BMC Pregnancy and Childbirth

RESEARCH

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Association of fear of childbirth and postpartum depression with perceived partner response during pregnancy

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Abstract

Background Fear of childbirth may affect delivery experience and postpartum recovery, and even lead to postpartum depression. Spouses, as the primary caregivers of pregnant women, are an important source of emotional support and have a significant impact on their psychological adjustment. The aim of this study is to explore the association of fear of childbirth and postpartum depression with perceived partner response during pregnancy.

Methods A longitudinal study was conducted at the Northern Theater Command General Hospital from June 2023 to April 2024. 289 pregnant women completed two surveys in total. The questionnaire included the Childbirth Attitude Questionnaire, the Edinburgh Postnatal Depression Scale, and the Perceived Partner Responsiveness Scale. Latent class analysis was used to identify categories of postpartum depression. The moderating effect was analyzed by multiple linear regression analysis, and visualized by simple slope analysis.

Results Postpartum depression was classified into three types: "Low postpartum depression -Insomnia and sadness group" (46.5%), "Moderate postpartum depression -Anxiety and crying group" (42.6%), and "High postpartum depression -Emotional suppression group" (10.9%). The interaction term (fear of childbirth*perceived partner response) has a significant impact on postpartum depression ($\Delta R^2 = 0.047$, $\beta = 0.226$, $P < 0.01$), indicating a moderating effect. The effect of fear of childbirth on postpartum depression was gradually decreased in the low (Mean-SD), mean, and high (Mean + SD) groups of perceived partner response ($P < 0.01$).

Conclusions Pregnant women had three characteristics of postpartum depression, and the overall rate was relatively high. The perceived partner response can effectively regulate the association of fear of childbirth and postpartum depression during pregnancy.

Keywords Perceived partner response, Fear of childbirth, Postpartum depression, A longitudinal study, Moderating role, Latent class analysis

Background

Pregnancy is an important period for women, as they experience significant changes in their physical and mental health, as well as the intersection of changes in family roles and hopes for a good delivery outcome, leading to fear of childbirth (FOC) [1]. FOC refers to the anxiety and fear that women feel during pregnancy and before childbirth due to concerns about fetal injury, labor pain, adverse effects or complications during childbirth, and

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the inability to control themselves well, causing physical and mental obstacles and coping difficulties [2]. Due to differences in geography, culture, medical conditions, evaluation methods, and sample size, there are certain differences in the incidence of FOC. Studies in eastern Ethiopia [3] and Turkey [4] showed that 23.3% and 42.4% of pregnant women have FOC. A study in Finland including one million pregnant women showed that the proportion of FOC increased from 1.5% in 2004 to 9.1% in 2018 [5]. A meta-analysis of 853,988 pregnant women, including 33 studies from 18 countries, showed that the global incidence rate of FOC was 3.7% to 43%, and the overall incidence rate was about 14% [6]. Studies in some regions of China showed that the incidence of FOC among pregnant women was 67.8% [7] and 70.3% [8], respectively. A meta-analysis involving 8,815 subjects, including 21 studies published in 18 regions of China from 2016 to 2022, showed that the comprehensive incidence rate of FOC in Chinese pregnant women was 72.1%, which was at a high level [9]. FOC can cause harm to the physical and mental health of pregnant women, such as stomach pain, tachycardia, accelerated pulse, sleep disorders, difficulty concentrating, physical fatigue, anxiety, tension, and other symptoms, and may even choose to terminate pregnancy or have behaviors of avoiding or delaying pregnancy [10, 11]. FOC may affect delivery experience and postpartum recovery, and even lead to postpartum depression, which is one of the common psychological problems during the perinatal period [12].

Postpartum depression (PPD) is also a common mental illness that occurs the first 12 months postpartum [13]. PPD refers to a group of mental disorders characterized by sustained emotional decline within 6 weeks postpartum, which may be accompanied by changes in thinking and action, as well as physical symptoms [14]. A study covering 5 continents and 45 countries showed that the combined prevalence of PPD in the world was 26% [15]. The prevalence of PPD in Chinese Mainland was 14.8% [16]. Women with PPD have an increased risk of natural death [17], and suicidal behavior [18], especially in the first year after diagnosis, and the risk continues to rise throughout the entire eighteen years follow-up. And they also face persistent health consequences, such as recurrent depressive episodes, premenstrual disorders, and bipolar disorder, with a higher risk of vascular and autoimmune diseases [19]. It is worth noting that the impact of PPD can extend to infants, partners, and families, which increases the probability of delayed psycho-motor development in children [20]. Moreover, women with PPD may encounter challenges in their relationships with intimate partners and their social networks [21]. Previous study showed pregnant women who experienced FOC were more prone to PPD [22]. Study also found that 19% women experienced depressive symptoms 2 months after birth, and 12% experienced persistent or recurrent depressive symptoms [22]. Regardless of the time period of pregnancy, FOC is closely connected to PPD [23].

Spouses, as the primary caregivers of pregnant women, are an important source of emotional support and have a significant impact on their symptom management, psychological adjustment, and quality of life. Perceived partner response (PPR) refers to one partner feeling the other's positive attention/response to various personal needs/hobbies/desires [24]. For married individuals, sharing their inner feelings with intimate partners is an important way to alleviate their painful emotions [25, 26]. Previous researches have reported that if the demander receives a positive response from their partner when they have a need, it can not only stimulate their personal positive emotions and enhance their personal happiness, but also actively mobilize their confidence to cope with various difficulties [27–29]. Long term negative responses, such as silence, avoidance of physical contact, disinterest in topics raised by the spouse, and ignoring the other person's feelings, can lead to negative communication patterns, which not only affect the intimate relationship between partners/spouses, increase psychological pressure on both parties, but also further affect physical and mental recovery [30, 31]. According to the interpersonal process theory of intimate relationships, the expression of pain between spouses does not occur naturally. Only when the spouse can empathize and understand their own pain, and this understanding is effectively perceived by themselves, will they actively express their inner feelings to their spouse [32]. This theory suggests that timely and accurate perception of a partner's response is a key step in establishing an intimate relationship. Spouses will naturally exhibit the expected communication and emotional support behaviors of their partner, making it easier for them to perceive their partner's emotional response and be more willing to actively express their inner pain and thoughts to their partner [32]. In the context of Chinese culture, perceived partner reactions have different impacts on men and women. Women have high emotional needs and are more involved in the communication process between spouses [33]. Therefore, during pregnancy, a positive response from the husband can motivate pregnant women to adopt proactive coping strategies, actively communicate with their spouses, thereby improving their adaptability and alleviating psychological fears related to childbirth.

Based on the above research, this study hypothesizes that the perceived strength of partner response during pregnancy can alleviate the impact of fear of childbirth on PPD in pregnant women. Specifically, this study focuses on exploring the association of fear of childbirth

and postpartum depression with perceived partner response during pregnancy.

Materials and methods

Study design and sample

This study is a longitudinal survey. We selected pregnant women who underwent routine prenatal check ups at the Northern Theater Command General Hospital from June 2023 to November 2023, planned to give birth at the hospital, and met the inclusion criteria. From December 2023 to April 2024, we followed up with pregnant women approximately 42 days after delivery. According to Kendall's sample size calculation formula, the sample size should be at least 10–20 times the number of independent variables [34]. We included 16 independent variables, and considered a 20% dropout rate, the final calculated sample size was 16*(10–20)/0.8 = 200–400 participants. Finally, a total of 300 questionnaires were distributed before delivery, and 289 pregnant women completed both surveys, with an effective rate of 89.0%. Inclusion criteria: Age ≥ 18 years old; Pregnancy of 12 weeks or more; Regular prenatal check ups in our hospital; Informed consent and voluntary cooperation in the investigation. Exclusion criteria: Serious complications or comorbidities; Diagnosed with mental illness.

Measurements

Demographic variables

A self-designed questionnaire was used, including age, education level ("High school or below", "Undergraduate or above"), occupation ("Company employees", "Public institutions/civil servants", "Individual/Temporary Worker", "Full time wife"), per capita family income ("< 4000CNY", "4000-8000CNY", "> 8000CNY"), single child situation ("Yes", "No"), first pregnancy ("Yes", "No"), planned pregnancy ("Yes", "No"), body and appearance anxiety ("Yes", "No").

Fear of childbirth

We used the Childbirth Attitude Questionnaire (CAQ) developed by Lowe et al. [35] to measure the FOC among pregnant women. CAQ consists of 16 items, divided into 4 dimensions, including fetal health, self-control, pain and injury during childbirth, and medical care. The answer is scored on a 1–4 scale, with a total score of 16–64, which is positively correlated with FOC level.

Perinatal depression

We used the Edinburgh Postnatal Depression Scale (EPDS) developed by Cox et al. [36] to measure the PPD of pregnant women. EPDS consists of 10 items, including three dimensions: emotional deficiency, anxiety, and depression. The answer is scored on a 0–3 scale, with a total score of 0–30, which is positively correlated with PPD level.

Perceived partner responsiveness

We used the Perceived Partner Responsiveness Scale (PPRS) developed by Reis et al. [37] to measure the perceived partner responsiveness (PPR) of pregnant women. PPRS consists of 12 items, and the answer is scored on a 1–7 scale, with a total score of 12–84, which is positively correlated with PPR level.

Statistic analysis

Mplus8.3 software was used to conduct LCA. The model fitting indicators include Akaike information criterion (AIC), Bayesian information criterion (BIC), and adjusted Bayesian information criterion (aBIC), and the smaller the value, the better the model fit [38]. The closer the entropy classification index is to 1, the more accurate the classification is [38]. Lo-Mendel-Rubin (LMR) and Bootstrap Likelihood Ratio Test (BLRT) are likelihood ratio test indicators, if $P < 0.05$, it indicates that the fitting effect of the k classification models is better than that of the k-1 model [39]. The research variables follow a normal distribution and have a linear relationship, while VIF < 5 indicates the absence of multicollinearity. Therefore, SPSS26.0 was used to conduct multiple linear regression analysis, verifying the moderating effect of PPR. If the interaction was statistically significant, we would perform a simple slope analysis to visualize the interaction terms. A two-tailed $P < 0.05$ was considered to be statistically meaningful.

Results

Latent class analysis

Table 1 shows the fitting indices of the five models. The *P*-values of LMR in the 4-class and 5-class model have no statistical significance ($P > 0.05$), which should be excluded. The AIC, BIC, and aBIC values of the 3-class model are lower than those of the 2-class model, indicating a higher fitting degree of the model. The Entropy value of the 3-class model is also higher than that of the 2-class pattern model, indicating a more accurate model classification. Based on the above judgment, this study divided all pregnant women into three different trait groups.

The potential category diagram of the three characteristics of pregnant women was shown in Fig. 1. The group of pregnant women represented by the blue line scored the lowest level in each component of PPD, but scored higher in insomnia and sadness items. Therefore, it was named "Low PPD -Insomnia and sadness group", which accounts for 46.5% of the total pregnant women. The group of pregnant women represented by the green line

Table 1 The fit indices of the latent class models

Models	AIC	BIC	aBIC	Entropy	LMR	BLRT	Class Probability(%)
1-class	7969.814	8043.143	7979.720				
2-class	7205.974	7319.634	7221.328	0.946	< 0.001	< 0.001	49.3/50.7
3-class	6873.386	7027.376	6894.188	0.956	0.0203	< 0.001	47.0/43.6/9.4
4-class	6732.168	6732.168	6758.417	0.967	0.0721	< 0.001	47.1/37.6/7.9/7.4
5-class	6628.267	6862.918	6659.964	0.974	0.1722	< 0.001	37.2/47.1/7.6/3.1/5.0

PPD Postpartum depression, *AIC* Akaike information criterion, *BIC* Bayesian information criterion, *aBIC* adjusted Bayesian information criterion, *LMR* Lo-Mendel-Rubin, *BLRT* Bootstrap Likelihood Ratio Test

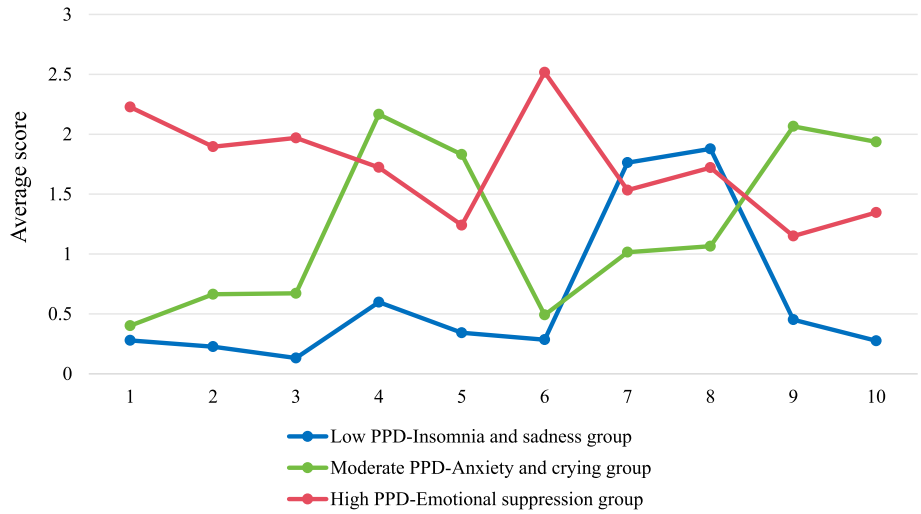

Fig. 1 Latent class plot based on PPD. Notes: PPD, Postpartum depression; 1–10, 10 items of the Edinburgh Postnatal Depression Scale

scored a moderate level in each component of PPD, but scored higher in anxiety and crying items. Therefore, it was named "Moderate PPD -Anxiety and crying group", which accounts for 42.6% of the total pregnant women. The group of pregnant women represented by the red line scored the highest level in each component of PPD, and scored higher in emotional suppression items. Therefore, it named "High PPD -Emotional suppression group", which accounts for 10.9% of the total pregnant women.

Univariate analysis

Table 2 shows that compared to the other two groups, pregnant women with a per capita monthly income below 4000 have the highest levels of PDD; Compared with the other group, pregnant women who are single child have a higher level of PDD; Pregnant women with physical anxiety and appearance anxiety have a higher level of PDD than those without physical anxiety and appearance anxiety.

Correlation analysis

Table 3 shows that the higher the fear of childbirth (FOC), the higher the postpartum depression (PDD) ($P<0.01$). The higher the fear of childbirth (FOC), the lower the perceived partner response (PPR) ($P<0.01$). The higher the perceived partner response (PPR), the lower the postpartum depression (PDD) ($P<0.01$).

Multiple linear regression analysis

Table 4 shows the moderating effects of FOC. We added the variables with statistical significance in Table 2 to step 1 as control variables. In step 2, we added FOC and PPR. In step 3, we added the centralized interaction terms (FOC * PPR). The results showed that after adding the interaction term, although the effect value of FOC on PDD increased (from 0.245 to 0.252), the absolute value of effect value of PPR on PDD increased even more (from 0.414 to 0.457). Therefore, the above results preliminarily indicated the moderating role of PPR ($\Delta R^2=0.047$, $\beta=0.226$, $P<0.01$), that is, as the PPR increases, the effect of FOC on PDD may gradually decrease.

Table 5 shows the results of the moderating effect of the four dimensions respectively. We omitted the reporting of control variables in step 1 in Table 5 because it is identical to step 1 in Table 4. The difference is that the values of the single factor omitted in the step2 and step2 are different,

Table 2 The impact of demographic characteristics on PPD

Variables	N(%)	Mean (SD)	F/t	P
Age			1.512	0.222
18–24	17(5.9%)	11.64 (4.41)		
25–30	196(67.8%)	9.93 (4.45)		
31 ~	76(26.3%)	9.53 (4.82)		
Educational level			1.876	0.061
High school or below	136(47.1%)	10.46 (4.63)		
Undergraduate or above	153(52.9%)	9.45 (4.45)		
Occupation			0.468	0.705
Company employees	153(52.9%)	10.14 (4.42)		
Public institutions/civil servants	69(23.9%)	9.98 (4.61)		
Individual/Temporary Worker	46(15.9%)	9.39 (4.87)		
Full time wife	21(7.3%)	9.28 (4.77)		
Per capita monthly income			7.539	0.001
< 4000	36(12.5%)	12.08 (4.75)*		
4000–8000	175(60.6%)	10.05 (4.37)*		
> 8000	78(27.0%)	8.64 (4.48)*		
Single child			3.533	< 0.001
Yes	111(38.4%)	11.09 (4.18)		
No	178(61.6%)	9.19 (4.63)		
First pregnancy			0.684	0.494
Yes	180(62.3%)	10.07 (4.70)		
No	109(37.7%)	9.69 (4.31)		
Planned pregnancy			−1.661	0.098
Yes	222(76.8%)	9.68 (4.53)		
No	67(23.2%)	10.73 (4.56)		
Worried about losing shape			−2.520	0.013
Yes	182(63.0%)	10.46 (4.24)		
No	107(37.0%)	9.02 (4.92)		
Worried about aging appearance			−3.689	< 0.001
Yes	165(57.1%)	10.78 (4.10)		
No	124(42.9%)	8.78 (4.87)		

F represents homogeneity of variance test, used to test whether there is a significant difference in variance between two or more populations. *, Least-Significant Difference shows the significant differences between three or more groups. T represents independent sample t-test, used to compare whether there is a significant difference in the mean between two independent sample groups

but only per capita monthly income has statistical significance, which is the same as Table 4. The results showed that after adding the interaction term, although there was an increase or decrease in the impact of the four dimensions of FOC on PDD, the absolute value of effect value of PPR on PDD increased more in each dimension. The interaction term of FOC 1*PPR ($\Delta R^2 = 0.052$, $\beta = 0.236$, $P < 0.01$), FOC 2*PPR ($\Delta R^2 = 0.043$, $\beta = 0.216$, $P < 0.01$), FOC 3*PPR ($\Delta R^2 = 0.037$, $\beta = 0.204$, $P < 0.01$), and FOC 4*PPR ($\Delta R^2 = 0.064$, $\beta = 0.264$, $P < 0.01$) had significant impacts on PPD respectively, indicating moderating effects, that is, as the PPR increases, the effect of the four dimensions of FOC on PPD may also gradually decrease.

Simple slope test

Figure 2 visualizes the moderating effect of PPR. According to the mean and its next standard deviation of PPR, the subjects were divided into high PPR group (Mean + SD), medium PPR group (Mean), and low PPR group (Mean-SD). As PPR increases from low to high, the impact of FOC and its four dimensions on PPD gradually decreases respectively. PPR plays a moderating role in the relationship between FOC and its four dimensions and PPD respectively.

Discussion

In this study, we identified three different types of potential PPD, namely, "Low PPD -Insomnia and sadness group", "Moderate PPD -Anxiety and crying group" and "High PPD -Emotional suppression group". 155 pregnant women showed moderate to high PPD, accounting for 53.5% of the total. The above incidence rate is higher than the previous research results [40–42]. Perhaps it's because we used latent class analysis (LCA) to classify PPD. Previous studies typically used the total score of self-assessment scales as the criteria for classifying PPD in pregnant women [40–42]. This variable centered analysis technique assumes that the psychological state of patients is evenly distributed. However, other studies have shown that this distribution is heterogeneous after trauma, indicating that studies using variable focus analysis techniques may not reflect psychological responses associated with patient heterogeneity, as they ignore individual differences [43]. LCA is a more scientific and rigorous statistical method that classifies the latent characteristics of the population based on the probability of each item's score, which is superior to traditional methods, especially when applied to categorical data or qualitative research analysis [44, 45]. This study used LCA to classify PPD, taking into account symptom characteristics and severity, in order to develop more targeted intervention measures.

Research has shown that FOC may increase the risk of PPD. FOC includes fear of children's health, fear of losing control during childbirth, fear of pain and injury, and fear of hospital intervention and environment. Previous studies have shown that women with high FOC are more likely to experience perinatal depression [23]. To reduce the FOC and its impact on PPD, various intervention measures can be taken, including psychological education, cognitive-behavioral therapy, group discussions, peer education, and art therapy [46, 47]. These intervention measures aim to help pregnant women

Table 3 Correlation analysis of FOC, the four dimensions of FOC, PPR, and PPD

Variables	FOC	FOC1	FOC2	FOC3	FOC4	PPR	PPD
FOC	1						
FOC 1	0.940**	1					
FOC 2	0.949**	0.854**	1				
FOC 3	0.935**	0.813**	0.864**	1			
FOC 4	0.916**	0.851**	0.846**	0.813**	1		
PPR	−0.501**	−0.455**	−0.481**	−0.456**	−0.484**	1	
PPD	0.459**	0.364**	0.470	0.431**	0.431**	−0.575**	1
Mean	36.99	11.89	9.35	9.21	6.67	63.13	9.92
SD	12.66	4.26	3.36	3.30	2.64	15.00	4.55

FOC Fear of childbirth, *FOC 1* Fear of children's health, *FOC 2* Fear of losing control during childbirth, *FOC 3* Fear of pain and injury, *FOC 4* Fear of hospital intervention and environment, *PPR* Perceived partner responsiveness, *PPD* Postpartum depression

** $P<0.01$

Table 4 Multiple linear regression analysis of FOC, PPR, and PPD

Variables	PPD		
	Step1(*β*)	Step2(*β*)	Step3(*β*)
Age	−0.067	−0.028	−0.022
Per capita monthly income	−0.211**	−0.146**	−0.122*
Single child	−0.193**	−0.072	−0.049
Worried about losing shape	0.040	−0.072	−0.104
Worried about aging appearance	0.177**	0.052	0.036
FOC		0.245**	0.252**
PPR		−0.414**	−0.457**
FOC*PPR			0.226**
F	7.242**	23.113**	24.787**
Adjusted R^2	0.115	0.381	0.426
ΔR^2	0.134	0.264	0.047

FOC Fear of childbirth, *PPR* Perceived partner responsiveness, *PPD* Postpartum depression

** $P<0.01$

build confidence in childbirth, provide strategies for coping with childbirth, and enhance their decision-making abilities during pregnancy and childbirth. In summary, the FOC in pregnant women is a multifactorial issue that is associated with PPD. Research has shown that family economic status is one of the factors affecting PPD. Postpartum mothers who experience a decrease in income or loss of economic sources due to maternity leave may worry about a decline in their material quality of life or the inability of their children to have better conditions, which may lead to PPD [48].

This study found that PPR has a moderating effect on the relationship between FOC and PPD, that is, pregnant women who perceive higher partner response have a reduced impact of FOC on PPD. Pregnant women who perceive a high level of partner response can strengthen intimate relationships through communication between

Table 5 Multiple Regression Analysis of the four dimensions of FOC, PPR, and PPD

Variables	PPD	
	Step2(*β*)	Step3(*β*)
FOC 1	0.126*	0.124*
PPR	−0.467**	−0.507**
FOC 1*PPR		0.236**
F	20.832**	22.914**
Adjusted R^2	0.355	0.406
ΔR^2	0.240	0.052
FOC 2	0.265**	0.260**
PPR	−0.409**	−0.448**
FOC 2*PPR		0.216**
F	23.995**	25.356**
Adjusted R^2	0.390	0.432
ΔR^2	0.273	0.043
FOC 3	0.234**	0.257**
PPR	−0.429**	−0.464**
FOC 3*PPR		0.204**
F	22.927**	23.687**
Adjusted R^2	0.396	0.262
ΔR^2	0.433	0.037
FOC 4	0.194**	0.238**
PPR	−0.435**	−0.465**
FOC 4*PPR		0.264**
F	22.139**	25.490**
Adjusted R^2	0.387	0.254
ΔR^2	0.451	0.064

FOC Fear of childbirth, *FOC 1* Fear of children's health, *FOC 2* Fear of losing control during childbirth, *FOC 3* Fear of pain and injury, *FOC 4* Fear of hospital intervention and environment, *PPR* Perceived partner responsiveness, *PPD* Postpartum depression

* $P<0.05$

** $P<0.01$

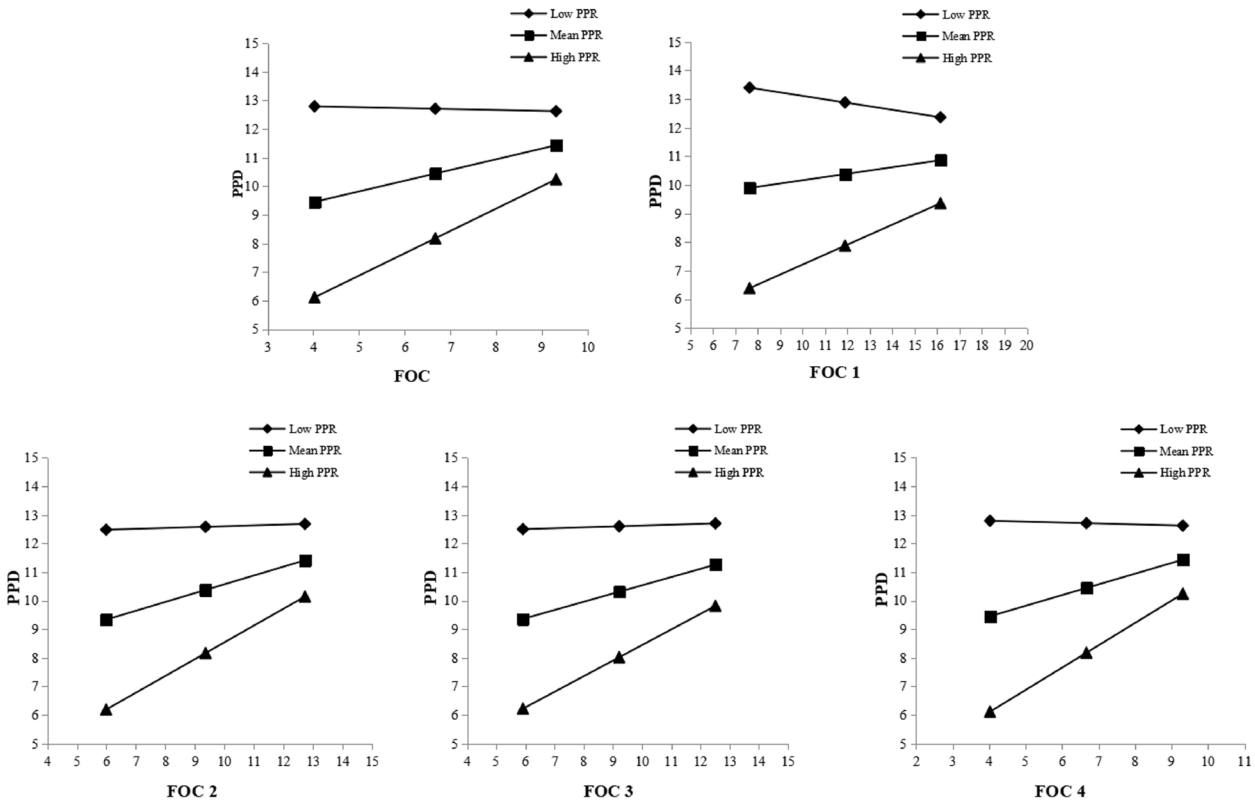

Fig. 2 Simple slope plot of interaction between FOC and its four dimensions and PPR on PPD. Notes: Low, − 1 SD below the mean; High, + 1SD above the mean; FOC, Fear of childbirth; FOC 1, Fear of children's health; FOC 2, Fear of losing control during childbirth; FOC 3, Fear of pain and injury; FOC 4, Fear of hospital intervention and environment; PPR, Perceived partner responsiveness; PPD, Postpartum depression

one partner's self disclosure/narration and the other's listening and response [25–29]. Therefore, when pregnant women encounter significant difficulties, partners can promptly identify the situation they are facing and respond promptly when they need encouragement and support to reduce their FOC and alleviate PPD. Therefore, medical staff should pay attention to both the empathy ability of spouses and the perception of partner response in patients. In subsequent nursing interventions, medical staff should not only focus on the physical health of pregnant women, but also help pregnant women and their families establish good partner response and intimate relationships through relevant health education. Medical staff can try to adopt a couple centered psychological intervention, encouraging pregnant women and their spouses to participate together, making their spouses aware of the key role they play in the patient's recovery process. By enhancing their empathy ability, their emotional support can be effectively perceived by the patient, thus encouraging pregnant women to actively express their inner fears and negative emotions and improve their psychological environment.

There are several advantages to this study. We first used LCA to identify potential categories of PPD in pregnant women, considering the characteristics and severity of symptoms, in order to develop more targeted intervention measures. We have analyzed for the first time the regulatory role of PPR between FOC and PPD, providing a new perspective for healthcare professionals to implement nursing interventions. This study is a longitudinal study that can verify causal relationships. There are several limitations to this study. The pregnant women included in this study only came from one hospital, and extrapolation of the results may be limited. This study used a self-administered questionnaire, and respondents may provide inaccurate answers. This study ignored the influence of gestational age on the fear of childbirth, which may have an indirect impact on the results.

Conclusions

Pregnant women had three characteristics of PPD, and the overall rate was relatively high. The FOC seriously affects PPD, and the level of PPR can effectively regulate the impact of FOC on PPD.

Abbreviations

PPD Postpartum depression
FOC Fear of childbirth
PPR Perceived partner response
LCA Latent class analysis

Acknowledgements
This study was grateful to the staff of the hospital who cooperated and the pregnant women who participated in the survey.

Authors' contributions
BF Lcontributed to data collection, statistical analysis, drafting and revision of the manuscript. T L, D M, and JL S contributed to organizing the survey and interpretation of the data. JS L contributed to the study design, data collection and revision of the manuscript. All authors reviewed the manuscript.

Funding
This study did not receive any funding.

Data availability
The datasets generated and/or analysed during the current study are not publicly available due the data also forms part of an ongoing study but are available from the corresponding author on reasonable request.

Declarations

Ethics approval and consent to participate
This study was reviewed and approved by the Ethics Committee of General Hospital of the Northern Theater Command. The study followed the principles of the Declaration of Helsinki. All participants were requested to read and sign the informed consent form before starting this study.

Consent for publication
Not applicable.

Competing interests
The authors declare no competing interests.

Received: 17 September 2024 Accepted: 14 February 2025
Published online: 26 February 2025

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