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Mediating Effect of Marital Satisfaction Level on the Relationship between Partner Phubbing and Depression in Late Pregnancy

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【Abstract】 **Background** The prevention and treatment of depression is a priority among mental health issues in China, and pregnant women are a key target group. Prenatal depression is easily ignored although it is highly prevalent and harmful. To reduce its prevalence, it is crucial to identifying the interaction mechanism between psychosocial factors (such as marital satisfaction and partner support) associated with prenatal depression, and controlling the modifiable risk factors. **Objective** To explore the relationship between marital satisfaction, partner phubbing and depression in late-pregnancy women, and to assess the level of mediating effect of marital satisfaction on the relationship between the latter two, providing maternal and child healthcare professionals with evidence on interventions for prenatal depression. **Methods** Convenience sampling method was used to select women in late pregnancy who underwent routine prenatal check-ups in the Obstetrics Clinic, the First Affiliated Hospital of Anhui Medical University from October 2020 to May 2021. A self-designed general information questionnaire was used to collect sociodemographic and obstetric data. The Partner Phubbing Scale (PPS) was used to assess partner phubbing prevalence. The Quality of Marriage Index (QMI) was used to measure the level of marital satisfaction. The Edinburgh Postnatal Depression Scale (EPDS) was used to assess the prenatal depression prevalence. Mplus 8.3 was used to establish a structural equation model for mediation analysis. **Results** Altogether, 300 cases were recruited. All of them were included for analysis except nine cases who returned unresponsive questionnaires, obtaining a survey response rate of 97.00%. The prenatal depression prevalence in the respondents was 40.89% (119/291). The mean scores of PPS, QMI, and EPDS for them were (25.6 ± 6.3) , (37.9 ± 6.0) , and (8.0 ± 3.5) , respectively. Correlation analysis showed that partner phubbing was negatively associated with marital satisfaction ($r=-0.292$, $P<0.01$), and positively associated with prenatal depression ($r=0.350$, $P<0.01$). Marital satisfaction level was negatively correlated with prenatal depression ($r=-0.338$, $P<0.01$). Mediation analysis revealed that the size of direct effect of partner phubbing on prenatal depression was 0.214, accounting for 82.63%

of the total effect. Marital satisfaction partially mediated the relationship between partner phubbing and prenatal depression, with a size of mediation effect of 0.045, accounting for 17.37% of the total effect. **Conclusion** Partner phubbing could positively predict depression in late pregnancy, and their relationship may be partially mediated by marital satisfaction. To reduce the prevalence of depression in late pregnancy, maternal and child healthcare professionals could improve the marriage of pregnant woman via providing them with interventions to decrease the prevalence of partner phubbing.

【Key words】 Prenatal depression; Partner phubbing; Marital satisfaction; Intermediary role; Late pregnancy

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Industry contribution:

Phubbing is a prevalent social phenomenon today, and phubbing between partners can affect the couple's relationship, which in turn reduces marital satisfaction and causes individuals to have bad moods. Given the current high and increasing prevalence of antenatal depression, it is important to investigate the mechanisms underlying the relationship between partner phubbing, marital satisfaction and antenatal depression in women. This study shows that partner phubbing in late pregnancy predicts the onset of antenatal depression, reduces marital satisfaction and increases the risk of antenatal depression. This provides a theoretical basis for clinical interventions for antenatal depression.

In recent years, the incidence of antenatal depression has been increasing at an annual rate of 9%[1], and has reached as high as 40% in China[2]. At the same time, antenatal depression is the strongest predictor of postnatal depression, which not only seriously affects the psychological and physical health of pregnant women, but also the normal cognitive, emotional and behavioural development of infants and children[3]. Previous national and international studies have focused on postnatal depression. In the past, most domestic and foreign studies focused on postpartum depression[4-5], but with the change of research perspective in recent years, how to improve antenatal women's mental health and reduce their depression from the perspective of postpartum depression prevention has become a major public health problem faced by maternal and child health care professionals worldwide.

Late pregnancy is a special time when a woman's functional load on all organs reaches its peak during pregnancy and she is about to give birth[6]. Studies have confirmed that a lack of adequate partner support during this period can lead to poor

marital quality or reduced marital satisfaction thereby increasing the risk of antenatal depression[7-9]. In family life, pregnant women expect more attention and care from their partners, but with the increased frequency of mobile phone use and dependence on mobile phones in the information age, partners may neglect pregnant women due to excessive use of mobile phones. The habitual use of mobile phones by a partner can lead to neglect and alienation of the individual. When talking to one's partner, it is likely that the partner's phone will cause a brief interruption; we call this partner phubbing because of the feeling of being ignored and left out when the partner uses her/his mobile phone in the former's presence[10]. Partner phubbing in pregnant women may lead to reduced marital satisfaction, an important protective factor for marital quality, which refers to the attitudes and perceptions of the partner and the marital relationship[11]. Some studies have shown that partner phubbing in Chinese adults is negatively associated with marital satisfaction and positively associated with depressed mood[12], but there is a lack of studies on the population during pregnancy. In conclusion, the effects of partner phubbing and marital satisfaction on antenatal depression and the mediating role of marital satisfaction between the two from the perspective of postnatal depression prevention were investigated in the study, in order to provide a basis for maternal and child health workers to strengthen education and guidance for pregnant women and their partners on phubbing and regulate their marital relationships, with a view to improving antenatal depression in pregnant women and protecting maternal and infant health effectively.

1 Subjects and methods

1.1 Study population A convenience sampling method was used to select women in late pregnancy who underwent routine obstetric check-ups at the First Affiliated Hospital of Anhui Medical University from October 2020 to May 2021. Inclusion criteria: (1) age ≥ 20 years, married and at the legal age of marriage; (2) pregnant women living with their partners during pregnancy; (3) gestational week ≥ 28 weeks; (4) orthophrenia, normal understanding and expression ability, and informed consent. Exclusion criteria: (1) previous history of psychological disorders and severe mental illness; (2) pregnant women at high-risk of pregnancy; (3) comprehension and communication difficulties.

The sample size was calculated according to the formula $N = Z_{1-\alpha/2}^2 P(1-P)/d^2$, with N being the sample size required for the study, $Z_{1-\alpha/2}$ is the percentile corresponding to an area of $1-\alpha/2$ under the standard normal distribution, and $Z_{1-\alpha/2} = 1.96$ when $\alpha=0.05$; d is the error of permissible deviation, often taken as 10% of the expected incidence, and P denotes the incidence of antenatal depression, which was reviewed in the literature at approximately 41%[13], giving the d of 4.1%. The sample size was calculated to be ≥ 283 cases, and the sample size for this study was 300 cases. All pregnant women gave their informed consent to this study, and the study was approved by the Ethics Committee of Anhui Medical University (Ethics Number: 2020H031).

1.2 Research tools

1.2.1 General information questionnaire Designed by the researcher on the basis of extensive literature reading, including socio-demographic information (ages, degree of education, current working status, per capita monthly household income, planned pregnancy or not, sleep quality, couple's relationship) and obstetric information (gestational week, first pregnancy or not).

1.2.2 Partner Phubbing Scale (PPS) The PPS was developed by ROBERTS et al[10] in 2016 for partners in a relationship and was translated in Chinese by Ding Qian et al[14]. The PPS was used in this study to assess the severity of partner phubbing as perceived by pregnant women in a marital relationship. The PPS is a one-dimensional scale consisting of nine items rated on a five-point Likert-type scale (from one to five), with all items scored positively except for item seven, which is scored negatively. "one" means "never" and "five" means "always", with a total score of nine to forty-five. Responses to all items were summed to produce a composite score, with higher scores indicating higher levels of partner phubbing and greater levels of neglect by the husband. Cronbach's alpha in this aspect of the study was 0.854.

1.2.3 Quality Marriage Index (QMI) The QMI was developed by NORTON[15] in 1983 to measure a married couple's subjective assessment of their satisfaction with their marital relationship. The QMI is a one-dimensional scale with six items. The first five items on a seven-point Likert-type scale (from one to five), with "one" representing "strongly disagree" and "seven" representing "strongly agree". The sixth item is scored on a ten-point scale, with "one" representing "very dissatisfied" and "ten" representing "very satisfied". All entries are positively scored, with a total score of six to forty-five. Higher scores on the scale indicate a higher level of satisfaction with the current marriage. Cronbach's alpha in this aspect of the study was 0.948.

1.2.4 Edinburgh Postnatal Depression Scale (EPDS) The EPDS was developed by COX et al[16] in 1987 and Chineseized by LEE et al[17] in 1998. It is a self-report scale commonly used to assess maternal depression and the degree of depression in the antenatal and postnatal periods. The EPDS is one-dimensional and consists of ten items, each rated on a four-point scale (from zero to three), with higher scores indicating more severe antenatal depression. In this study, a total EPDS score of ≥ 9 was used to indicate antenatal depression[18]. Cronbach's alpha in this aspect of the study was 0.790.

1.3 Data collection methods and quality control Questionnaires were administered to women in late pregnancy using the questionnaire method. To avoid bias, all information was distributed and collected centrally by the researcher. The researcher used a uniform guideline to explain the purpose and significance of the survey to the pregnant women and obtained their informed consent before administering the questionnaire. To ensure the authenticity and validity of the questionnaire, the questionnaire was distributed by anonymous means and was completed by pregnant women independently and then collected

and reviewed on site. The exclusion criteria of the questionnaire were: (1) there was a clear pattern in the choices; (2) the number of missing questions was more than four; (3) two or more answers were chosen for the single choice questions.

1.4 Statistical methods The database was first created using EpiData 3.1 software and data was input after double checking; then SPSS 24.0 software was used for statistical analysis. The data are expressed as ($\bar{x}\pm s$) for normally distributed measures, t-test was used for comparison between two groups, and ANOVA was used for comparison between multiple groups. Statistical data were expressed as relative numbers; correlations were analysed using Pearson correlation analysis. Mplus 8.3 was used to develop a structural equation model, and the mediating effect of maternal marital satisfaction between partner phubbing and antenatal depression was tested using the Bootstrap method with 5,000 replicate samples, and the presence of a mediating effect was considered at 95% CI not including 0. A statistically significant difference was considered at $P < 0.05$.

2 Results

2.1 Control and testing for common method bias The data in this study were obtained from the self-reports of pregnant women, and there may be common method bias in the measurement. Therefore, possible common method bias was controlled for, including anonymous completion of the questionnaire content and reverse scoring of some items. The Harman one-way test was used to test for common method bias[19]. All 25 items measured were analyzed by unrotated principal component analysis, and five common factors with roots > 1 were analyzed. The interpretation rate of the first common factor was 28.652%, which was less than the recommended threshold of 40%, indicating that there was no serious common method bias in the data of this study.

2.2 General information of women in late pregnancy A total of 300 questionnaires were distributed and 9 invalid questionnaires were excluded. Two hundred and ninety-one valid questionnaires were returned, with a valid return rate of 97.00%. Two hundred and ninety-one late pregnant women included 13 (4.46%) aged 20~24 years, 104 (35.74%) aged 25~29 years, 141 (48.45%) aged 30~35 years and 33 (11.34%) aged > 35 years. Fourteen cases (4.81%) had junior high school and below, 95 cases (32.65%) had high school and middle school, 182 cases (62.54%) had bachelor's degree or above; 160 cases (54.98%) were on-the-job; 216 cases (74.23%) had per capita monthly household income (RMB) $< 5,000$ yuan; 202 cases (69.42%) were planned pregnancies. The sleep quality: 32 cases were (11.00%) very good, 109 (37.46%) cases were good, 132 (45.36%) general, 18 (6.18%) cases were poor. The couple's relationship: 170 couples (58.42%) were very good, 110 couples (37.80%) were good, 11 couples (3.78%) were general. 12 (4.12%) cases were at 28~32 weeks of gestation, 158 (54.30%) cases were at 33~36 weeks of gestation and 121 (41.58%) cases were at 37~42 weeks of gestation; 143 (49.14%) cases were first pregnancies.

2.3 Comparison of EPDS scores among women with different characteristics in late pregnancy The prevalence of antenatal depression in late pregnant women in this study was 40.89% (119/291). There was no statistically significant difference in the EPDS scores among women of different age, education level, current work status, per capita monthly household income, gestational week and whether first pregnancy ($P > 0.05$). The differences were statistically significant ($P < 0.05$) when comparing the EPDS scores of women with or without planned pregnancy, different sleep status and couple relationship status, as shown in Table 1.

Table 1 Comparison of prenatal depression scores among women in late pregnancy by personal characteristics ($\bar{x} \pm s$, N=291)

Categories	Number	EPDS score	<i>F</i> (<i>t</i>) value	<i>P</i> value
Ages(years old)			1.071	0.362
20~24	13	8.2±2.79		
25~29	104	8.3±3.78		
30~35	141	7.9±3.39		
>35	33	7.6±3.05		
Degree of education			1.488	0.228
Junior high school and below	14	7.2±3.21		
High school and middle school	95	8.5±3.43		
Bachelor's degree or above	182	7.9±3.49		
Working position			0.307	0.736
On-the-job	160	7.9±3.24		
On maternity leave	78	7.9±3.42		
Unemployed	53	8.5±4.15		
Per capita monthly household income (RMB)			0.631	0.533
<3000	7	9.9±3.29		
3000~5000	68	8.1±3.19		
>5000	216	7.9±3.55		
Planned pregnancy?			-2.450 ^a	0.015
Yes	202	7.8±3.14		
No	89	8.6±4.06		
Sleep quality			8.803	<0.001
Very good	32	5.8±2.74		
Good	109	7.5±2.92		
Generally	132	8.6±3.50		
Poor	18	11.1±4.22		
How do you relate to your partner?			10.326	<0.001
Very good	170	7.4±3.67		

Good	110	8.9 ± 2.88		
Generally	11	10.2 ± 3.16		
Gestational week			0.484	0.617
28~32 week	12	8.4 ± 3.85		
33~36 week	158	8.1 ± 3.11		
37~42 week	121	8.0 ± 3.87		
First pregnancy?			0.362 ^a	0.718
Yes	143	8.1 ± 3.66		
No	148	7.9 ± 3.27		

Note: a indicates t score; EPDS = Edinburgh Postpartum Depression Scale

2.4 Correlations between partner phubbing, marital satisfaction and antenatal depression in late pregnancy women

Women in late pregnancy had PPS scores of (25.6 ± 6.3), QMI scores of (37.9 ± 6.0) and EPDS scores of (8.0 ± 3.5). The results of the correlation analysis showed that partner phubbing of women in late pregnancy and marital satisfaction ($r = -0.292$, $p < 0.01$), partner phubbing was positively associated with antenatal depression ($r = 0.350$, $p < 0.01$); marital satisfaction was negatively associated with antenatal depression ($r = -0.338$, $p < 0.01$).

2.5 Analysis of the mediating role of marital satisfaction in the relationship between partner phubbing and antenatal depression

To further understand the pathway of partner phubbing in late pregnancy on antenatal depression, a structural equation model was developed using Mplus 8.3 software. Partner phubbing (PPS score, assignment: continuous) was used as the independent variable, marital satisfaction (QMI score, assignment: continuous) as the mediating variable and antenatal depression as the dependent variable (assignment: 0 = depressed, 1 = not depressed). The control variables were: whether the pregnancy was planned or not (assignment: 1 = yes, 2 = no), sleep status (assignment: 1 = very good, 2 = good, 3 = generally, 4 = poor) and couple relationship (assignment: 1 = very good, 2 = good, 3 = general, 4 = poor). The fit of the model was tested using the great likelihood method for estimation of the parameters. Based on criteria of $\chi^2/df \leq 3$, Comparative Fit Index (CFI) ≥ 0.90 , Tucker-Lewis Index (TLI) ≥ 0.90 , Root Mean Square Error of Approximation (RMSEA) ≤ 0.08 , and Standardized Root Mean Square Residual (SRMR) ≤ 0.08 , it can be seen that in this study, $\chi^2/df = 2.15$, CFI = 0.921, TLI = 0.911, RMSEA = 0.063, SRMR = 0.080, and the model is acceptable. The 95% CI for the mediating effect was calculated using the bias-corrected Bootstrap resampling method to test the significance of the mediating effect. The mean path coefficient for the mediating effect was calculated by repeating a random sample of 5000 samples from the original data. The 95% CI for the mediating effect was (0.011, 0.108) with an interval excluding 0, indicating that the mediating effect was significant. The direct effect of partner phubbing on antenatal depression in late pregnancy women was 0.214, accounting for 82.63% of the total effect, and the mediated effect value was 0.045, accounting for 17.37% of the total effect. The results suggest that marital satisfaction partially mediates the relationship between partner phubbing and antenatal depression, and the effect values and mediated

effect sizes for each mediated pathway are shown in Table 2.

Table 2 Total effect, direct effect and mediation effect of marital satisfaction analysis on the mediating effect between the late pregnancy woman partner phubbing and prenatal depression

Indicators	Effector value	Boot standard error	Relative effect value (%)
Total effect	0.259 (0.123, 0.393)	0.069	—
Direct effect	0.214 (0.078, 0.344)	0.067	82.63
Mediation effect of marital satisfaction	0.045 (0.011, 0.108)	0.024	17.37

Note: "—" means no value

3 Discussion

3.1 Levels of partner phubbing, marital satisfaction and antenatal depression in late pregnancy women The results of this study showed that women's PPS scores in late pregnancy were (25.6 ± 6.3), with a mean score of (2.8 ± 0.7) for each entry. The perceived partner phubbing of late pregnant women was moderately high, which was lower than the (3.03 ± 0.78) score of Hu Mengjie's[20] findings on partner "head-down" phenomenon and intimacy in the love / married population. This may be due to the fact that women are more sensitive and emotionally vulnerable during late pregnancy. Pregnant women want their partner's undivided attention when get along, and when their partner's mobile phone is used more often or for longer periods of time, it will interrupt their meaningful conversations. This can interrupt meaningful conversations between them when their spouse is using their mobile phone more frequently, which can lead to a higher level of feeling left out. PPS scores for women in late pregnancy were moderately high but lower than those for women in non-pregnant states. This may be related to a reduction in phubbing in family life by spouses who are sensitive to feelings during late pregnancy.

The marital satisfaction score of pregnant women in this study was slightly lower than the (39.80 ± 6.59) score of Li et al's[21] survey results on the marital quality of newly married couples. Compared to newly married women, women in late pregnancy are subjected to both physical and psychological stress from pregnancy and childbirth, and naturally expect more support and attention from their partners during pregnancy. However, the results of this study showed that women in late pregnancy had higher levels of partner phubbing, which may have affected maternal marital satisfaction, suggesting that spouses still need to give more adequate family support and care to pregnant women[22].

At the same time, nearly half of the women in this study were jobless and on maternity leave during late pregnancy. Increasingly, women will choose to temporarily withdraw from the workplace during pregnancy and childbirth to devote more time and energy to their families. High expectations of marital relationships may be another reason for the low marital

satisfaction scores of pregnant women.

The incidence of antenatal depression in this study was higher than the incidence of postnatal depression investigated by Zhao Zhimei et al[23], suggesting that antenatal depression needs to be taken seriously by healthcare professionals. The poorer the sleep status, the higher the depression score. This may be related to the growing fetus and the pressure of the uterus on various maternal organs and tissues that affects maternal sleep, while the higher fatigue due to easy waking at night and lack of sleep may further increase the risk of depression[24]. At the same time, pregnant women who have planned pregnancies can take active and effective measures to cope with the physical and psychological changes caused by pregnancy, and their depression scores are lower. Yang Yang[25] reported that poor couple relationship is an independent risk factor for antenatal depression in pregnant women, and the better the couple relationship in late pregnancy, the lower the depression score, which is consistent with the results of many studies[26-27].

3.2 Correlation between partner phubbing, marital satisfaction and antenatal depression in late pregnancy women The results of this study showed that partner phubbing was positively associated with antenatal depression in pregnant women, i.e. the higher the level of partner phubbing in late pregnancy, the higher the prevalence of antenatal depression in women. This is consistent with the findings of WANG et al[12]. At the same time, partner phubbing was negatively associated with marital satisfaction, suggesting that the higher the level of partner phubbing the lower the maternal rating of marital satisfaction. The present study found that maternal marital satisfaction was also negatively associated with antenatal depression, which may be that partner phubbing interrupts or hinders communication between partners, increases conflict between partners and ultimately leads to greater stress and depression[28-29].

The family act as a whole of interpersonal interactions, and partner phubbing can pose a serious risk to an individual's mental health. KRASNOVA et al.[30] found that the majority of young Germans who experienced partner phubbing had negative emotional reactions to it. ROBERTS et al[10] found that partner phubbing can weaken interpersonal relationships, undermine the quality of intimacy and marriage, lead to a range of negative consequences conflict with a number of negative knock-on effects. Partner phubbing can affect the psychological well-being of women during late pregnancy. Therefore, it is important for partners to reduce the amount of time they spend on their mobile phones when accompanying pregnant women, and to be more present and emotionally supportive to reduce the incidence of antenatal depression in pregnant women[25].

3.3 Marital satisfaction in late pregnancy women partially mediates the relationship between partner phubbing and antenatal depression This study verified the mediating effect of marital satisfaction in late pregnancy on partner phubbing and antenatal depression in women by modelling structural equations. The results showed that both partner phubbing and marital satisfaction had a significant predictive effect on antenatal depression. This suggests that partner phubbing and marital

satisfaction are predictors of antenatal depression. Marital satisfaction partially mediated the relationship between partner phubbing and antenatal depression, i.e. partner phubbing could act on antenatal depression by reducing marital satisfaction. For pregnant women in late pregnancy, partner and family support is the primary source of social support[31]. Pregnant women who perceive high levels of partner phubbing have reduced frequency, depth of communication and quality of intimacy with their partners, and experience feelings of alienation and lack of attention from their partners, affecting their psychological well-being and interpersonal relationships[32-33]. Partner phubbing is influenced by both intra-individual and extra-individual environmental factors influence partner phubbing. It is suggested that partner phubbing can be intervened, and that guidance on the appropriate length and frequency of mobile phone use when partners are with pregnant women can be used to improve their marital satisfaction and reduce the incidence of antenatal depression.

In summary, in order to effectively reduce the incidence of antenatal depression in women in late pregnancy and to protect maternal and child health, maternal and child health care workers should not only provide psychological counselling to pregnant women, but also guide their partners in the rational use of mobile phones. To increase effective face-to-face communication between couples, they should pay attention to the emotional changes and needs of pregnant women and provide them with adequate social support.

3.4 Implications for maternal and child health workers Pregnant women are the key group in the field of mental health in China and their level of mental health cannot be ignored. The results of this study show that women in late pregnancy have a slightly higher level of partner phubbing and a slightly lower level of marital satisfaction. The prevalence of antenatal depression was high, and marital satisfaction partially mediated the relationship between partner phubbing and antenatal depression. The results provide new ideas for the prevention and intervention of antenatal depression in late pregnancy women. Maternal and child health care workers should pay more attention to the level of mental health of pregnant women and instruct their partners on the appropriate use of mobile phones in the home, in order to improve the social support and marital satisfaction of pregnant women to reduce the incidence of antenatal depression.

3.5 Limitations and outlook of the study Firstly, this study is a cross-sectional study and no causal conclusions can be drawn; future longitudinal surveys could be used to collect data from women during pregnancy. Secondly, the self-report method of collecting questionnaires in this study may be subject to reporting bias, and follow-up methods such as clinical interviews, observations, measurements and diary entries could be used in the follow-up to improve the robustness of the study results. Finally, the sample site of this study was only one tertiary care hospital, and the representativeness of the study population needs to be improved. In the future, the inclusion of multicentre couples during pregnancy could be considered for investigation to provide a basis for family-centred antenatal depression interventions.

Author Contribution: Tian Yun was responsible for proposing the research idea and defining the main research objectives. She was responsible for the distribution and collection of questionnaires and statistical analysis of the data, writing the first draft of the paper and revising it. Zhao Jingjing, Zhang Yudong and Zhang Liu were responsible for reviewing the literature/data; Li Yuhong was responsible for the overall design of the study, quality control, supervision and management, as well as article review and proofreading, and was responsible for the article as a whole.

There is no conflict of interest in this paper.

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