

# Prevalence and Incidence of Postpartum Depression among Chinese Women: A Longitudinal Study

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## Research

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# Abstract

## Purpose

Postpartum Depression (PPD) is significant public health and clinical concern regarding to women of reproductive age. This study aims to examine the prevalence, incidence and persistence of at 1 and 6 months after delivery among Chinese women.

## Method

This is a prospective cohort study in Wuhan, China. Participants were mothers recruited Wuhan Women and Children Medical Care Center, who gave singleton and live birth from January 2016 to September 2018. Edinburgh Postnatal Depression Scale (EPDS) was used to assess possible (scores of EPDS >9) and high-level (scores of EPDS >12) of depression at 1 and 6 months after delivery. Prevalence and incidence with 95% confidence intervals were calculated.

## Results

We included 1884 mothers. The prevalence of possible and high-level depression at 1 month were 37.7% and 15.2%, respectively; at 6 months were 32.6% and 13.1%, respectively. Both prevalence rates of possible and high depression were higher at 1 month than that at 6 month after delivery. The incidence rates of possible and high-level depression at 6 months were 11.8% and 7.2%, respectively. Of those with possible symptoms at 1 month, 20.8% continued to have symptoms at 6 months. Higher EPDS scores at 1 month, employment during pregnancy and multiparas were risk factors for elevated EPDS scores at 6 months( $P<0.05$ ).

## Conclusion

Data of incidences suggests that later-onset PPD after delivery. These results suggest that continuous postpartum monitoring maternal depression is helpful to identify high-risk groups as early as possible and reduce the incidence of PPD.

## Background

Maternal postpartum depression (PPD) refers to a constant low mood, with the symptoms of feeling sad, worthless and hopeless, etc., discerned in mothers who have recently gone through their childbirth [1, 2]. It is a common and serious mental disorder with long-lasting adverse consequences for the mother and child, as well as family harmony [3]. Two recent reviews found that the pooled prevalence of PPD based on self-report scales were 13.1%[4] and 19.7%[5], respectively. PPD negatively affects a mother's ability to engage with her family[6], mother-infant bonding and reduces breastfeeding[7]. It also constitutes a serious threat to the offspring' the physical, cognitive and psychological development during childhood and adolescence[8]. Given its high prevalence and impact, PPD has ranked as one of priorities of public health and clinical concerns.

There were numbers of studies have investigated the prevalence of PPD, however, the prevalence ranged widely because of variations in definition, rating scale, and assessment time [9], which is not conducive to the formulation of policies and interventions. Evidence suggested that depressive symptoms are transient among some women who experience depressive symptoms during pregnancy or a one-off, short-lived episode after childbirth and recovers to previous good level of mental health, while among other women, depression is a persistent and/or recurrent problem [4]. This means that the time trajectories of PPD are heterogeneous and the prevalence of PPD may change over time. However, most of previous studies did not assess the prevalence of PPD over times, which thus were unable to provide information on the prevalence of PPD at several points in time [10]. In addition, previous studies did not distinguish between point prevalence and period prevalence [11], so it is not possible to explore the extent to which women recover from depression or experience persistent symptoms after childbirth. Moreover, because of difficulties in define the onset of PPD by cross-sectional approach, it is unclear if the point estimates of PPD reported in many studies are new or the persistent ongoing episode [11], which mirror that data on incidence of PPD is scarce. In light of these issues, some researchers underlined the need of research on the prevalence and incidence of PPD using a sound methodology [11, 14], such as longitudinal studies [13].

Although the causes of PPD have not been clarified, it is clear that the presence of certain influencing factors increase the risk of PPD [15]. These main risk factors include depression/anxiety during pregnancy or a previous depressive illness, life stress, lack of social support, poor marital status, poor family economic status, younger maternal age, lower educational level and smoking during pregnancy [1, 3, 16] Recent studies shown there were differences in risk factors for new onset and recurrent PPD, [17]. However, previous studies investigated risk factors of PPD did not distinguish women with a history of depression and/or postpartum depression from those with a first-ever episode during the postpartum period [11], thus, it is remain unclear whether the risk factors of recurrent PPD and first-ever episode PPD are different. Phillips et al. also found that women with recurrent PPD had more personality vulnerabilities and maternal-specific negative attitudes than women with new onset PPD[18]. When PPD is the first episode of depression in the mother's life, it may be unexpected and difficult for her or others close to her to identify, which may obstacle them from seeking for adequate treatment [19], and in turn leads to adverse consequences for the mother, child and family. Therefore, it is important to investigate the incidence of different subtypes of PPD, since it may provide new insights into the determinants of PPD.

Based on literature review, this study aims to examine 1) the prevalence and incidence of PPD at 1 and 6 months' postpartum; 2) the persistence of these symptoms from 1 month to 6 months; and 3) the predictors of elevated EPDS scores from 1 month to 6 months.

## Methods

### Study Design and Participants

The present study is part of a prospective prenatal cohort study at Wuhan Women and Children Medical Care Center (Wuhan, Hubei, China). Details of the study design and methodology have been reported in our previous work [20, 21]. The participated women completed face to face interviews at 1 and 6 months after delivery. A total of 1884 women completed PPD symptoms evaluated at 1 month and 6 months postpartum between January 2016 and September 2018. The research protocol was approved by the ethics committee of Tongji Medical College, Huazhong University of Science and Technology (No. (2012) 07), and Wuhan Women and Children Medical Care Center (No. 2012003). All participants agreed and signed informed consent.

## **Edinburgh Postnatal Depression Scale**

Presence and severity of PPD symptoms were measured by the Edinburgh Postnatal Depression Scale (EPDS)[22], Chinese version [23]. The EPDS is a self-reported scale consisting of 10 items with 4-point Likert scale responses: 0; 1; 2, 3, (scored 3)[24] and the total scores range from 0 to 30 points. Higher total scores represent more serious symptoms of PPD. The Chinese version of the EPDS was validated by Wang et al. (2009) and has been demonstrated a satisfactory psychometric properties [23]. According to the previous studies in mainland China and Hong Kong[23, 25], we used the cut-off value proposed by Cox et al., where score > 9 indicates possible depressive symptomatology, and has been recommended for community-based screening to identify individuals who require further follow-up, while a score > 12 indicates high level of depressive symptomatology[22].

## **Other variables**

Based on the literature review, we collected various of co-variables of PPD in present study, which included the following four aspects: socio-demographic factors, pregnancy-related factors, delivery-related factors and newborn-related factors. Socio-demographic factors included maternal gestational age (continuous data), educational level ( $\leq$  junior school, senior school or  $\geq$  college), annual family income (< 30,000, 30,000 ~ 49,000, 50,000 ~ 99,000, 100,000 ~ 190,000, or  $\geq$  200,000), and pre-pregnancy employment status (yes or no). The pregnancy related factors were passive smoking during pregnancy (yes or no), accidental pregnancy (yes or no), parity (primiparous or multiparous), gestational and employment status during pregnancy (yes or no). The delivery-related factors included mode of delivery (vaginal delivery or cesarean delivery), and preterm birth (preterm birth described as a living birth before 37 weeks gestation (yes or no)[26]. The newborn-related factors included birth weight (< 2500 g, 2500 ~ 3999 g, or  $\geq$  4000 g), infant gender (male or female).

## **Statistical Analysis**

At each observation time (1 and 6 months after delivery), the continuity-corrected method was used to calculate the prevalence and incidence with 95% CIs. Point prevalence was calculated by dividing the number of cases at each time by the total number of participants with no missing outcome data at that time. Incidence was determined by dividing the number of new cases since the preceding observation time by the number "at risk" for the condition. Persistence over time was calculated as the proportion of participants who had the condition at the first 2 observation times. The denominators for these

calculations were all women with the outcome at the preceding time. Analyses were conducted for the overall sample and disaggregated by EPDS scores difference at 1 month to 6 months. Specifically, all women divided into the following three groups: new-onset group (EPDS scores < 10 at 1 month and  $\geq 10$  at 6 months), persistent group (both EPDS scores  $\geq 10$  at 1 month and 6 month), improved group (EPDS scores  $\geq 10$  at 1 month and < 10 at 6 months) and non-PPD group (both EPDS score < 10). Demographic variables were examined sequentially among the subtypes.

Then, generalized linear mixed effects model were used to identify any factors that might predict a high EPDS score at 6 months' postpartum. Factors which we included were based on bivariate analyses of the potential predictors, and only those found to be significantly predictive on bivariate analysis ( $P < 0.1$ ) were retained in the final model. Baseline EPDS was examined in the final model as a predictor for later elevated score. The goal of these analyses was to identify any factors that might be useful in predicting the EPDS scores at 6 months based on 1 month scores.

## Results

### Overall Prevalence, Incidence and Persistence

Table 1 shows the prevalence and incidence of possible depressive symptomatology and high level of depressive symptom for participant at 1 and 6 months after delivery. The prevalence of XX was higher at 1 month and declined over time. Possible depressive symptomatology was mostly prevalent and occurred at 1 month (37.7%, 95% CI, 35.5%~39.9%) and decreased at 6 months (32.6%, 95% CI, 30.6%~34.8%). The prevalence of high level of depressive symptoms was 15.2% (95% CI, 13.7%-16.9%) at 1 month and decreased slightly to 13.1% (95% CI, 11.6%-14.7%) at 6 months. Furthermore, of those with possible depressive symptomatology at 1 month, 20.8% (95% CI, 19.0%-22.7%) continued to have symptoms at 6 months. For high levels of depressive symptomatology, 5.9% (95% CI, 4.9%-7.0%) continued to have symptoms at 6 months.

Table 1  
Postpartum Depressive Symptomatology at 1 month and 6 months Postpartum

	Prevalence		Incidence	
	Cases/Observations,n	%, 95%CI	Cases/At Risk,n	%, 95%CI
Possible depressive				
Symptomatology <sup>a</sup>				
1month	710/1884	37.7, (35.5,39.9)	NA	NA
6months	615/1884	32.6, (30.6,34.8)	223/1884	11.8,(10.4,13.3)
High depressive				
Symptomatology <sup>b</sup>				
1month	287/1884	15.2, (13.7,16.9)		
6months	247/1884	13.1, (11.6,14.7)	136/1884	7.2,(6.1,8.4)
Note: CI, confidence interval; NA, not applicable; <sup>a</sup> More than 9 on the Edinburgh Postnatal Depression Scale (EPDS); <sup>b</sup> More than 12 on the EPDS.				

## Comparisons of Basic characteristics among subtypes

Table 2 displays comparing the basic information stratified by women with an elevated EPDS at 6 month postpartum (new-onset group), women with EPDS less than 10 on both occasions (non-PPD group), women with EPDS at more than 10 on both occasions (persistent group), and women with EPDS declined at 6 month postpartum (improve group). Univariate analysis showed that there were significant differences among subgroups on the maternal age, parity, employed during pregnancy and birth weight of infant (all  $P < 0.05$ ).

Table 2  
Basic Characteristics of Women Eligible for Repeated Postpartum Depression Elevated

Basic Characteristics	new-onset group	persistent group	improve group	non-PPD group	F/ $\chi$	P-value
	(n = 223)	(n = 392)	(n = 318)	(n = 951)		
Age, mean(sd), year	29.37(3.63)	29.14(3.60)	28.81(3.59)	29.55(3.90)	3.49	0.02
Pre-pregnancy Employed, No.(%)						
yes	168(75.3)	310(79.1)	243(76.7)	741(77.9)	1.37	0.71
no	55(24.7)	82(20.9)	74(23.3)	210(22.1)		
Educational Level, No.(%)						
≤junior school	16(7.2)	21(5.4)	27(8.5)	52(5.5)	6.25	0.40
senior school	27(12.1)	60(15.3)	50(15.7)	140(14.7)		
≥college	180(80.7)	311(79.3)	241(75.8)	759(79.8)		
Annual family income No.(%)						
< 50,000	27(12.2)	45(11.6)	41(12.9)	82(8.7)	10.66	0.30
50,000 ~ 99,000	70(31.5)	136(35.0)	105(33.1)	300(31.7)		
100,000 ~ 190,000	103(46.4)	173(44.5)	148(46.7)	478(50.5)		
≥ 200,000	22(9.9)	35(9.0)	23(7.3)	87(9.2)		
Passive smoking during pregnancy, No(%)						
yes	75(33.6)	135(34.4)	100(31.4)	290(30.5)	2.37	0.50
no	148(66.4)	257(65.6)	218(68.6)	661(69.5)		
Accidental pregnancy, No(%)						
yes	69(31.1)	108(27.9)	71(22.4)	246(26.3)	5.55	0.14
no	153(68.9)	279(72.1)	246(77.6)	691(73.7)		
missing	1.0	5.0	1.0	14.0		
Primiparous, No.(%)						
yes	166(74.4)	313(79.8)	264(83.0)	695(73.1)	25.36	0.00

Basic Characteristics	new-onset group	persistent group	improve group	non-PPD group	F/ $\chi$	P-value
	(n = 223)	(n = 392)	(n = 318)	(n = 951)		
no	57(25.6)	79(20.2)	54(17.0)	256(26.9)		
Employed during pregnancy, No.(% )						
yes	127(57.0)	219(55.9)	189(59.6)	594(62.5)	6.20	0.10
no	96(43.0)	173(44.1)	128(40.4)	356(37.5)		
missing			1.0	1.0		
Cesarean delivery, No. (%)						
yes	105(47.1)	200(51.0)	143(45.0)	462(48.6)	2.74	0.43
no	118(52.9)	192(49.0)	175(55.0)	489(51.4)		
Preterm birth, No.(% )						
yes	5(2.2)	16(4.1)	7(2.2)	25(2.6)	3.13	0.37
no	218(97.8)	376(95.9)	311(97.8)	926(97.4)		
Infant gender						
male	113(50.7)	208(53.1)	183(57.5)	480(50.5)		
female	110(49.3)	184(46.9)	135(42.5)	471(49.5)		
Birth weight (g), No(%)						
< 2500 g	4(1.8)	12(3.1)	3(0.9)	16(1.7)	11.50	0.07
2500 ~ 3999	201(90.1)	365(93.1)	289(90.9)	868(91.3)		
$\geq$ 4000	18(8.1)	15(3.8)	26(8.2)	67(7.0)		

Factors that may predict a high EPDS score at 6 months' postpartum included a baseline EPDS higher than 1, multiparas and employment during pregnancy. Of these factors, a baseline EPDS higher than 1 was risk factor (OR = 6.5, 95%CI: 6.3–6.7), multiparas and employment during pregnancy were protective factors (OR = 0.4, 95%CI: 0.2–0.6 and OR = 0.2, 95%CI: 0.1–0.5, respectively). In the mode, maternal age and birth weight of infant did not predict or prevent an increase in EPDS scores at 6 months. (Table 3)

Table 3  
Predictors of Elevated EPDS Scores at 6 month

Predictor	OR (95% CI)	P-value
Parity, $\geq 2$	0.2(0.1,0.5)	0.04
Employed during Pregnancy	0.4(0.2,0.6)	< 0.001
EPDS score > 9 at 1 month	6.5(6.3,6.7)	< 0.001

## Discussion

In this longitudinal cohort study, we examined the prevalence, incidence, and persistence of postpartum depressive symptomatology over the 6 months postpartum among Chinese Han women. The rate of possible depressive symptomatology (the score of >9 on the EPDS was judged for possible depressive symptoms) was high at 1 month, while the rate for high depressive symptomatology was relatively low. In addition, incidences of possible depressive symptomatology and high depressive symptomatology at 6 months were moderate. Besides, our generalized linear mixed effects model analysis found that the factors associated with scores fluctuation from 1 month to 6 months included employed during pregnancy, parity ( $\geq 2$ ) and EPDS score >9 at 1 month.

The rate of possible depression symptomatology at 1 month was 37.7%, which is higher than the overall Chinese immigrant women prevalence of 24.4% reported by Dennis et al [27] and the prevalence of 13% reported by longitudinal study in Western countries[28,29]. This rates also significant higher than the average prevalence of 13.1% reported from a recent systematic review conducted by Underwood et al [4]. It is worth noting that these longitudinal studies mentioned above were measured at 6-8 weeks after childbirth and counted in the Western countries, that making their results difficult to interpret or compare with our data. Furthermore, of those with possible depressive symptomatology at 1 month, more than one-fifth women continued to have symptoms at 6 months. This result proves our previous hypothesis that postpartum depressive symptoms for mother are dynamic after childbirth, becoming a mother has on emotional health considered as an event within a process, rather than simply a turning point. These rates were lower than the 19.4% of Italian women 8 weeks postpartum reported by Abdollahi et al. and other recent longitudinal studies, while they were higher than that of New Zealand women at 9 months postpartum.

In our study, the rates for high depressive symptomatology (the score of >12 on the EPDS was judged for high depressive symptoms) were 15.2% at 1 month and 13.1% at 6 months after child birth, respectively. They were lower than the 19.4% of Italian women 8 weeks postpartum reported by Abdollahi et al.[30], as well as other recent longitudinal studies [31,32]. But they were higher than the 9 months postpartum rate of New Zealand women [33]. Differences in measurement time and cultural criteria may account for the higher rate of PPD in the present study, especially for possible depressive symptomatology. Firstly, the difference of the time periods used in the research of PPD may have great influence on the prevalence of PPD. Generally speaking, the rates obtained in 4 to 6 weeks postpartum are higher than those conducted

closer to delivery (eg. at 1week) [34] or later postpartum (eg.at 3 month to 12 month. Secondly, special cultural beliefs and postnatal practices in China may have caused the higher rate in our survey. “Doing the month” is the most significant cultural event associated with childbirth for Chinese mother. Chinese women remain in seclusion with activity, dietary restrictions and rest while her mother or mother-in-law takes care of both the baby and the household during this time [35,36]. Recent studies indicated that the traditional Chinese practice of postpartum care, such as “Doing the month” may be a potential influencing factor for PPD. For instance, a lot of women argue that traditional period “Doing the month” causes conflicts among family members involved and often restrict the smooth transition of women in their maternal role[35]. However, the relationships between the traditional Chinese practice of postpartum care and PPD were inconsistent [37,38]. These findings suggest that research is needed to elucidate psychosocial, cultural, and systemic factors that may result in a longer period of vulnerability for this population, who may need ongoing monitoring and support for the entire postpartum year. Thirdly, the cut-off points differed across studies is another potential reason for different rate of PPD among studies. In our study, we selected two cut-off scores of the EPDS which focus on the cognitive and affective features of depression [39]. These means that for such Chinese, they may have a tendency towards somatic rather than cognitive presentation and may be missed using a higher cut-off values. In contrast, lower cut-off score is appropriate for identifying at-risk groups [23,25].

Previous studies shown the incidence of PPD ranged from 3.4% to 34% worldwide [40]. In our study, incidences of possible depressive symptomatology and high depressive symptomatology at 6 months were 11.8% and 7.2%, respectively. This result concurs with the most previous studies, which reported the incidence ranges between 12 and 20 %[41]. Our result further confirmed that a significant number of PPD onset during postpartum. Whereas for many women depressive symptoms remit within the first few months postpartum, the high incidence of depressive symptoms beyond the early postpartum period indicates that depressive symptoms are not necessarily limited to the early postpartum period. This highlights the need for more incidence studies to be conducted, in order to identify the predictors for new onset of PPD so the treatment can be administered effectively. According to the results of generalized linear mixed effects model analysis in our study, the factors associated with scores fluctuation from 1 month to 6month included employed during pregnancy, parity ( $\geq 2$ ) and EPDS score  $>9$  at 1 month. The most frequently described risk factor for developing PPD is a personal history of postpartum/non-puerperal depressive episodes [42]. Beck et al. estimated 30% increased risk of developing PPD among with women with a personal history of major depressive episode. In our study, the association between personal history of a postpartum depressive symptom at 1 month and 6 month was even higher (OR=6.5, 95%CI: 6.3-6.7). These results indicate that the association between depression during pregnancy/past episodes of depression and the PPD has been recognized, the extent to which depression during pregnancy/past episodes of depression confers and may modify PPD risk has still unclear, which need further study[42]. In our study, working during pregnancy was found to be a protective factor (OR=0.2, 95%CI: 0.1-0.5). The reasons for this result may include the following two aspects: firstly, working mothers usually have higher income level. Adequate financial means for raising an infant indicates a low level of stress, which can reduce the incidence of depressive symptoms; secondly, work can enable

mothers to get more social support in addition to their families. However, the association between working and PPD has been inconclusive. Furthermore, we found multiparas to be at lower risk at 6 months postpartum (OR=0.4, 95% CI: 0.2-0.6). This result was also found in Satoh et al's study [12]. They attributed this to decreased obstetric events of multiparas. Compared to primiparas, multiparas have more confidence in playing the role of mother may be another potential reason. In contrast, however, Fiala et al. [42] found primiparas had a lower risk at 6 months postpartum in their study. In view of the lack of research in this area, the above contradictions need to be confirmed and specified by further research.

## **Limitations**

A significant limitation of our study is that the depressive symptoms of all participants were measured at 1 month and 6 months after childbirth, and antenatal depressive symptoms were not assessed. Therefore, when identifying the influencing factors of PPD, the effects of antenatal depression were not taken into account. Our data are based on EPDS, a self-report scale, which is not the same as a clinically confirmed PPD diagnosis. As a result, we cannot report the rate of newly identified depression, but only the rate of women who have an increased risk of depression. Furthermore, due to the use of hospital-based study design, the selection bias is inevitably, which may limit the generalizability of our results.

## **Conclusion**

Understanding the development trajectory of maternal PPD is helpful to identify the most beneficial moments of intervention. Our findings showed that the prevalence of maternal depressive symptoms decreased from 1 month to 6 months after childbirth. Furthermore, our study highlights the significant number of PPD onset during postpartum. Our results point to the need to extend that recommendation to continued evaluation of women beyond the early postpartum period and throughout the first year after childbirth.

## **Declarations**

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### **Authors' contributions**

Ling Qi: Conceptualization, Data curation, Formal analysis, Investigation, Methodology, Resources, Validation, Visualization, Writing – original draft.

Ao-Shuang Xiao: Data curation, Formal analysis, Methodology, Resources, Software, Visualization.

Xin Wang: Data curation, Formal analysis, Methodology, Resources, Visualization.

Yuan-Xia Liu: Data curation, Formal analysis, Methodology, Resources, Visualization.

Meng-Tian Zhang: Data curation, Formal analysis, Methodology, Resources, Visualization.

Hong-Ling Zhang: Conceptualization, Data curation, Formal analysis, Investigation, Methodology, Resources, Validation, Visualization.

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## **Availability of data and materials**

The raw data involved in this study are from a large birth cohort study, which available after application..

## **Ethics approval and consent to participate**

Not applicable

## **Consent for publication**

Not applicable

## **Competing interests**

All authors have read and approved to submit it to your journal. There is no conflict of interest of any authors in relation to the submission.

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