest China. BMC Psychiatry. 2021;21(1):151. https://doi.org/10.1186/s12888-021-03155-9.

48. Li C, Lu H, Qin W, Li X, Yu J, Fang F. Resilience and its predictors among chinese liver cancer patients undergoing transarterial chemoembolization. Cancer Nurs. 2019;42(5):E1-e9. https://doi.org/10.1097/ncc.0000000000000640.

49. Wang L, Shi Z, Zhang Y, Zhang Z. Psychometric properties of the 10-item connor-davidson resilience scale in Chinese earthquake victims. Psychiatry Clin Neurosci. 2010;64(5):499–504. https://doi.org/10.1111/j.1440-1819.2010.02130.x.

50. Zimet GD, Powell SS, Farley GK, Werkman S, Berkoff KA. Psychometric characteristics of the multidimensional scale of perceived social support. J Pers Assess. 1990;55(3–4):610–7. https://doi.org/10.1080/00223891.1990.9674095.

51. Huang L, Jiang QJ, Ren WH. The correction study of coping style, social support and psychosomatic symptoms among cancer patients. Chin Ment Health J. 1996;10(04):160–1.

52. Lt Hu, Bentler PM. Cutoff criteria for fit indexes in covariance structure analysis: conventional criteria versus new alternatives. Struct Equ Model Multidiscip J. 1999;6(1):1–55. https://doi.org/10.1080/10705519909540118.

53. Lindell MK, Whitney DJ. Accounting for common method variance in cross-sectional research designs. J Appl Psychol. 2001;86(1):114–21. https://doi.org/10.1037/0021-9010.86.1.114.

54. Han L, Zhan Y, Li W, Xu Y, Xu Y, Zhao J. Associations between the perceived severity of the COVID-19 pandemic, cyberchondria, depression, anxiety, stress, and lockdown experience: cross-sectional survey study. JMIR Public Health Surveill. 2021;7(9):e31052. https://doi.org/10.2196/31052.

55. Hamzehgardeshi Z, Omidvar S, Amoli AA, Firouzbakht M. Pregnancy-related anxiety and its associated factors during COVID-19 pandemic in Iranian pregnant women: a web-based cross-sectional study. BMC Pregnancy Childbirth. 2021;21(1):208. https://doi.org/10.1186/s12884-021-03694-9.

56. Jing W, Liu J, Ma Q, Zhang S, Li Y, Liu M. Fertility intentions to have a second or third child under China's three-child policy: a national cross-sectional study. Hum Reprod. 2022;37(8):1907–18. https://doi.org/10.1093/humrep/deac101.

57. Brunton R, Wood T, Dryer R. Childhood abuse, pregnancy-related anxiety and the mediating role of resilience and social support. J Health Psychol. 2022. https://doi.org/10.1177/1359105320968140.

58. Werner-Seidler A, Afzali MH, Chapman C, Sunderland M, Slade T. The relationship between social support networks and depression in the 2007 national survey of mental health and well-being. Soc Psychiatry Psychiatr Epidemiol. 2017;52(12):1463–73. https://doi.org/10.1007/s00127-017-1440-7.

59. Cohen S, Wills TA. Stress, social support, and the buffering hypothesis. Psychol Bull. 1985;98(2):310–57.

60. Silva MMJ, Nogueira DA, Clapis MJ, Leite E. Anxiety in pregnancy: prevalence and associated factors. Rev Esc Enferm USP. 2017;51:e03253. https://doi.org/10.1590/s1980-220x2016048003253.

61. Lakey B, Orehek E. Relational regulation theory: a new approach to explain the link between perceived social support and mental health. Psychol Rev. 2011;118(3):482–95. https://doi.org/10.1037/a0023477.

62. Wei DM, Au Yeung SL, He JR, Xiao WQ, Lu JH, Tu S, et al. The role of social support in family socio-economic disparities in depressive symptoms during early pregnancy: evidence from a Chinese birth cohort. J Affect Disord. 2018;238:418–23. https://doi.org/10.1016/j.jad.2018.06.014.

63. Abdollahyar A, Baniasadi H, Doustmohammadi MM, Sheikhbardesiri H, Yarmohammadian MH. Attitudes of Iranian nurses toward spirituality and spiritual care. J Christ Nurs. 2019;36(1):E11–6. https://doi.org/10.1097/CNJ.0000000000000581.

64. He D, Ren J, Luo B, Xiang J, Wang G, Gu L, et al. Women's psychological health, family function, and social support during their third trimester of pregnancy within the COVID-19 epidemic: a cross-sectional survey. Disaster Med Public Health Prep. 2022;16(5):1822–6. https://doi.org/10.1017/dmp.2021.244.

65. Sun S, Li J, Ma Y, Bu H, Luo Q, Yu X. Effects of a family-support programme for pregnant women with foetal abnormalities requiring pregnancy termination: a randomized controlled trial in China. Int J Nurs Pract. 2018. https://doi.org/10.1111/ijn.12614.

66. Feldman R. Maternal versus child risk and the development of parent-child and family relationships in five high-risk populations. Dev Psychopathol. 2007;19(2):293–312. https://doi.org/10.1017/s0954579407070150.

67. Sheikhbardsiri H, Raeisi A, Khademipour G. Domestic violence against women working in four educational hospitals in Iran. J Interpers Violence. 2020;35(21–22):5107–21. https://doi.org/10.1177/0886260517719539.

68. Connor KM, Davidson JR. Development of a new resilience scale: the connor-davidson resilience scale (CD-RISC). Depress Anxiety. 2003;18(2):76–82. https://doi.org/10.1002/da.10113.
69. Li G, Kong L, Zhou H, Kang X, Fang Y, Li P. Relationship between prenatal maternal stress and sleep quality in Chinese pregnant women: the mediation effect of resilience. Sleep Med. 2016;25:8–12. https://doi.org/10.1016/j.sleep.2016.02.015.
70. Kukihara H, Yamawaki N, Ando M, Nishio M, Kimura H, Tamura Y. The mediating effect of resilience between family functioning and mental well-being in hemodialysis patients in Japan: a cross-sectional design. Health Qual Life Outcomes. 2020;18(1):233. https://doi.org/10.1186/s12955-020-01486-x.
71. Zhang L, Pang J, Zhu F. Effect of perceived social support on psychache: mediating effect of psychological resilience. Iran J Public Health. 2022;51(2):386–94. https://doi.org/10.18502/ijph.v51i2.8691.
72. Xu Y, Lin X, Chen S, Liu Y, Liu H. Ageism, resilience, coping, family support, and quality of life among older people living with HIV/AIDS in Nanning. China Glob Public Health. 2018;13(5):612–25. https://doi.org/10.1080/17441692.2016.1240822.
73. Lu C, Yuan L, Lin W, Zhou Y, Pan S. Depression and resilience mediates the effect of family function on quality of life of the elderly. Arch Gerontol Geriatr. 2017;71:34–42. https://doi.org/10.1016/j.archger.2017.02.011.
74. Winwood PC, Colon R, McEwen K. A practical measure of workplace resilience: developing the resilience at work scale. J Occup Environ Med. 2013;55(10):1205–12. https://doi.org/10.1097/JOM.0b013e3182a2a60a.
75. Banks K, Newman E, Saleem J. An overview of the research on mindfulness-based interventions for treating symptoms of posttraumatic stress disorder: a systematic review. J Clin Psychol. 2015;71(10):935–63. https://doi.org/10.1002/jclp.22200.
76. Cheng P, Casement MD, Kalmbach DA, Castelan AC, Drake CL. Digital cognitive behavioral therapy for insomnia promotes later health resilience during the coronavirus disease 19 (COVID-19) pandemic. Sleep. 2021. https://doi.org/10.1093/sleep/zsaa258.
77. Baumgartner DJ. Schneider DT (2021) A randomized controlled trial of mindfulness-based stress reduction on academic resilience and performance in college students. J Am Coll Health. 2021. https://doi.org/10.1080/07448481.2021.1950728.
78. Safi-Keykaleh M, Aliakbari F, Safarpour H, Safari M, Tahernejad A, Sheikhbardsiri H, et al. Prevalence of postpartum depression in women amid the COVID-19 pandemic: a systematic review and meta-analysis. Int J Gynaecol Obstet. 2022;157(2):240–7. https://doi.org/10.1002/ijgo.14129.
79. Sahebi A, Yousefi A, Abdi K, Jamshidbeigi Y, Moayedi S, Torres M, et al. The prevalence of post-traumatic stress disorder among health care workers during the COVID-19 pandemic: an umbrella review and meta-analysis. Front Psychiatry. 2021;12:764738. https://doi.org/10.3389/fpsyt.2021.764738.
80. Heidarijamebozorgi M, Jafari H, Sadeghi R, Sheikhbardsiri H, Kargar M, Gharaghani M. The prevalence of depression, anxiety, and stress among nurses during the coronavirus disease 2019: a comparison between nurses in the frontline and the second line of care delivery. Nurs Midwifery Stud. 2021;10(3):188–93. https://doi.org/10.4103/nms.nms_103_20.

Publisher's Note