

# Between Personality Traits and Postpartum Depression: The Mediated Role of Maternal Self-Efficacy

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**Purpose:** Postpartum depression is related to many factors, which affect the health of mothers and infants. The purpose of this study is to test the mediated effect of self-efficacy in the relationship between vulnerable personality and postpartum depression.

**Patients and Methods:** A cross-sectional survey was conducted with pregnant women aged  $\geq 20$  years from February to April 2021 in Zhengzhou, China. We recruited 587 pregnant women, and 429 pieces of data were available. The demographic characteristics questionnaire, General Self efficacy Scale (GSES) and Vulnerable Personality Style Questionnaire (VPSQ) were distributed in the prenatal survey. The Edinburgh Postnatal Depression Scale (EPDS) was used to screen postpartum depression symptoms at one month through WeChat and telephone follow-up. A mediated model was constructed to explain the relationship of variables and test the mediated effect of self-efficacy.

**Results:** The valid questionnaires were 429 (effective response rate: 90.7%). The vulnerable personality and low self-efficacy were related to postpartum depression (all  $P < 0.01$ ). The self-efficacy of pregnant women was inversely associated with vulnerable personality ( $\beta = -0.415$ ) and postpartum depression ( $\beta = -0.216$ ). The vulnerable personality and self-efficacy can explain 29.0% of the variation in postpartum depression. It was confirmed that a partial mediating effect of self-efficacy accounted for 18.0% (0.090/0.501) of the total effect.

**Conclusion:** Maternal self-efficacy partly mediates the relationship between vulnerable personality traits and postpartum depression. The study implies the importance of targeted interventions to improve self-efficacy for women with vulnerable personality traits to reduce the risk of postpartum depression.

**Keywords:** postpartum depression, vulnerable personality, self-efficacy, mediated effect

## Introduction

Postpartum depression (PPD) is defined as “a major depressive episode with peripartum onset and onset of mood symptoms occurs during pregnancy or within 4 weeks following delivery” according to the Diagnostic and Statistical Manual of Mental Disorder (DSM-5).<sup>1-3</sup> One of the main concerns of women’s mental health is postpartum depression.<sup>1,4,5</sup> According to international research data, PPD was a global disease with a prevalence of 17.7%.<sup>6</sup> Prevention of postpartum depression has become an urgent issue.

Multifarious variables have been identified as risk factors associated with PPD,<sup>7,8</sup> including young age,<sup>7</sup> overweight,<sup>9</sup> multiple births,<sup>10</sup> emergency caesarean section,<sup>11,12</sup> lack of social support<sup>13</sup> and immigration status,<sup>10</sup> especially the vulnerable personality traits.<sup>14</sup> Dennis and Boyce<sup>14</sup> has reported that the vulnerable personality is positively associated with postpartum depression. In the past two decades, the role of personality traits has been gaining attention as a predictor for PPD.<sup>15-18</sup> Vulnerable personality is not confined to one particular trait,<sup>17</sup> mainly includes coping, nervy, timidity, sensitivity, worry, organisation, obsessive, expressive and volatility.<sup>17</sup> However, the relationship between

vulnerable personality and PPD, though widely demonstrated and reported in previous studies, is seldom investigated clearly in China.<sup>19,20</sup>

The direct relationship between vulnerable personality and postpartum depression has been identified in a previous study.<sup>14</sup> However, their interrelationship cannot be well revealed by traditional analytical methods. Previous studies often used the methods of regression analysis to investigate the association between variables and PPD.<sup>9,21</sup> Although several variables may have no direct effects on postpartum depression, there are possible intermediary variables to connect them. It is indicated that verifying the possible interrelations between variables and PPD could help us find potential risk factors for postpartum depression.<sup>7</sup>

Prior studies observe that the low self-efficacy of pregnant women is related to PPD, which is an individual's ability to make meaningful, healthy choices and translate those choices into desired actions and outcomes.<sup>12,22–24</sup> Notably, self-efficacy has been investigated as a mediated factor in previous researches.<sup>25–28</sup> A cross-sectional study of 740 participants suggests that self-efficacy mediated the relationship between social support and dietary intake.<sup>26</sup> Likewise, Cutrona et al<sup>28</sup> note that infant temperamental difficulty and social support were strongly related to PPD directly and through the mediation of parenting self-efficacy. Identifying the underlying mediated factors could be helpful to explain the relationship between vulnerable personality and PPD clearly.

Therefore, this survey was conducted to explore the mediated effect of self-efficacy in the relationship between vulnerable personality and PPD by using structural equation modelling (SEM). The main variables of this study mentioned above were evaluated using self-report questionnaires or scales. Based on previous research, the most widely used cut-off scores were adopted to report the positive screening results of PPD and other variables. It was to demonstrate whether and how vulnerable personality influenced PPD through self-efficacy and, hopefully, help to prevent maternal from PPD.

## Materials and Methods

### Design

From February to April 2021, a cross-sectional study was conducted at two large tertiary general hospitals in Zhengzhou, China. After signing the Informed Consent Form, we recruited eligible pregnant women into the survey using convenience sampling.

The survey was composed of two sections. First, the prenatal survey was conducted by researchers and trained midwives at maternity wards and obstetric clinics. All recruited participants who were pregnant at least 37 weeks were required to finish the prepartum survey, including the General Self Efficacy Scale (GSES) and the Vulnerable Personality Style Questionnaire (VPSQ). Meanwhile, a demographic characteristics questionnaire was used to collect basic information about pregnant women during the prenatal survey. At the same time, we created two WeChat groups respectively in two hospitals to collect postpartum data online and keep good contact with pregnant women. WeChat is a widely used application in China that can help people communicate with two or more users by creating a chat group. Second, the postpartum survey consisted of the Edinburgh Postpartum Depression Scale (EPDS) and general obstetric information. Based on WeChat groups, we conducted a postpartum survey by the Wenjuanxing platform (<https://www.wjx.cn/app/survey.aspx>) one month after childbirth. Then we checked the postpartum data carefully to ensure that all informed participants had finished the postpartum survey. Furthermore, the unfinished one and those less than one month after childbirth would be notified again through telephone follow-up.

Finally, 587 pregnant women were recruited, among which 158 were invalid, thus there were 429 eligible samples.

### Study Participants

Eligible participants were those who: 1) aged at least 20 years, 2) were pregnant at 37–41 weeks, 3) had no history of severe physical illness, 4) could understand Chinese and 5) agreed to participate in this survey and signed informed consent.

Exclusion criteria included the diagnosis of more than three pregnancy complications or other physical severe diseases during this pregnancy. Additionally, pregnant women who refused to participate in the research and exited halfway were also excluded.

## Measurements

### Sociodemographic and Obstetrical Characteristics Questionnaire

Based on previous reviews and researches,<sup>5,7,10,12</sup> we designed the sociodemographic and obstetrical characteristics questionnaire to collect basic information of participants. It consisted of age, parity, gestational week, pregnancy complication, employment status, educational level, average monthly family income, marital status, residence, planning of pregnancy, planned mode of birth and primary caregiver in the prenatal survey. Postpartum data collection was conducted at the first month after delivery, including infant gender, breastfeeding behaviour and mode of birth.

### The General Self Efficacy Scale (GSES)

The GSES, a unidimensional scale that included ten items, was constructed by Schwarzer and Renner.<sup>29</sup> In this survey, we used the Chinese version of GSES that Wang et al<sup>30</sup> translated in 2001 (Cronbach's  $\alpha = 0.87$ ). It was used extensively to evaluate participants' self-efficacy in China. Each item of GSES scored on a 4-point Likert scale (1 "definitely no" to 4 "definitely yes"). The sum scores of the scale ranged from 10 to 40. The higher the sum scores were, the better sense of self-efficacy. Internal consistency of GSES in this survey also showed excellent (Cronbach's  $\alpha = 0.852$ ).

### The Vulnerable Personality Style Questionnaire (VPSQ)

Dennis and Boyce initially developed the 9-item VPSQ in 2004.<sup>14</sup> A localised version of VPSQ translated by Jin and Li<sup>20</sup> was utilised widely in China, which consisted of 9 items. Each item represented a dimension, which scored on a 5-point Likert scale (1 "not at all" to 5 "very much so"). The sum scores of the questionnaire ranged from 9 to 45. There were two sub-scales, which consisted of the "vulnerability" (nervy, timidity, sensitivity, worrier, obsessive and volatility) and the "organised/responsive" (coping, organised and expressive). The sum scores of all the items revealed one's personality tendency. Internal consistency of VPSQ was proved good in our survey (Cronbach's  $\alpha = 0.602$ ), and Cronbach's  $\alpha$  of the sub-scales were 0.714 ("vulnerability") and 0.671 ("organized/responsive") respectively.

### The Edinburgh Postnatal Depression Scale (EPDS)

The Edinburgh Postnatal Depression Scale (EPDS) was used globally to screen for symptoms of postpartum depression at one month. Cox and his team constructed EPDS initially,<sup>31</sup> which was translated into Chinese by Lee and a cut-off score of 9/10 was recommended.<sup>32,33</sup> The EPDS consisted of ten items scored from 0 to 3. The sum scores of the scale ranged from 0 to 30. Additionally, the women who scored over 9 were probably at risk of suffering from depression.<sup>32,33</sup> The threshold score of 9/10 was used in this study. The internal consistency of EPDS was shown excellent in this research (Cronbach's  $\alpha = 0.805$ ).

## Data Collection

From February to April 2021, we conducted a cross-sectional survey among pregnant women by using convenient sampling. The survey was performed by researchers and trained midwives at maternity wards and obstetric clinics. At the beginning of the survey, all eligible participants were informed of the purpose of the study and required to provide informed consent. To ensure the authenticity and completeness of the data, researchers informed participants of the matters needing attention in filling in the questionnaire.

At first, 587 pregnant women were available, and 545 agreed to participate in this study. After the prenatal survey, including the GSES, VPSQ and demographic characteristics questionnaires, 72 women were excluded from 545 participants because of the following reasons: exit halfway ( $n=6$ ), fail to meet the inclusion criteria ( $n=52$ ), and incomplete questionnaires ( $n=14$ ). In the first month after childbirth, we distributed electric questionnaires consisting of the EPDS and general obstetric information to mothers through the WeChat groups, and 159 completed questionnaires were finally returned. Then we continued to collect the rest data by telephone follow-up, and 44 participants could not be contacted. Finally, 429 pieces of data were analysed (response rate: 90.7%).

## Data Analysis

The software of IBM SPSS Statistics 25.0 and AMOS Graphics 25.0 were employed to analyse data. Sociodemographic and obstetrical information and the scores of GSES, VPSQ and EPDS were examined by descriptive statistics of

frequencies, percentages, means, standard deviations, and scores range. Pearson Correlation Coefficient was performed to explore the relationships among demographic characteristics, self-efficacy, vulnerable personality and postpartum depression. The internal consistencies of measurement tools were retested in this survey.

According to previous reviews,<sup>5,10,34</sup> many sociodemographic characteristics such as age, parity, monthly income and educational level were associated with PPD. Therefore, the relationship between sociodemographic factors and PPD was first tested. And the predictors of self-efficacy and vulnerable personality were also explored, respectively. Then we investigated the direct relationship of self-efficacy, vulnerable personality and PPD.

After the fundamental data analysis, we made the structural equation modelling (SEM) consists of self-efficacy, vulnerable personality and postpartum depression. The bootstrap method (5,000 replicates)<sup>35,36</sup> and product of coefficients test<sup>37,38</sup> were used to verify the mediation effect of maternal self-efficacy on vulnerable personality and postpartum depression. The bootstrap method was more accurate and efficient in demonstrating the mediator effect than traditional statistical methods.<sup>37,39,40</sup> Ninety-five percent confidence intervals were constructed by using a bootstrap resampling approach.<sup>39</sup> The model's fit with our data was tested using chi-square statistics (CMIN), degrees of freedom (*df*), goodness-of-fit index (GFI), adjusted goodness-of-fit index (AGFI), Tucker-Lewis index (TLI), comparative fit index (CFI), and root mean square error of approximation (RMSEA). A two-tailed significance level of 0.05 was used for statistical analysis.

## Results

### Participant Characteristics

There were 429 valid questionnaires in this survey. The age of pregnant women ranged from 20 to 43 years old, and the mean age was 31.15 (SD =4.0). Characteristics of all of the participants are shown in [Table 1](#).

### Descriptive Statistics of the Measurements

The score ranges, means and standard deviations of maternal self-efficacy, vulnerable personality and postpartum depression were performed in [Table 2](#). We found that the average score of PPD was generally low (M=2.57, SD=3.3), and the rate of postpartum depression at one month determined by a score  $\geq 10$  on the EPDS was 3.3% (N=14).

### Correlations Analyses

The results of correlational analyses of sum scores of GSES, VPSQ and EPDS are shown in [Table 3](#). As [Table 3](#) described to us, postpartum depression is negatively correlated with self-efficacy ( $r = -0.382$ ,  $P < 0.01$ ), but positively correlated with vulnerable personality ( $r = 0.457$ ,  $P < 0.01$ ). There is an inverse correlation between self-efficacy and vulnerable personality ( $r = -0.283$ ,  $P < 0.01$ ). Based on the significant correlation of three main variables, further analysis and exploration could be carried out to investigate the hypothesis.

### The Mediation Effect of Self-Efficacy Analysis

After basic statistical analyses, we constructed the structural equation modelling to test the hypothesis by using AMOS. The trimmed SEM is shown in [Figure 1](#), and its model fit well with the data was: CMIN=43.485,  $df=32$ ,  $\chi^2/df=1.359$ , GFI=0.982, AGFI=0.963, TLI=0.974, CFI=0.985, RMSEA=0.029 and RMR=0.034. The SEM model demonstrated that vulnerable personality had a direct effect on postpartum depression ( $\beta = 0.411$ ,  $P < 0.001$ ). And self-efficacy negatively predicted PPD ( $\beta = -0.216$ ,  $P < 0.001$ ) as well vulnerable personality ( $\beta = -0.415$ ,  $P < 0.001$ ). Additionally, vulnerable personality was indirectly related to PPD through self-efficacy ( $\beta = 0.090$ ,  $P < 0.001$ ). Moreover, vulnerable personality and self-efficacy can explain 29.0% of the variation in PPD.

The standardised total, indirect, and direct effects of the model are depicted clearly in [Table 4](#). It was revealed that maternal self-efficacy played a mediated role in the relationship between vulnerable personality and postpartum depression. A partial mediating effect of self-efficacy on PPD accounted for 18.0% (0.090/0.501) of the total effect. The bootstrapped 95% confidence interval of indirect effect between vulnerable personality and postpartum depression did not include zero (95% CI= [0.050, 0.136]), which indicated that the mediation effect of self-efficacy was significant.

**Table I** Sociodemographic Characteristics of Participants (N=429)

		n (%)	Range	Mean (SD)
<b>Age</b>	≤25	33 (7.7)	20–43	31.15 (4.0)
	26–30	146 (34.0)		
	31–35	198 (46.2)		
	36–39	38 (8.9)		
	≥40	14 (3.3)		
<b>Parity</b>	Primiparous	253 (59.0)		
	Multiparous	176 (41.0)		
<b>Gestational week</b>	37–38	160 (37.3)	37–41	38.82 (1.3)
	39–40	231 (54.0)		
	>40	38 (8.9)		
<b>Pregnancy complication</b>	Yes	113 (26.3)		
	No	316 (73.7)		
<b>Employment status</b>	Not working	132 (30.8)		
	Working	297 (69.2)		
<b>Educational level</b>	Junior high school or below	27 (6.3)		
	Senior high school	43 (10.0)		
	College diploma or certificate	130 (30.3)		
	Bachelor's degree	176 (41.0)		
	Graduate degree or above	52 (12.1)		
	others	1 (0.2)		
<b>Average monthly family income (CNY)</b>	<5000	138 (32.2)		
	5000–7999	180 (42.0)		
	8000–9999	51 (11.9)		
	>10,000	60 (14.0)		
<b>Marital status</b>	Single	5 (1.2)		
	Married	409 (95.3)		
	Remarried	15 (3.5)		
<b>Residence</b>	Urban	359 (83.7)		
	Rural	70 (16.3)		
<b>Planning of pregnancy</b>	Planned	161 (37.5)		
	Unplanned	64 (14.9)		
	Natural conception	191 (44.5)		
	ART	13 (3.0)		
<b>Planned mode of birth</b>	Normal vaginal delivery	297 (69.2)		
	Caesarean section	132 (30.8)		

(Continued)

**Table 1** (Continued).

		n (%)	Range	Mean (SD)
<b>Primary caregiver</b>	Parents	34 (7.9)		
	Husband	271 (63.2)		
	Parents-in-law	52 (12.1)		
	Others	69 (16.1)		
<b>Infant gender</b>	Boy	253 (59.0)		
	Girl	169 (39.4)		
	Twins	7 (1.6)		
<b>Breastfeeding behaviour</b>	Yes	405 (94.4)		
	No	24 (5.6)		
<b>Mode of birth</b>	Normal vaginal delivery	246 (57.3)		
	Caesarean section	171 (39.9)		
	Normal delivery to CS	12 (2.8)		

**Abbreviations:** ART, assisted reproductive technology; CS, caesarean section; CNY, Chinese Yuan.

**Table 2** Descriptive Statistics of Questionnaire Data (N=429)

		M/R	SD
<b>EPDS</b>		2.57(0–12)	3.3
<b>GSES</b>		26.25(11–40)	4.9
<b>VPSQ</b>		26.31(13–45)	4.6
	Vulnerability	15.90(6–30)	4.0
	Q 2	2.8	1.0
	Q 3	2.2	1.0
	Q 4	2.8	1.1
	Q 5	2.9	1.1
	Q 7	2.8	1.1
	Q 9	2.4	1.0
	Organised/ responsive	10.33(4–15)	1.9
	Q 1	3.6	0.9
	Q 6	3.6	1.1
	Q 8	3.1	1.1

**Abbreviations:** EPDS, Edinburgh postpartum depression scale; GSES, general self efficacy scale; VPSQ, vulnerable personality style questionnaire; M/R: M, mean; R, range; SD, standard deviation.

**Table 3** Pearson Correlations for Risk Factors, VPSQ, GSES and EPDS (N=429)

	1	2	3	4	5	6	7	8
<b>1. EPDS</b>								
<b>2. GSES</b>	-0.382**							
<b>3. VPSQ</b>	0.457**	-0.283**						
<b>4. Pregnancy complication</b>	0.117*	0.042	0.053					
<b>5. Planned mode of birth</b>	0.109*	0.006	0.078	0.037				
<b>6. Average monthly family income (CNY)</b>	-0.013	0.021	-0.104*	0.018	0.014			
<b>7. Age</b>	0.073	0.157**	0.002	0.176**	0.221**	0.054		
<b>8. Parity</b>	0.038	0.108*	0.008	0.125**	0.152**	-0.007	0.313**	
<b>Mean</b>	2.57	26.25	26.31	1.26	1.31	2.08	31.15	1.41
<b>Standard Deviation</b>	3.25	4.89	4.58	0.44	0.46	0.99	4.04	0.49

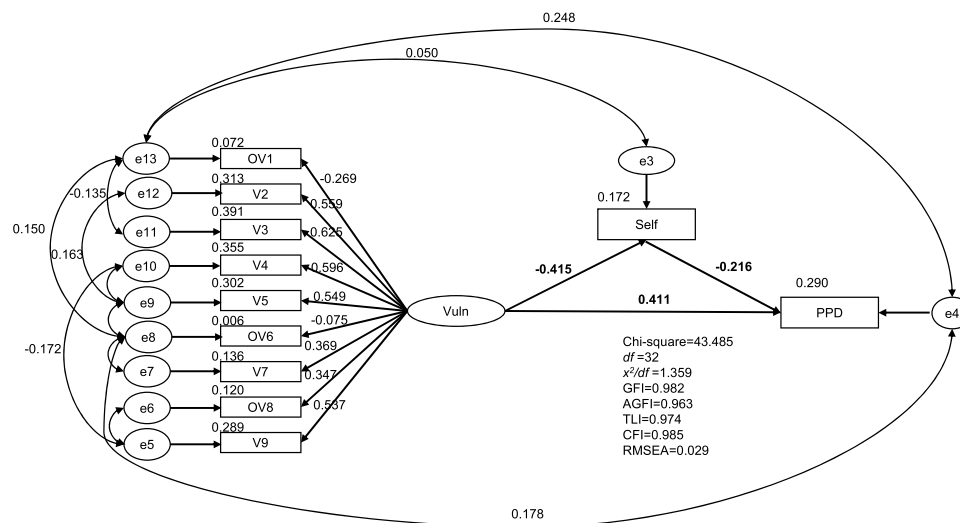
Notes: \*p < 0.05, 2-tailed; \*\*p < 0.01, 2-tailed.

Abbreviations: EPDS, Edinburgh postpartum depression scale; GSES, general self efficacy scale; VPSQ, vulnerable personality style questionnaire; CNY, Chinese Yuan.

## Discussion

We found that self-efficacy played a mediated role in the relationship between vulnerable personality and postpartum depression. It is indicated that self-efficacy may be a key factor for pregnant women with personality traits of vulnerable to reduce the prevalence of PPD.

PPD is one of the most common complications after childbirth,<sup>41</sup> which is negatively associated with mother-infant bonding and women’s mental health.<sup>3,8</sup> Reports in various studies of the prevalence of PPD and associated predictive factors are inconsistent. The heterogeneity of measurement tools and the differences in cut-off scores of EPDS to define severe PPD might contribute to this inconsistency. The reported prevalence of postpartum depression ranges from 6.5 to 12.9% and is even higher in developing countries.<sup>3,42</sup> With the EPDS threshold of 13, the incidence of postpartum



**Figure 1** Structural equation model of mediating role of self-efficacy in vulnerable personality and postpartum depression.

Abbreviations: Vuln, vulnerability personality; PPD, postpartum depression; Self, self-efficacy.

**Table 4** The Standardised Total, Indirect, and Directs Effect of Mediation Model Among Self-Efficacy, Vulnerable Personality, and Postpartum Depression (N=429)

Model Pathway	Point Estimate	Product of Coefficients		Bootstrap*			
				Bias Corrected 95% CI		Percentile 95% CI	
				SE	Z	Lower	Upper
<b>Total effect</b>							
VP→ PPD	0.501	0.052	9.635	0.404	0.604	0.396	0.598
<b>Indirect effect</b>							
VP→ PPD	0.090	0.021	4.286	0.050	0.136	0.048	0.133
<b>Direct effect</b>							
VP→ PPD	0.411	0.062	6.629	0.296	0.538	0.290	0.529
VP→ SE	-0.415	0.052	-7.981	-0.515	-0.310	-0.513	0.308
SE→ PPD	-0.216	0.051	-4.235	-0.310	-0.109	-0.313	0.111

Note: \*Number of bootstrap samples: 5000.

Abbreviations: VP, vulnerability personality; PPD, postpartum depression; SE, self-efficacy.

depression is reported as 23.5% in Shanghai, China.<sup>43</sup> However, a recent cross-sectional study shows a higher prevalence of postpartum depression (56.9%)<sup>44</sup> in Hubei, China, which is probably a consequence of the COVID-19 pandemic.

In this survey, the prevalence of PPD was 3.3% (EPDS  $\geq 10$ ). The result is in line with the research in Changsha of China (5.0%)<sup>45</sup> and a cross-sectional study from three continents (6.7%), including Denmark (6.4%), Vietnam (1.9%) and Tanzania (12.6%).<sup>46</sup> The low prevalence of PPD in this study may be due to the data being collected cross-sectionally and certain methodological limitations or bias rendered by convenience sampling. For example, only 16.3% of participants with senior high school certificates or below in this survey. With reference to previous research, Wesselhoeft et al<sup>46</sup> investigated those mothers with low education levels were prone to significant depressive symptoms. Further, according to statistics published by the National Bureau of Statistics of China in 2021 (<http://www.stats.gov.cn/>), Zhengzhou's GDP ranks first in Henan Province, where the study was conducted. It seems that the city's good economic status and health care system may partly contribute to the low sum scores of EPDS in this study. Taken together, the differences in sampling and data collection methods may be the main reasons for the low incidence of postpartum depression in this study. And further studies with larger sample sizes and more follow-up time points are needed to investigate the prevalence and risk factors of PPD in China. In terms of numerous factors related to PPD, it would be helpful to reduce the incidence of postpartum depression by controlling alterable risk factors.

Our study confirmed that pregnancy complications and preferred caesarean section are strong predictors of postpartum depression, which are consistent with previous studies.<sup>7,12,47</sup> Meanwhile, Tobe<sup>48</sup> notes that young age and primipara are risk factors for PPD in Japan. And a path model analysis suggests that younger maternal age led to a higher level of postpartum depression in the form of a direct pathway.<sup>7</sup> Conversely, increasing age is proved to be an independent risk factor for the development of PPD in recent research.<sup>46</sup> However, there was no significant correlation between women's age as well as other demographic characteristics and PPD in our survey (Table 3). Vigod et al<sup>49</sup> found that the prevalence of PPD was higher among women living in urban areas than in rural areas. However, according to the present survey, there is no significant correlation between the residence and the sum scores of EPDS. Additionally, the risk factors of PPD reported in previous studies include hormonal fluctuations,<sup>48</sup> chronic pain caused by surgical wounds,<sup>50</sup> difficulties in breastfeeding,<sup>23</sup> poor quality sleep<sup>51</sup> and lack of support from family.<sup>52</sup> We were not able to compare all potential risk factors of PPD between our study and others due to different eligible samples. In addition,



although several variables may have no direct effects on PPD, there are possible intermediary variables to connect them. Therefore, further research is needed to confirm and specify this association.

Our study identified that vulnerable personality was negatively related to high sum scores of EPDS. According to a series of studies,<sup>16,17,53,54</sup> it is compelling that vulnerable personality predicts postpartum depression symptoms from personality and cognitive perspectives. A longitudinal study shows that our personality has a stable component across the life span,<sup>55</sup> and the mechanism of personality change is still a cloud.<sup>56</sup> Moreover, it is unclear whether indirect factors mediate the relationship between vulnerable personality and PPD.

Interestingly, in our present study, self-efficacy measured by GSES partly mediated the relationship between vulnerable personality and PPD. Furthermore, we found that self-efficacy negatively correlates with both vulnerable personality and postpartum depression. Many studies have also proved that self-efficacy is a mediator factor related to other variables.<sup>26,27,57</sup> In addition, women over 35 years and multiparas obtained high GSES scores in this survey, which were in line with previous studies.<sup>58,59</sup> However, a review points out that older adults may be less sensitive to self-efficacy interventions.<sup>60</sup> According to an experimental randomised control study, psychological education can enhance general self-efficacy.<sup>61</sup> Based on the SEM, strengthening pregnant women's self-efficacy may be helpful to reduce the incidence of postpartum depression theoretically.

In light of the evidence about improving self-efficacy, the nurse-led intervention program,<sup>62</sup> physical activity intervention,<sup>63</sup> behaviour change techniques<sup>64</sup> and interventions based on an empowering self-management model effectively improved the self-efficacy and health-promoting behaviours.<sup>65</sup> To some extent, the present study may help improve our understanding of reducing the prevalence of PPD from a new perspective.

Additionally, a series of studies have pointed out that prenatal health care and behavioural intervention showed effectiveness in reducing the prevalence of PPD. Simhi et al<sup>66</sup> investigated that cognitive-behavioural interventions reduced postpartum anxiety, distress, and depressive symptoms among postpartum women. Similarly, electronic nursing intervention,<sup>67</sup> doula-home-visiting on postpartum maternal and infant,<sup>68</sup> educational counselling program based on precede-proceed model<sup>69</sup> also decrease the sum scores of EPDS of mothers. Despite the large number of interventions to prevent PPD, there are still no reported self-efficacy improvement programs for women with vulnerable personality traits to decrease the depressive symptoms. Theoretically, the implementation of interventions that enhance the self-efficacy of pregnant women may be helpful to decrease the risk of postpartum depression.

Of note, it is a cross-sectional study, which limits the possibility of establishing causal relationships among variables. Longitudinal and experimental studies are warranted to identify factors that increase or decrease PPD and construct effective targeted interventions of postpartum depressive symptoms among pregnant Chinese women.

## Clinical Implication

The results of the study suggest that self-efficacy intervention may be helpful for pregnant women with vulnerable personality to reduce the incidence of postpartum depression. Due to China's second-child policy, the number of women giving birth in hospitals is increasing rapidly.<sup>70</sup> Compared with obstetricians, nurses and midwives are medical workers who accompany pregnant women more in China. General psychological screening for vulnerable personality conducted by midwives would help improve pregnant women's mental health. Correspondingly, a series of train courses could be set up to improve maternal self-efficacy with the help of midwives.

## Limitations

There are several limitations to our research. First, the sample selection bias may have occurred due to the investigation completed in only two hospitals in China. And the universality of the results was limited. Second, the variables of vulnerable personality and maternal self-efficacy explain less than 40% of the variance of the PPD. Third, all the main variables in this study are the sum scores of measurement tools, and they cannot be considered the diagnosis of psychopathology. Longitudinal and cohort studies are necessary to obtain a more conclusive causality inference. Finally, the mediation effect of self-efficacy is partial. Further research is required to confirm the results and construct efficient intervention programs to enhance maternal self-efficacy.

## Conclusions

In summary, this study expanded the previous research by investigating the relationship that vulnerable personality and self-efficacy are significantly related to postpartum depression. To our knowledge, there is a dearth of studies to report the personality traits of pregnant women and explore the mediated role of self-efficacy between personality traits and PPD in China. Postpartum depression exacerbates maternal vulnerable mental health and impairs the mother-child bond.<sup>8</sup> Therefore, the importance of effective and targeted antenatal health education against possible risk factors to reduce the prevalence of PPD cannot be overstated.

This study found that the prevalence of PPD was 3.3% and revealed that maternal self-efficacy partly mediated the relationship between vulnerable personality traits and postpartum depression. The finding underscores the importance of mental health interventions that target and improve self-efficacy in pregnant women with vulnerable personality to decrease the risk of postpartum depression. While we cannot infer causality from the present data, the vulnerable personality trait of pregnant women in this sample may have contributed to the tendency to postpartum depression. And further studies with larger sample sizes and more follow-up time points are needed to investigate the mediated model of self-efficacy and the relationship between vulnerable personality traits and PPD.

## Ethics Approval and Informed Consent

The procedure was done in agreement with the Declaration of Helsinki. The study was supported by the Ethics Committee of the Third Affiliated Hospital of Zhengzhou University and the Chinese Health Department. Written consent was obtained from the participants, and they were utterly voluntary to participate in this survey.

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## Author Contributions

All authors made significant contributions to conception and design, acquisition of data, or analysis and interpretation of data; took part in drafting the article or revising it critically for important intellectual content; agreed to submit to the current journal; gave final approval of the version to be published; and agree to be accountable for all aspects of the work.

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## Disclosure

The authors report no conflicts of interest for this work.

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