

# Psychosocial Risk Factors for Postpartum Depression in Chinese Women: A Meta-Analysis

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## Research article

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# Abstract

*Background:* Postpartum depression (PPD) has been identified as a recognized public health problem that may adversely affect mothers, infants, and family units. Recent research has identified risk factors for this disease in Westerners; however, a comprehensive study has yet to pool all evidence to provide estimates of psychological and social risk factors in China. Therefore, this study aimed to quantitatively assess all qualified studies and identify the psychological and social risk factors for postpartum depression in Chinese women.

*Methods:* The following databases were used in the literature search from their inception until June 2019: PubMed, Embase, FMRS, China Science and Technology Journal Database (VIP), China National Knowledge Infrastructure (CNKI), and China Biology Medicine disc (CBM). Meta-analysis was conducted by RevMan software. Study heterogeneity and publication bias were estimated.

*Results:* From a total of 887 identified studies, 48 were included in the analysis. Prenatal depression (OR 7.70; 95% CI 6.02-9.83) and prenatal anxiety (OR 7.07; 95% CI 4.12-12.13) were major risk factors for PPD. A poor economic foundation (OR 3.50; 95% CI 2.92-4.20) and a poor relationship between husband and wife (OR 3.42; 95% CI 2.82-4.13) were moderate risk factors. Minor risk factors included a poor relationship between mother-in-law and daughter-in-law (OR 2.89; 95% CI 2.12-3.95), a lack of social support (OR 2.57; 95% CI 2.32-2.85), unplanned pregnancy (OR 2.55; 95% CI 2.08-3.14), mother-in-law as the caregiver (OR 2.5; 95% CI 1.67-3.74) and poor living conditions (OR 2.44; 95% CI 1.92-3.10).

*Conclusions:* This study demonstrated a number of psychological and social risk factors for postpartum depression in Chinese women. The major and moderate risk factors are prenatal depression, prenatal anxiety, a poor economic foundation and a poor relationship between husband and wife. These findings suggest that prenatal prevention aimed at these risk factors is important due to the presence of many of these factors during the prenatal period.

## Background

Postpartum depression (PPD) is the most common type of nonpsychotic psychiatric syndrome during the perinatal period<sup>1</sup>. The prevalence of PPD varies from 0.5–60.8% around the world and from 3.5–63.3% in Asian countries, as measured using the Edinburgh Postpartum Depression scale (EPDS)<sup>2</sup>. The prevalence of PPD in China is estimated to be between 1.1% and 52.1% and is increasing yearly<sup>3</sup>. PPD has been identified as a recognized public health problem that not only affects mothers' health but also causes poor developmental outcomes in children and poor relationships in families<sup>4</sup>.

Postpartum depressive symptoms include the inability to sleep, anxiety, sadness, extreme concern and worry about the baby, and even recurrent thoughts of death<sup>5</sup>. Because maternal emotion plays an important role in the development of children, the pathogenesis of PPD merits greater attention. Although numerous studies have identified risk factors for postpartum depression, due to factors such as the small

sample sizes of individual studies, incomplete patient data, and different assessment methods, the results of these studies are still controversial.

In addition, review<sup>6</sup> on the risk factors for postpartum depression have primarily included studies conducted in Western populations and have overlooked many studies undertaken in the Chinese cultural context. Western and Chinese women differ considerably in terms of genetics, philosophical traditions, cultural practices, ethnicity, religion and attitudes toward psychological problems<sup>7</sup> Western women express their thoughts overtly and have always maintained a more open attitude in facing the world. The two different cultural backgrounds lead to differences in the psychosocial risk factors for PPD<sup>8</sup>. Given the deeply rooted influence of the Chinese cultural traditions of Confucianism, Buddhism and Taoism, the thought processes of Chinese females have historically been more traditional and conservative in nature<sup>9</sup>. Currently, Chinese women still maintain a conservative self-concept and manifest their emotional problems through somatic complaints. This kind of psychology often limits communication and is more likely to lead to anxiety and depression.

At present, studies on Chinese women have reported that poor relationships with husbands or mothers-in-law, introverted maternal personality, anxiety or depression during pregnancy, an unsmooth delivery process, poor postpartum sleep quality, dissatisfaction with neonatal sex and poor health conditions of newborns were risk factors for postpartum depression<sup>10</sup>. However, most of the reports are cross-sectional or case-control studies and often include recall bias, and the risk factors for postpartum depression have still not been completely identified. In addition, although some Chinese individuals have emigrated overseas, they have been influenced by traditional Chinese culture for a long time, and thus, their way of thinking and their living habits are still similar to those of individuals in their motherland. Thus, this study aimed to quantitatively assess all qualified studies and identify the psychosocial risk factors for postpartum depression in Chinese women, including those living overseas.

## Methods

### Search strategy

A systematic search of the electronic databases PubMed, Embase, FMRS, the China Science and Technology Journal Database (VIP), China National Knowledge Infrastructure (CNKI), and China Biology Medicine disc (CBM) was performed for relevant studies published before June 2019. Chinese search terms included postpartum depression, risk factors, influencing factors, social factors, and psychological factors. English search terms included the following: Postnatal Depression OR Depression, Postnatal OR Post-Partum Depression OR Depression, Post-Partum OR Post Partum Depression OR Postpartum Depression OR Post-Natal Depression OR Depression, Post-Natal OR Post Natal Depression AND Factor, Risk OR Factors, Risk OR Risk Factor OR Population at Risk OR Risk, Population at OR Populations at Risk OR Risk, Populations at AND Chinese OR in China. Additionally, we also performed a manual search of the reference lists of retrieved articles and recent reviews.

# Selection criteria and exclusion criteria

The inclusion criteria were as follows: (1) the studies evaluated the psychosocial risk factors associated with postpartum depression in Chinese women; (2) the study was a case-control study or a cohort study; (3) the studies reported relative risks (RRs) or odds ratios (ORs) with corresponding 95% confidence intervals (CIs) or provided data to calculate them; and (4) participants were Chinese mothers, including those living overseas. Reviews, case reports or articles with repeated samples were excluded.

## Data extraction and quality assessment

Data were obtained from each included study independently by two reviewers. Disputes were discussed between the reviewers until consensus was reached. Data extracted from the studies included the first author, publication year, study sites, sample size and type, and quality score. We used the Newcastle-Ottawa Scale (NOS) to assess the quality of the selected cohort and case-control studies<sup>11</sup>. The NOS was used to score the studies on three criteria: the selection of the study groups; the comparability of the groups; and the ascertainment of outcome or exposure. The total score ranged from 0 to 9, with higher scores representing higher methodological quality and lower risk of bias.

## Statistical analysis

Different outcome data types were converted into the form of odds ratios (ORs) with 95% confidence intervals (CIs), which were used to pool the outcome data. The Cochrane Q test was performed to assess statistical heterogeneity, and the Higgins  $I^2$  statistic was used to determine the extent of variation between effect estimates (0–100%). For outcomes with low heterogeneity,  $I^2 < 50\%$  and  $p > 0.1$ , the fixed-effects model (M-H method) was used for analysis. In addition to  $I^2 \geq 50\%$  or  $p < 0.1$ , the random-effects model (D-I method) was used<sup>12</sup>. The sensitivity analysis was carried out by changing the model method. Publication bias was evaluated via the visual analysis of funnel plots. Statistical analyses were performed using Review Manager 5.3 (Cochrane Collaboration, UK).

## Results

### Literature search

A total of 887 studies were obtained through six database searches, of which 196 were excluded because of duplicates. Most articles ( $n = 456$ ) were excluded after the title and abstract information were reviewed. Then, 187 articles that did not meet the inclusion criteria were excluded after the full text was reviewed. Finally, the meta-analysis included 48 studies, and the study selection process is shown in Fig. 1.

### Study characteristics

A total of 35,028 perinatal women were included across the 12 cohort studies and 36 case-control studies, with 6765 women identified as having postpartum depression. The studies investigated Chinese women in mainland China, Hong Kong and overseas. The EPDS and Self-Rating Depression Scale (SDS) were the most common instruments used to assess PPD. The quality score of the included studies ranged from 5 to 8, and 11 studies were scored 7 or more. The study characteristics and quality evaluation are summarized in Table 1.

## Quantitative synthesis

### Case-control studies and cohort studies

The study types of the five risk factors included case-control studies and cohort studies. Sixteen studies (12 case-control studies and 4 cohort studies) reported that a poor relationship between husband and wife was associated with an increased risk of PPD (OR = 3.42; 95% CI 2.82–4.13;  $I^2 = 24%$ ;  $p < 0.00001$ ) (Fig. 2).

Ten studies (8 case-control studies, 2 cohort studies) investigated the association between poor economic foundation and the risk of PPD (OR = 3.50; 95% CI 2.92–4.20;  $I^2 = 4%$ ;  $p < 0.00001$ ) (Fig. 3).

Nine studies (5 case-control studies, 4 cohort studies) investigated the association between prenatal depression and the risk of PPD (OR = 7.70; 95% CI 6.02–9.83;  $I^2 = 69%$ ;  $p < 0.00001$ ) (Fig. 4).

Thus, poor economic foundation and prenatal depression were significantly related to PPD. Nine studies (7 case-control studies, 2 cohort studies) reported that a poor relationship between mother-in-law and daughter-in-law was associated with an increased risk of PPD (OR = 2.89; 95% CI 2.12–3.95;  $I^2 = 72%$ ;  $p < 0.00001$ ) (Fig. 5).

Nine studies (4 case-control studies, 5 cohort studies) investigated the association between a lack of social support and the risk of PPD (OR = 2.66; 95% CI 1.57–4.53;  $I^2 = 98%$ ;  $p = 0.0003$ ). After subgroup analysis according to the type of study design, the heterogeneity of the case-control group decreased ( $I^2 = 46%$ ,  $p = 0.14$ ), but the heterogeneity of the cohort group was still very high ( $I^2 = 99%$ ,  $p < 0.00001$ ). After adjustment, it was found that the heterogeneity of the cohort group decreased significantly after one document was excluded ( $I^2 = 42%$ ,  $p = 0.16$ ) (Fig. 6–7). This may be due to major differences in social support between Chinese-Canadian women and Chinese women<sup>22</sup>.

### Case-control studies

Four of the risk factors included case-control studies. Seven studies investigated the association between unplanned pregnancy and the risk of PPD. The pooled OR for unplanned pregnancy was 2.55 (95% CI 2.08–3.14;  $I^2 = 26%$ ;  $p < 0.00001$ ) (Fig. 8). Six studies investigated the association between poor living

conditions and the risk of PPD. The pooled OR for poor living conditions was 2.44 (95% CI 1.92–3.10;  $I^2 = 21%$ ;  $p < 0.00001$ ) (Fig. 9). Four studies investigated the association between prenatal anxiety and the risk of PPD. The pooled OR for prenatal anxiety was 7.07 (95% CI 4.12–12.13;  $I^2 = 59%$ ;  $p < 0.00001$ ), and a random-effects model was adopted (Fig. 10). Three studies investigated the association between mothers-in-law as caregivers and the risk of PPD. The pooled OR for mothers-in-law as caregivers was 2.50 (95% CI 1.67–3.74;  $I^2 = 0%$ ;  $p < 0.00001$ ) (Fig. 11).

Therefore, unplanned pregnancy, poor living conditions, prenatal anxiety and mothers-in-law as caregivers were found to be significantly associated with postpartum depression.

## Heterogeneity test and sensitivity analysis

The results of 48 studies were tested by the Cochrane Q test. There was no significant difference in the heterogeneity of 7 risk factors (prenatal depression, poor economic foundation, poor relationship with partner, lack of social support, unplanned pregnancy, mothers-in-law as caregivers and poor living conditions). However, for the poor mother-in-law relationship and prenatal anxiety, the random-effects model was used because of the high heterogeneity. In sensitivity analyses, the change model method was used to estimate the point and interval of the OR values of all risk factors to judge the stability of the meta-analysis (Table 2). The point estimates of the combined OR values of the fixed-effects model and the random-effects model were similar, and the interval estimation range of the random-effects model was slightly wider than that of the fixed-effects model. This result indicated that the comprehensive analysis results of the influencing factors in this study were reliable overall.

## Publication bias

Publication bias was evaluated via the visual analysis of funnel plots. The funnel plot generally appeared to be symmetrical, indicating no publication bias (Fig. 12–13).

## Discussion

PPD is a crucial part of the spectrum of mood disturbances affecting postpartum women. A variety of factors affect the physical and mental health of pregnant women. Thus, identifying alterable risk factors for PPD and controlling them at an early stage are essential for the treatment and prevention of this condition.

The psychosocial risk factors for postpartum depression in Chinese women identified in this meta-analysis mainly included three kinds: prenatal emotional factors (prenatal anxiety and prenatal depression), social demographic factors (poor marital relationship, poor living conditions, lack of social support and unplanned pregnancy) and social and interpersonal factors (poor relationship between husband and wife, poor relationship between mother-in-law and daughter-in-law and mother-in-law as the

caregiver). First, prenatal anxiety and depression were significantly associated with an increased risk of PPD, as confirmed by some Western studies. An Italian study<sup>61</sup> showed that women with depression or anxiety during pregnancy and a lack of support from family and friends were at a higher risk of postpartum depression. This result has also been confirmed in China. According to the report of Lee<sup>13</sup>, most postpartum depression was the continuation of prenatal psychological problems and emotional disorders, indicating that there was a significant correlation between prenatal psychological status and the occurrence of postpartum depression.

Another explanation for the effect of prenatal emotional distress is physiological changes. For example, excessive anxiety and depression in pregnant women may lead to a series of physiological and pathological reactions, such as a decrease in norepinephrine secretion and changes in other endocrine hormones, which may lead to the weakening of uterine contractions, a prolonged stage of labor and increased bleeding. These challenges further aggravate the anxiety of pregnant women and lead to an increased risk of developing PPD<sup>62</sup>.

Second, this study found that social demographic factors were also risk factors for postpartum depression, such as a poor economic foundation, poor living conditions, a lack of social support and unplanned pregnancy. Among them, the economic foundation of the family had an important effect on the psychological status of the mother. Previous reviews suggested that the status of the family's economic income was positively related to the level of stress in pregnant women. Yu<sup>42</sup> suggested that after adjustments were made for other related factors, the incidence of postpartum depression among women who were worried about family economic status was 3.162 times higher than among those who did not worry about it. The probable explanation may be that after childbirth, the cost of raising the baby and the basic cost of living for the family significantly increased. If the family income is insufficient, it will lead to high levels of pressure for pregnant women and easily cause negative emotions. In recent years, with China's two-child policy, raising multiple children in a family increases the family's financial burden, which may be a factor of PPD. A study in Turkey shows that there was a significant relationship between monthly income and depression, which was similar<sup>63</sup> to the results of the present study<sup>63</sup>.

In addition, previous studies have shown that social support was a protective factor against postpartum depression, and as far as mothers were concerned, the greatest social support comes from their husbands. Xiong et al<sup>64</sup> suggested that puerperae with spousal support were much less likely to develop postpartum depression. A Chinese study also confirmed that high levels of social support can reduce the risk of postpartum depression, with other factors were fixed<sup>23</sup>. Our findings are generally consistent with those of previous reviews. Eastern and Western women differ considerably in terms of social and cultural systems, and these differences have an impact on many aspects after delivery. For example, in Taiwan, family relations play a dominant role in social communication. During puerperium in traditional Chinese culture, women are often taken care of by relatives for at least one month. Traditional postnatal practices and family support protect the health and well-being of women after childbirth in China. In contrast, the absence of support for these practices among Chinese migrants in Western societies may have negative

implications for their health<sup>65</sup>. Therefore, giving adequate social support to parturients during the puerperal period can help them get through this critical period smoothly.

Third, in this study, the interpersonal risk factors for postpartum depression were a poor relationship between husband and wife, a poor relationship between mother-in-law and daughter-in-law and mother-in-law as the caregiver. The poor relationship between husbands and wives, as an important factor affecting human physical and mental health, has attracted the close attention of researchers worldwide. Zhang<sup>66</sup> suggested that the quality of the husband-wife relationship was mainly reflected in the quality of the husband's care for his wife, and women who were less satisfied with their husband's care were more likely to have depression. Poor marriage and family relationships will not only reduce maternal social support but also become a maternal stressful life event, which brings about an increased risk of developing PPD. This study was confirmed in a Polish study. Malus et al<sup>67</sup> confirmed the significance of the marital relationship in the development of postpartum depression. A sense of closeness and intimacy in the relationship were associated with better mood and a greater ability to cope with the difficulties of labor, puerperium, and caring for a newborn baby.

In addition, the results of this study found that the risk factors for postpartum depression related to Chinese cultural characteristics included the mother-in-law as the caregiver and a poor relationship between mother-in-law and daughter-in-law. Traditionally, mothers-in-law exercise significant power in the family and are a major influence on the postpartum care of new mothers. In China, due to the influence of doing-the-month culture, mothers and newborns are mostly cared for by their mothers-in-law. The strain between mothers-in-law and daughters-in-law is a sensitive problem and may be a cause of PPD in China. Steinberg<sup>68</sup> indicated that the strain between mothers-in-law and daughters-in-law often offset the benefits of assistance and may even contribute to negative mood during the postpartum period. In traditional Confucian philosophy, the new mother should be considered a good daughter-in-law if they behave in a way that is respectful at home and are obedient to their in-laws and husband<sup>69</sup>. The relationship between women and their parents-in-law is based on the environment rather than consanguinity. Sometimes they were reluctant to express their own feelings and opinions to their in-laws. New mothers feel very stressed when they have opinions different from their care providers. The situation may become even worse when conflicts occur with mothers-in-law. Because of the differences in backgrounds, values, identity, and logic of ideas, conflicts with respect to childcare between women and their mothers-in-law become prominent<sup>17</sup>. Meanwhile, the birth of newborns makes both of them focus on their children, and both want to spend more time with their children and grow closer to them. Because of the possessive and exclusive nature of love, competition and conflicts inevitably arise between them. In addition, after the birth, the focus of the attention of the mothers-in-law shifted from the new mother to the newborn, causing the new mother to feel left out, which brings about an increased risk of developing PPD<sup>70</sup>. Pregnant women think that they should be rewarded and valued for "carrying on the family line", but the gap between reality and ideals leads to maternal depression. Additionally, in China, because of the close relationship between the son and his original family, he will be on his mother's side when conflicts

occur between family members. Wives' lack of support from husbands can lead to marital disharmony, which is also an important risk factor for PPD.

## Limitations

This study had several inevitable limitations. First, some risk factors have received less attention; for example, nonuniform measurement standards and statistical difficulties have not been combined, such as the type of residence, postpartum wound recovery, postpartum work stress, and maternal occupation. Second, postpartum depression is the result of the interaction of multiple factors, but due to methodological limitations, it is difficult to investigate the interaction among risk factors. Third, in terms of language selection, this study only includes literature in Chinese and English, which may lead to bias in the comprehensiveness of the literature search, thus affecting the research results and the intensity of the argument.

In addition, this study covers a wide range of research sites, including pregnant Chinese women in mainland China, Hong Kong and overseas. Although some Chinese women have emigrated overseas, because they have been influenced by traditional Chinese culture for a long period of time, their way of thinking and living habits are still similar to those of individuals in their motherland.

## Conclusion

In conclusion, psychosocial risk factors for postpartum depression mainly include prenatal depression, prenatal anxiety, a poor economic foundation, a poor relationship between husband and wife, a poor relationship between mother-in-law and daughter-in-law, a lack of social support, unplanned pregnancy, the mother-in-law as the caregiver and poor living conditions. These psychosocial risk factors are meaningful for identifying mothers "at-risk" during pregnancy even earlier. Meanwhile, some psychosocial interventions targeting these risk factors may be conducted during the pregnancy period to prevent PPD, such as interpersonal psychotherapy, mindfulness therapy and psychoeducational programs.

## Abbreviations

PPD: Postpartum depression; EPDS, Edinburgh postnatal depression scale

HADS: Hospital Anxiety and Depression Scale, SDS: Self-rating [depression](#) scale

SCL-90: Symptom Checklist 90, BDI: Beck Depression Inventory

CES-D: Center for Epidemiological Studies Depression Scale

VIP: the China Science and Technology Journal Database

CNKI: China National Knowledge Infrastructure

CBM: China Biology Medicine disc

RRs: relative risks

ORs: odds ratios

CIs: corresponding 95% confidence intervals

NOS: Newcastle-Ottawa Scale

## **Declarations**

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

Not applicable

### **Consent for publication**

Not Applicable

### **Availability of data and material**

All data generated or analyzed during this study are included in this article (and its supplementary files).

### **Competing interests**

The authors declare that they have no conflict of interest.

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### **Authors' contributions**

WQ, FZ, JH, YL, and QL were all involved in the processes of study design, data extraction, and statistical analysis. WQ wrote the manuscript. JH and FZ were responsible for the selection of articles. All authors read and approved the final version of the manuscript.

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## Tables

Table 1  
Characteristics of included studies

Author	Year	Place	Sample size	PPD Group	Non-PPD Group	Assessment method	Quality scores
Lee <sup>12</sup>	2004	Hong Kong	781	122	659	EPDS	8
Zhao <sup>14</sup>	2018	Shanghai	215	67	148	EPDS	7
Pan <sup>15</sup>	2004	Sichuan	427	33	394	EPDS	6
Zhao <sup>16</sup>	2018	Sichuan	1440	25	1415	EPDS	6
Siu <sup>17</sup>	2012	Hong Kong	805	126	679	EPDS	7
Li <sup>18</sup>	2017	Shanxi	1759	593	1166	EPDS	6
Gu <sup>19</sup>	2004	Shanghai	999	307	692	HADS	6
Sun <sup>20</sup>	2015	Yunnan	528	96	432	EPDS	6
Kang <sup>21</sup>	2015	Jiangsu	3972	468	3504	EPDS > 10	6
Dennis <sup>22</sup>	2017	Canadian immigrants	549	120	429	EPDS > 9	8
Cai <sup>22</sup>	2017	Chongqing	371	60	311	EPDS ≥ 13	7
Hu <sup>24</sup>	2010	Sichuan	264	146	118	EPDS > 9	6
Gu <sup>25</sup>	2017	Xinjiang	824	286	538	EPDS > 13	6
Zhang <sup>26</sup>	2017	Guangdong	538	49	489	EPDS > 10	7
Wu <sup>27</sup>	2019	Guangdong	1437	100	1337	EPDS > 10	6
Shen <sup>28</sup>	2011	Shanxi	104	52	52	EPDS > 13	6
Yang <sup>29</sup>	2016	Hubei	400	37	363	EPDS > 13	6
Zhang <sup>29</sup>	2001	Tianjin	463	47	416	EPDS ≥ 13	7
Yin <sup>31</sup>	2011	Guangdong	202	37	165	SDS > 40	5

PPD: Postpartum depression; EPDS, Edinburgh postnatal depression scale, HADS: Hospital Anxiety and Depression Scale, SDS: Self-rating depression scale, SCL-90: Symptom Checklist 90, BDI: Beck Depression Inventory, CES-D: Center for Epidemiological Studies Depression Scale.

Author	Year	Place	Sample size	PPD Group	Non-PPD Group	Assessment method	Quality scores
Huang <sup>32</sup>	2012	Hunan	302	56	246	EPDS	6
Song <sup>33</sup>	2012	Hunan	285	69	216	SDS	5
Wang <sup>34</sup>	2013	Beijing	435	27	408	SCL-90 > 2	6
Lin <sup>35</sup>	2014	Zhejiang	2023	204	1819	EPDS	5
Zhou <sup>36</sup>	2014	Hubei	378	294	84	EPDS/SDS	5
Wang <sup>37</sup>	2014	Guizhou	875	112	763	EPDS	7
Chen <sup>37</sup>	2017	Zhejiang	380	260	120	EPDS > 13	7
Jiang <sup>39</sup>	2018	Shandong	185	25	160	EPDS	5
Han <sup>40</sup>	2018	Henan	248	124	124	EPDS > 10	5
He <sup>40</sup>	2019	Zhejiang	398	217	181	SDS EPDS	5
Yu <sup>42</sup>	2010	Shanghai	673	73	600	EPDS	7
Zhang <sup>43</sup>	2012	Hunan	215	67	148	EPDS > 13	6
Zhang <sup>44</sup>	2014	Guangdong	586	87	499	EPDS > 13	6
Li <sup>45</sup>	2014	Anhui	687	103	584	EPDS	7
Liu <sup>46</sup>	2015	Hunan	232	43	189	EPDS/ HAD	5
Liu <sup>47</sup>	2015	Heilongjiang	576	162	414	EPDS	6
Chen <sup>48</sup>	2018	Northwest China	640	84	556	EPDS > 13	6
Wang <sup>49</sup>	2013	Shandong	917	168	749	EPDS/SDS	5
Li <sup>50</sup>	2019	Shanxi	170	85	85	SDS	5
Guan <sup>51</sup>	2012	Inner Mongolia	246	92	154	EPDS > 9	6

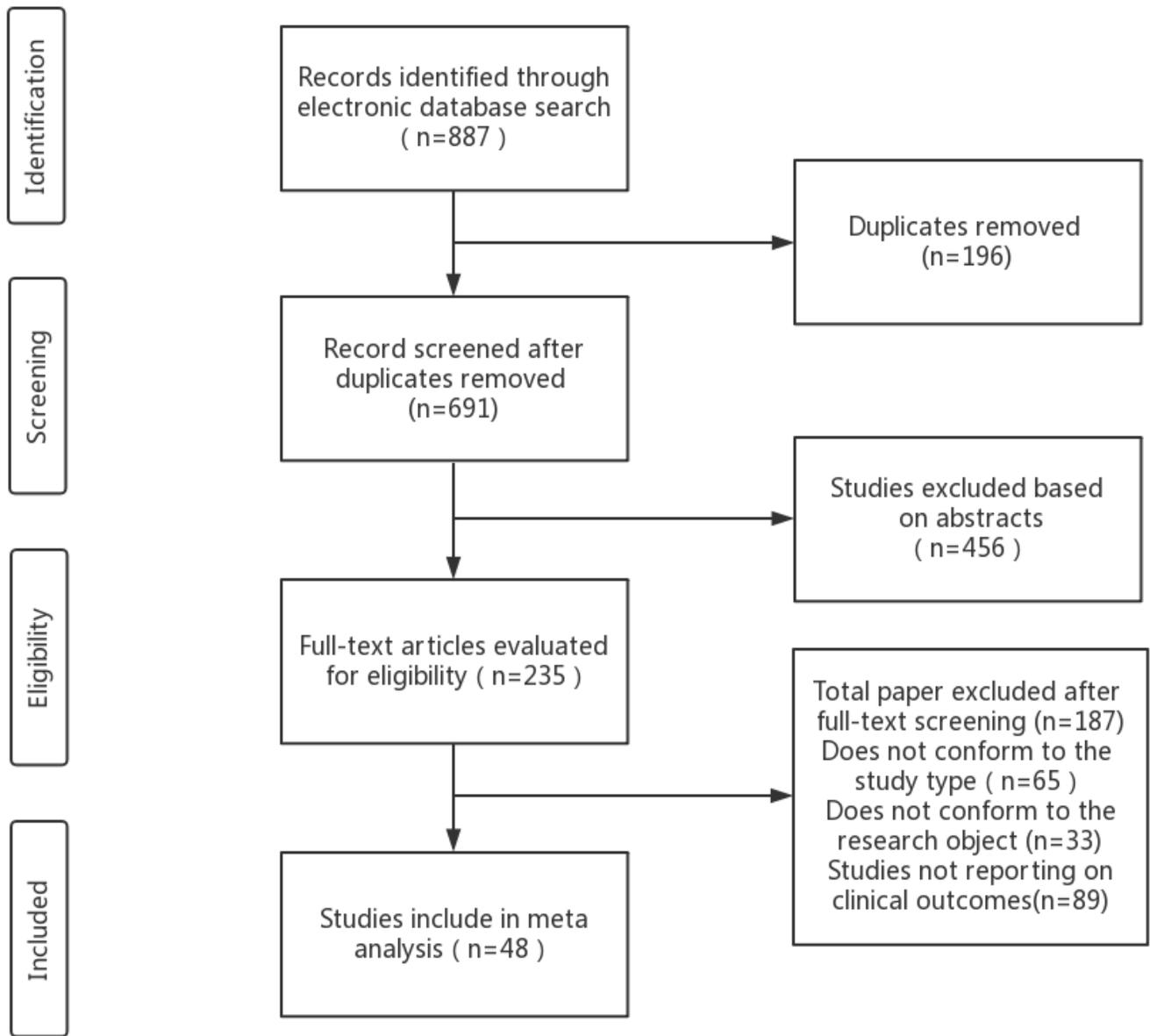
PPD: Postpartum depression; EPDS, Edinburgh postnatal depression scale, HADS: Hospital Anxiety and Depression Scale, SDS: Self-rating depression scale, SCL-90: Symptom Checklist 90, BDI: Beck Depression Inventory, CES-D: Center for Epidemiological Studies Depression Scale.

Author	Year	Place	Sample size	PPD Group	Non-PPD Group	Assessment method	Quality scores
Zhang <sup>52</sup>	2011	Hubei	479	167	312	BDI > = 5	6
Deng <sup>53</sup>	2014	Guangdong	2021	158	1863	CES-D > 20	6
Deng <sup>54</sup>	2014	Guangdong	1823	499	1324	EPDS > 13	7
Han <sup>54</sup>	2015	Beijing	203	189	14	EPDS > 13 HAD > 9	6
Liu <sup>56</sup>	2017	Guangdong	418	93	325	EPDS > 9.5	5
Zhou <sup>57</sup>	2019	Jiangsu	849	142	707	EPDS > 10	6
Liu <sup>58</sup>	2015	Hubei	1427	198	1229	EPDS ≥ 9	5
Xie <sup>59</sup>	2018	Hubei	534	103	431	EPDS	6
Pan <sup>60</sup>	2015	Zhejiang	745	93	652	EPDS	5
PPD: Postpartum depression: EPDS, Edinburgh postnatal depression scale, HADS: Hospital Anxiety and Depression Scale, SDS: Self-rating depression scale, SCL-90: Symptom Checklist 90, BDI: Beck Depression Inventory, CES-D: Center for Epidemiological Studies Depression Scale.							

Table 2  
Sensitivity analysis of risk factors of postpartum depression

Risk factors	Type of research	Fixed effect model		Random effect model	
		OR	95%CI	OR	95%CI
Prenatal depression	Cohort study	4.21	[2.82 6.27]	4.40	[2.64 7.34]
	Case control study	11.09	[8.13 15.12]	12.72	[7.85 20.62]
marriage relationship	Cohort study	5.76	[3.86 8.59]	5.76	[3.27 10.13]
	Case control study	2.93	[2.36 3.64]	2.93	[2.36 3.64]
Mother-in-law relationship	Cohort study	3.84	[2.61 5.65]	3.57	[1.87 6.82]
	Case control study	2.37	[2.17 2.58]	2.70	[1.90 3.85]
Social support	Cohort study	6.30	[5.07 7.83]	6.18	[4.10 9.31]
	Case control study	1.97	[1.75 2.22]	1.85	[1.52 2.25]
Economic foundation	Cohort study	3.50	[1.65 7.43]	4.46	[1.09 18.20]
	Case control study	3.50	[2.90 4.22]	3.50	[2.90 4.22]
Unplanned pregnancy	Case control study	2.55	[2.08 3.14]	2.64	[2.04 3.40]
Prenatal anxiety	Case control study	7.93	[5.76 10.90]	7.07	[4.12 12.13]
Mother-in-law as the caregiver	Case control study	2.50	[1.67 3.74]	2.50	[1.67 3.74]
Living conditions	Case control study	2.44	[1.92 3.10]	2.65	[1.96 3.57]
ORs: odds ratios; CIs: corresponding 95% confidence intervals					

## Figures



**Figure 1**

Flowchart steps of the meta analysis

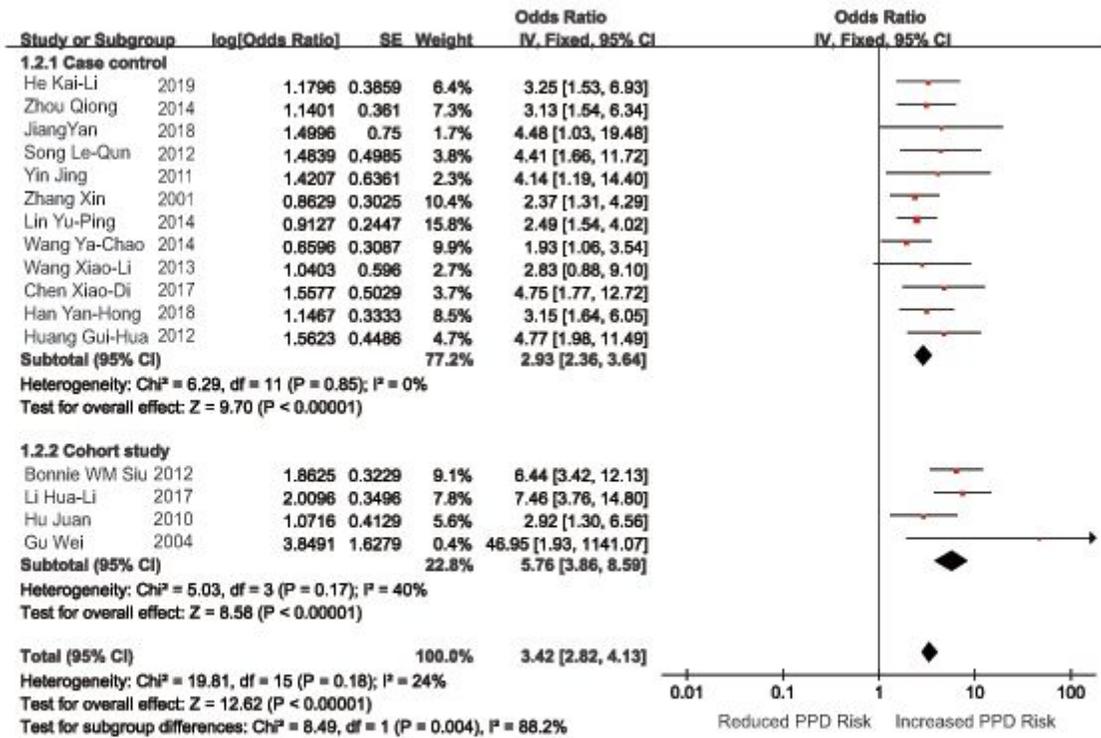


Figure 2

Poor relationship between husband and wife

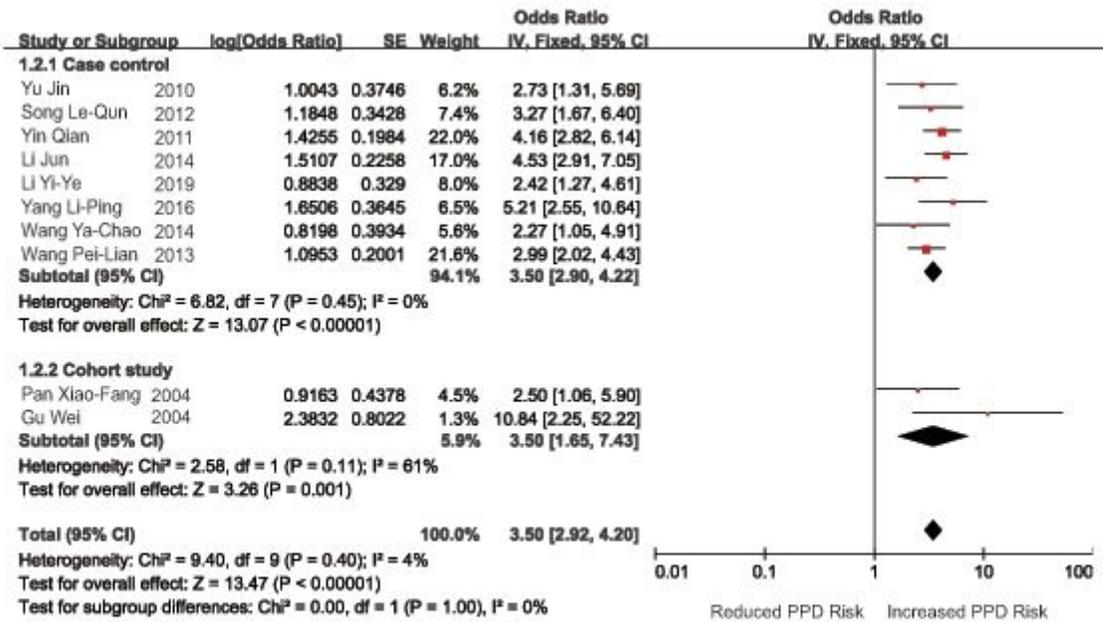


Figure 3

Poor economic foundation

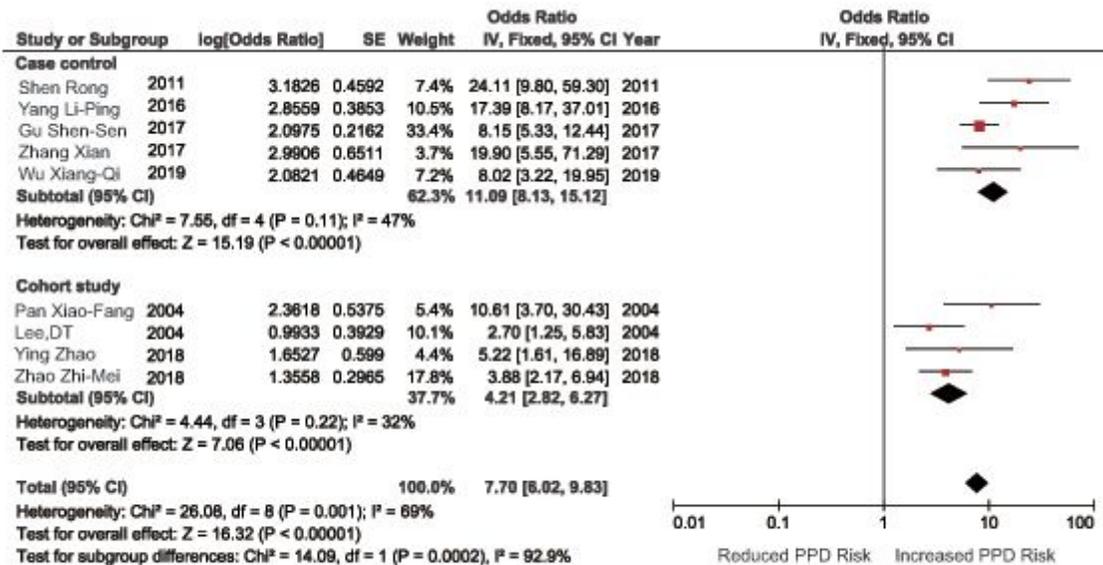


Figure 4

Prenatal depression

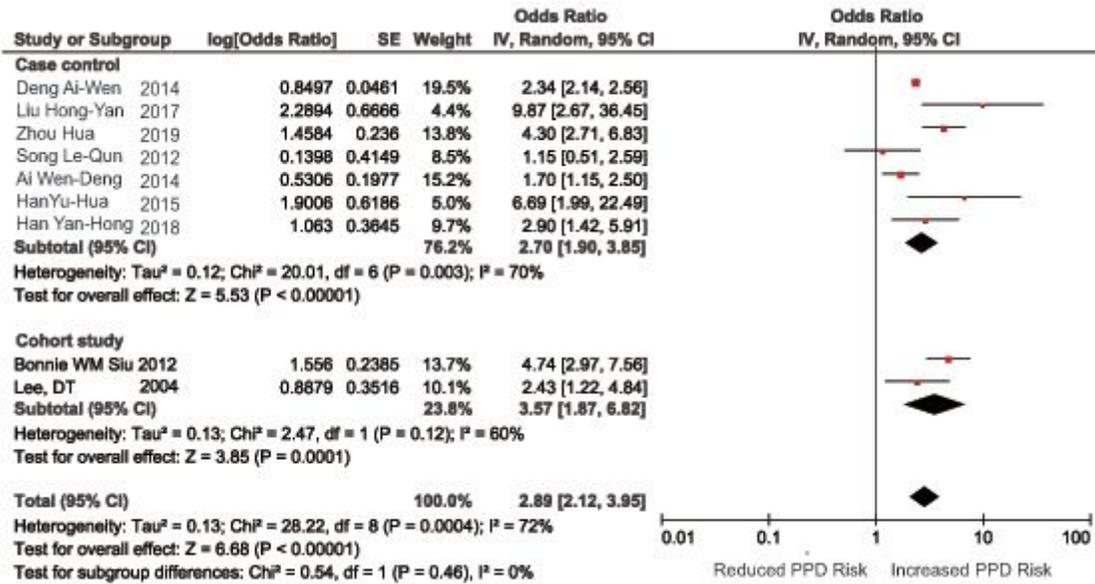


Figure 5

Poor relationship between mother-in-law and daughter-in-law

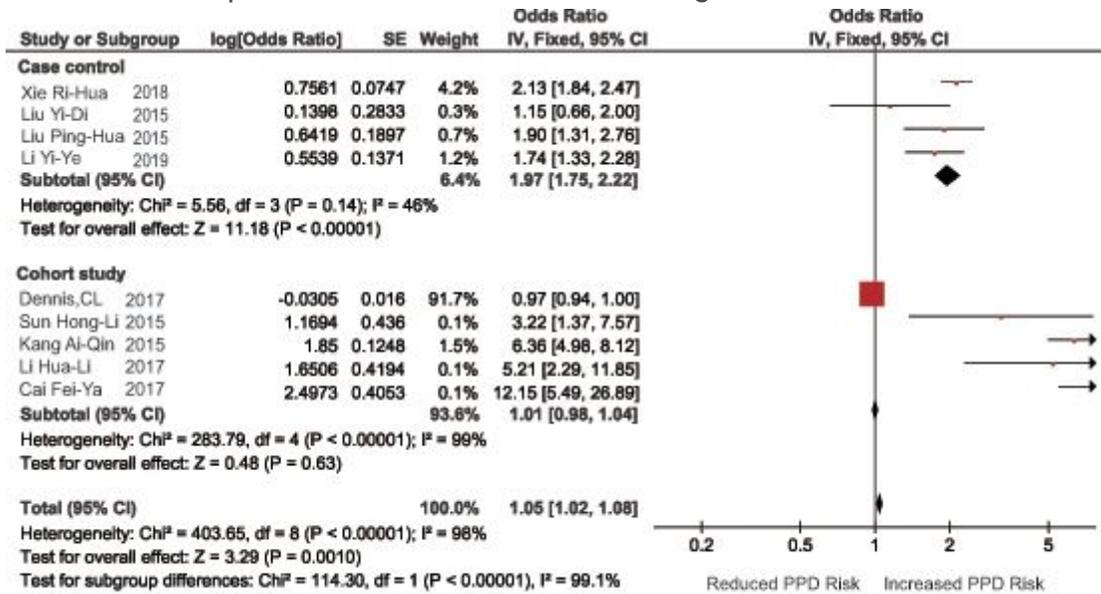


Figure 6

Lack of social support (before adjustment)

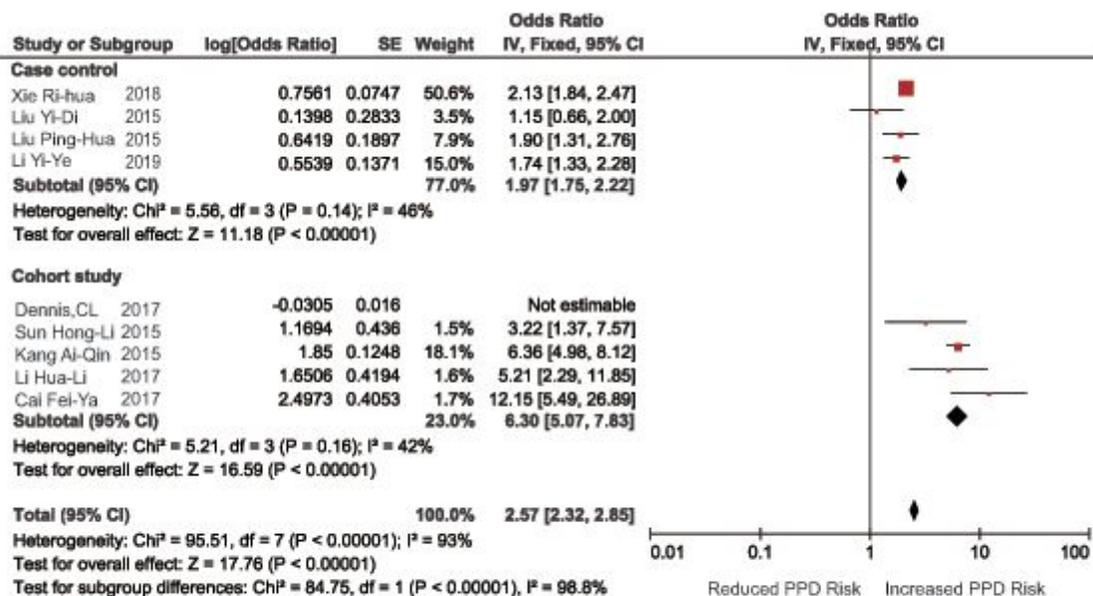


Figure 7

Lack of social support (after adjustment)

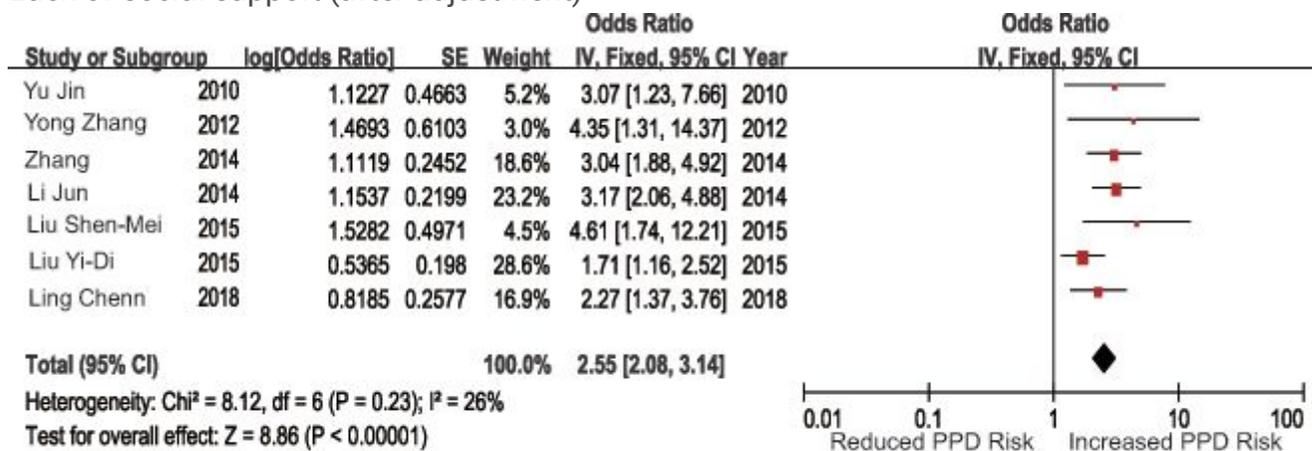


Figure 8

Unplanned pregnancy

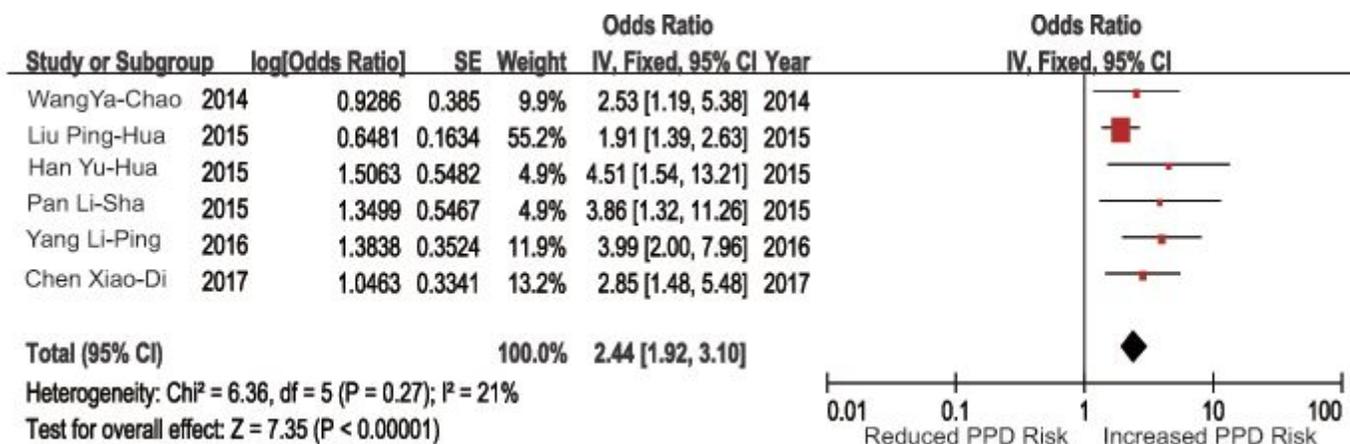


Figure 9

Poor living conditions

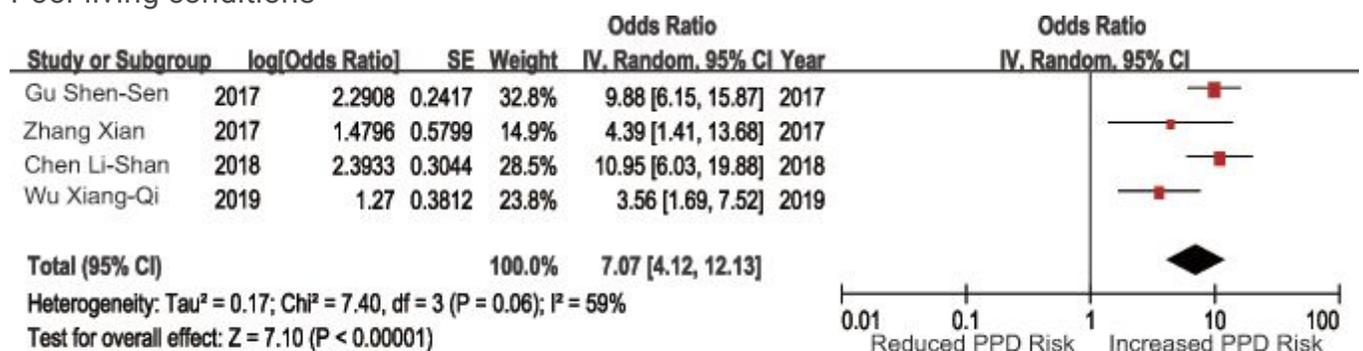


Figure 10

Prenatal anxiety

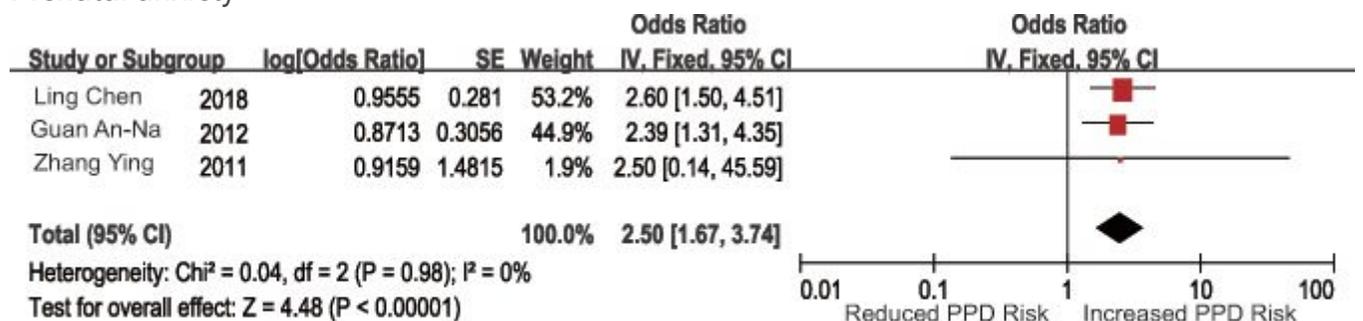


Figure 11

Mother-in-law as the caregiver



## Figure 13

Poor economic foundation funnel plot

## Supplementary Files

This is a list of supplementary files associated with this preprint. Click to download.

- [PRISMAforMetaAnalyseschecklist.doc](#)