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REVIEW

Prevalence and Risk Factors of Postpartum Depression in Women: A Systematic Review and Meta-analysis

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Abstract

Aim: The current systematic review aimed to present the pooled estimated prevalence and risk factors of PPD.

Background: Postpartum depression seriously affects the physical and mental health of the mother and child. However, high-quality meta-analysis is limited, which restricts the screening and intervention of postpartum depression.

Design: A systematic review and meta-analysis.

Methods: Cochrane Library, PubMed, Embase and Web of Science were searched for cohort and case-control studies investigating the prevalence and risk factors of postpartum depression from inception to December 31st, 2020. Meta-analyses were performed to identify postpartum depression prevalence and risk factors using a random-effects model.

Results: Of the 33 citations evaluated, 27 reported the prevalence of postpartum depression in 33 separate study populations containing 133,313.
subjects. Pooled prevalence in all studies was 14.0% (95%CI, 12.0%–15.0%). The prevalence varied according to country (from 5.0% to 26.32%) and developing countries, especially China, have a high prevalence of postpartum depression. The following risk factors were associated with postpartum depression: gestational diabetes mellitus(OR = 2.71, 95%CI 1.78–4.14, I^2 = 0.0%), depression during pregnancy(OR = 2.40, 95%CI 1.96–2.93, I^2 = 96.7%), pregnant women give birth to boys(OR = 1.62; 95%CI 1.28–2.05; I^2 = 0.0%), history of depression during pregnancy(OR = 4.82, 95%CI 1.32–17.54, I^2 = 74.9%), history of depression(OR = 3.09, 95%CI 1.62–5.93, I^2 = 86.5%) and epidural anaesthesia during delivery(OR = .81, 95%CI .13–4.87, I^2 = 90.1%).

Conclusions: The prevalence of postpartum depression seems to be high, especially in developing countries. Gestational diabetes mellitus, depression during pregnancy, pregnant women give birth to boys, history of depression during pregnancy, history of depression, epidural anaesthesia during delivery were identified as risk factors for postpartum depression. Understanding the risk factors of PPD can provide the healthcare personnel with the theoretical basis for the patients' management and treatment.

Implications for practice: This systematic review and meta-analysis identified six significant risk factors for PPD, which provides nurses with a theoretical basis for managing and treating women with PPD to effectively improve the screening rate, intervention rate and referral rate of women with PPD.

1 | INTRODUCTION

Postpartum depression (PPD) is characterised by depressive symptoms and syndromes that occur within the first year after childbirth (Hacking, 2013). The main symptoms of PPD include lack of interest, low self-esteem, tiredness, sadness, sleep disturbance, loss of appetite, hostile attitude towards infants, self-blame and feelings of humiliation, with symptoms lasting at least two weeks (Adamu & Adinew, 2018). PPD usually occurs within four weeks after delivery (O'Hara & Wisner, 2014) and can last 6 months or more after delivery (Buist, 2004). Previous research has reported that PPD can last for up to two years after delivery (Mayberry et al., 2007). Unfortunately, PPD has serious consequences: it can damage women's ability to work and their social adjustment, and quickly lead to chronic or chronic recurrent depression (Halbreich, 2005). Moreover, PPD affects the mother's physical and mental health, and the babies of depressed mothers manifest lower social engagement, fewer mature regulatory behaviours and more negative emotionality, and higher cortisol reactivity (Fan et al., 2020; Parsons et al., 2012). PPD is also closely associated with the increased risk of maternal suicide (Choo et al., 2017). Therefore, determining the prevalence of PPD and clarifying its risk factors are of great social significance for preventing and treating PPD.

Postpartum depression (PPD) has become one of the most common complications during the perinatal period (Wang et al., 2017). Although a child's birth can bring happiness and joy to the whole family, the prevalence of PPD is increasing and has recently attracted widespread attention (Śliwerski et al., 2020). The prevalence of postpartum depression is higher in low- and middle-income countries than in high-income countries (Hahn-Holbrook et al., 2017). In developing countries, 19.8% of women or more suffer from depression after delivery (Song et al., 2018). A recent systematic review of 291 studies from 56 countries/regions revealed that the comorbidity rate of PPD is relatively high, at 17.7% (Hahn-Holbrook et al., 2017). In a cohort study of 214 people in China, the incidence of PPD six weeks after delivery was 24.3% (Ding et al., 2014). In another cohort study of 254 people in Iran, the incidence of PPD 4 to 6 weeks after delivery was 5.5% (Goshtasebi et al., 2013). However, in cultural environments that value family support to the mother in the first month of delivery, the prevalence of PPD is very low (Halbreich, 2005). The prevalence of PPD is high and varies by country, cultural background and economic conditions. Given the harm to the mother's mental health and the child's social participation and emotional well-being (Fan et al., 2020; Parsons et al., 2012) and the increased incidence of PPD, a comprehensive assessment of the prevalence of PPD and early determination of risk factors for PPD has important clinical significance for improving pregnant women's quality of life and promoting the healthy growth of babies.

What does this paper contribute to the wider global clinical community?

- 27 studies included in the present meta-analysis, which involved 133,313 subjects, the pooled prevalence of PPD is 14.0%.
- Gestational diabetes mellitus, depression during pregnancy, pregnant women give birth to boys, history of depression during pregnancy, history of depression, epidural anaesthesia during delivery were identified as risk factors for PPD.

Although previous studies have identified several risk factors for postpartum depression, recent research has identified new risk factors. In addition, different studies have found different risk factors. One literature review concluded that current risk factors for PPD mainly involve physical, psychological and social aspects (Ko et al., 2017). Endocrine, immune and genetic biology research has reported that mood disorders and sudden oestrogen withdrawal, oestrogen fluctuations and continuous oestrogen deficiency may lead to the development of PPD (Brummelte & Galea, 2010; Douma et al., 2005; Viktorin et al., 2016). For example, one childbirth cohort study found that preterm birth was a clinical risk factor predicting PPD. In contrast, another study reported the opposite result (Drewett et al., 2004; Nielsen Forman et al., 2000). Such disagreement can make clinical decision-making less certain and consistent. In addition, previous studies have reported other factors for PPD, such as depression during pregnancy, history of domestic abuse or violence, sex of the newborn, pregnancy experience (Turkcapar et al., 2015), sleep (Okun, 2015), premature delivery (de Paula Eduardo et al., 2019), epidural labour analgesia (Ding et al., 2014) and education level (Matsumura et al., 2019). However, research has often found very different risk factors, and the results vary depending on the type of research, sample size, region and statistical method. Therefore, it is urgent to synthesise diverse research results for qualitative and quantitative analysis.

Systematic review and meta-analysis is a scientific method that synthesises the findings of different studies to obtain integrated results, thus providing a reasonable basis for medical decision-making. At present, the latest meta-analysis on PPD mainly synthesises individual risk factors, such as anaemia (Kang et al., 2020), preeclampsia (Caropreso et al., 2019) and premenstrual syndrome

(Cao et al., 2020). However, these previous reviews have several limitations that reduced the number of studies included in the systematic review and affected the accuracy and usability of the meta-analysis results. Additionally, we found that most of the previous meta-analyses included cross-sectional studies and lacked high-quality cohort studies and case-control studies (Upadhyay et al., 2017), which reduced the quality of the meta-analysis. It is thus necessary to conduct a comprehensive search and meta-synthesis of risk factors for PPD to obtain more accurate results to guide clinical practice. Therefore, we conducted the current systematic review to present the pooled estimated prevalence and risk factors for PPD with precision.

2 | METHODS

The meta-analysis was registered with PROSPERO (PROSPERO identifier CRD42020180380) and reported using Preferred Reporting Items for Systematic Reviews and Meta-Analysis (PRISMA) guidelines(see Supplementary File 1).

2.1 | Research strategy

The present meta-analysis was conducted according to the checklists of the Meta-analysis of Observational Studies in Epidemiology (Stroup et al., 2000). We systematically searched electronic databases, including the Cochrane Library, PubMed, Embase and Web of Science for articles published prior to December 2020. The following MeSH terms and words were combined to construct systemic searches: 'depression, postpartum OR postnatal depression OR depression, postnatal OR postpartum depression OR depression, postpartum OR postpartum depression OR postpartum depression OR postnatal depression OR depression, postnatal OR postnatal depression OR perinatal depression OR puerperium depression' AND 'factor risk OR risk factor OR risk factors OR factors, risk OR predictor OR predictors OR prediction' AND 'prospective cohort OR retrospective cohort OR case-control OR nested-case control'. We also manually searched the reference lists of the included studies and relevant reviews to identify additional records. For specific search strategies, please see Table 1.

2.2 | Criteria for study selection

Studies were included if:

1. Participating women included were assessed for PPD using a self-reported or validated diagnostic instrument;
2. The study period was within one year after delivery. If the study repeatedly measured the prevalence of PPD at multiple different periods within one year after delivery, we used the data measured during the last period;
3. Data reported included the prevalence of PPD or reported risk factors for PPD;
4. The studies were observational (case-control or cohort studies);
5. The study language was English.

Studies were excluded if they:

1. Had a response rate of less than 50%;
2. Were conducted in a high-risk population (e.g. women with HIV).

2.3 | Data extraction

Two of our authors independently completed data extraction, including author (year), study design, age, country/location, sample size, the measure of PPD, time of measurement, prevalence and risk factors for PPD. The details of all the extracted data are shown in Table 2.

2.4 | Quality assessment

The quality of the selected studies was assessed independently by two reviewers using the Newcastle–Ottawa Scale (NOS) and a third reviewer where consensus was not reached. For more details, please see Table 2.

TABLE 1 search methods

#1	**postpartum depression[Mesh]**
#2	depression, postpartum OR postnatal depression OR depression, postnatal OR postpartum depression OR depression, postpartum OR postpartum depression OR postpartum depression OR postnatal depression OR depression, postnatal OR postnatal depression OR perinatal depression OR puerperium depression
#3	factor risk OR risk factor OR risk factors OR factors, risk OR predictor OR predictors OR prediction
#4	prospective cohort OR retrospective cohort OR case-control OR nested-case control
#5	#1 OR #2
#6	#3 AND #4 AND #5

TABLE 2 Characteristics of studies of the prevalence and risk factors of postpartum depression

No.	author (Year)	Study design	Age (years)	country/ location	Sample size	Measure of postpartum depression
1	Hanieh Salehi -Pourmehr (2017)	cohort study	18–35	Iran	307	EPDS
2	Aleksi Ruohom aki(2018)	cohort study	/	Finland	1066	EPDS
3	Thangavelautham Suhitharan (2016)	case-control study	≥18	Singapore	479	EPDS
4	Chutima Roomruangwong (2016)	case-control study	≥18	Thailand	313	EPDS
5	Ting Ding (2013)	cohort study	mean 29	China	214	EPDS
6	R. Abdul Raheem(2018)	cohort study	≥18	Maldives	458	EPDS
7	Jane J. Rogathia(2017)	cohort study	≥18	Tanzania	1013	EPDS
8	Azita Goshtasebi(2013)	cohort study	18–35	Iran	254	EPDS
9	Linnet Onger(2018)	cohort study	18–45	Kenyan	188	EPDS
10	Irena Stepanikova(2017)	cohort study	15–49	Czech Republic	3005	EPDS
11	Monique Robinson(2014)	cohort study	/	Australian	706	EPDS
12	Stefanie N. Hinkle(2016)	cohort study	/	United States	162	EPDS
13	Yuexin Gan(2019)	cohort study	≥20	China	2546	EPDS
14	Fatemeh Abdollahi(2016)	cohort study	16–45	Iran	1739	EPDS
15	Despina Pampaka(2018)	cohort study	18–45	United States	1348	EPDS
16	Kenta Matsumura(2019)	cohort study	31.3 ± 5.04	Japan	90194	EPDS
17	Liping Meng(2019)	case-control study	≥18	China	360	EPDS
18	Pietro Gambadauro(2017)	cohort study	≥18	Sweden	3283	EPDS
19	Minatsu Kobayashi(2017)	cohort study	36.1 ± 4.1	Japan	710	EPDS
20	Simone Farías-Antúnez(2019)	cohort study	/	Brazil	3838	EPDS
21	Jeannette Milgrom(2018)	cohort study	30.3 ± 5.6	Australian	12361	EPDS
22	Bonnie WM Siu(2012)	cohort study	18–50	China	805	EPDS
23	Emi Mori (2018)	cohort study	≥16	Japan	2709	EPDS
24	Aza Sherin Mohamad Yusuff(2014)	cohort study	26.7 ± 5.6	Malaysia	1362	EPDS
25	Ri-Hua XIE(2010)	cohort study	20–45	China	534	EPDS
26	Shahed Abbasi(2010)	cohort study	18–35	United States	2972	EPDS
27	Ana Bernarda Ludermir(2010)	cohort study	18–49	Brazil	1045	EPDS
28	Nina O. Nielsen(2013)	case-control study	≥18	Denmark	1480	EPDS
29	A.L. Sutter-Dallay(2004)	cohort study	29.6 ± 4.2	France	497	EPDS
30	Haiyan Zhoua(2018)	cohort study	>20	China	228	EPDS
31	Linde van Lee(2020)	cohort study	18–50	Singapore	356	EPDS
32	Chin Wen Tan(2020)	cohort study	≥18	Singapore	651	EPDS
33	Eszter Anna Pataky(2020)	cohort study	18–45	Central Europe	687	EPDS

Note: EPDS, = Edinburgh Postnatal Depression Scale; NOS, = Newcastle-Ottawa Scale.

	Result		
Time of measurement	Prevalence	risk factor	NOS
6-8weeks, 12 months	7.8%,10.6% in 6–8 weeks, 1 year	Pre-pregnancy obesity	7
8 weeks	10.30%	Gestational diabetes mellitus	8
4–8 weeks	12.90%	Maternal age, History of depression; Nonepidural analgesia; Family history of depression; Previous peripartum depression	9
4–6 weeks	16.90%	History of depression; History of depression during pregnancy; Caffeine use during pregnancy; Actual baby feeding problems	8
6 weeks	24.30%	Attendance at childbirth classes during pregnancy; Received epidural labour analgesia; Continued breastfeeding at 42 d postpartum	8
1 and 6 months	24%	Antenatal depression; Had a stressful life event; Other infant health problems	8
40 days	12%	Physical violence; Sexual violence	8
4–6 weeks	5.50%	Hb at delivery; Educational level	8
6–10 weeks	18.70%	Conflict with partner	7
6 months	5%	Perceived discrimination	7
3 days	/	Maternal serum vitamin D during pregnancy	7
6 weeks	9.30%	Gestational diabetes	7
6 weeks	11.40%	Perceived social support during early pregnancy	7
2 weeks	6.90%	General health status, Depression in 1st/2nd trimester; Postnatal parenting self-efficacy; Unwanted pregnancy; Recurrent urinary infection; Gestational diabetes; Mother's age; Household income	7
15 weeks	11.70%	Nationality; Household income (KWD); Antenatal depressive; PTSD symptoms Social network; Sex of the baby	7
1momth, 6 months	14.5%in1months, 11.8%in6months	Education level	7
6 weeks	/	Dysmenorrhea	7
6 weeks, 6 months	13.8%in6weeks, 11.9%in6months	Depression history	7
1 months, 6 months	19.8%at 1 month, 12.8 at 6 months	/	8
12months	16%	/	7
6 weeks	7.50%	Antenatal depression; Prior history of depression; A low level of partner support	7
2 months	15.70%	Marital dissatisfaction; Dissatisfied relationship with mother-in-law; Antenatal depressive; Anxiety-prone personality	7
6 months	16.70%	Sex of infant	7
1 month, 3 months, 6 months	7.10%	Antenatal depression; Husband assisted with infant care; Satisfaction with marital relationship; Consistent worries about infant	7
2 weeks	19.30%	Husband support and parents support during pregnancy	7
1 month	5.10%	Race/ethnicity; Pregnancy depression or anxiety	8
3–6 months	25.80%	Psychological violence; Physical or sexual violence plus psychological violence	7
within one year	/	Vitamin D Status during Pregnancy	9
6 weeks	5.80%	Anxiety e disorder during pregnancy	8
1 month	26.32%	Sleep quality; Age; Miserable experience; Psychological distress (K10); Perceived stress (PSS)	7
3 months	/	The number of lifestyle risk factor score	8
3 months	23.35%	/	7
4-6weeks	18.49%	A history of depression; Symptoms of premenstrual syndrome (PMS) / premenstrual dysphoric disorder (PMDD) prior to the current pregnancy	7

2.5 | Data analysis

Stata 14.0 software (Stata Corp LP, College Station, TX) was used for data analysis. Heterogeneity was described by the I-squared statistic (I^2) (Higgins et al., 2003), representing the percentage of the study's total variation due to heterogeneity rather than chance. An I^2 value of less than 25% indicates a low degree of heterogeneity, 25–75% indicates moderate heterogeneity, and greater than 75% means high heterogeneity (Higgins et al., 2003). The prevalence of PPD and odds ratios of risk factors obtained from each study were pooled after transforming the original estimates. Publication bias was then assessed using Egger linear regression, with p values of <.05 suggesting the presence of bias. A sensitivity analysis was performed by calculating E-values and 95% CIs to evaluate the impact of possible unmeasured confounding factors (Figure 1).

3 | RESULTS

3.1 | Search results

The literature search yielded 5796 records, of which 2423 records were excluded after removal of duplicates; 3073 records were excluded following title and abstract screening. A total of 300 studies were included in the full-text screening. An additional 250 studies were then excluded: 146 studies did not meet the research purpose; 55 studies did not meet the study design criteria; 45 reviews did not meet the outcome criterion; and four articles analysed identical data. One study was excluded after the full-text screening because the author did not respond when asked to provide a critical table that was not listed in the paper. Ultimately, 33 reviews met the inclusion criteria and were incorporated in the meta-analysis (Figure 2).

3.2 | Characteristics of included studies

The characteristics of the 33 studies are described in Table 2. Five were from China (n = 6), four came from the United States (n = 3), three were from Iran (n = 3), three were from Japan (n = 3), three were from Singapore (n = 3), two were from Australia (n = 2), and two were from Brazil (n = 2). One each was from Thailand, Finland, Maldives, Tanzania, Czech Republic, Kenya, Sweden, Malaysia, Denmark, France and Central Europe. Twenty-nine were cohort studies, and four were case-control studies. Cohort studies included data from the beginning of pregnancy, during pregnancy and follow-up through a certain period after childbirth, from 3 days to 12 months; follow-up time was different in different studies. Sample sizes ranged from 162 to 90,194, with a total sample size of 137,866. The presence of PPD was assessed using the Edinburgh Postpartum Depression Scale (EPDS) in all included reviews (Table 2).

3.3 | Prevalence of Postpartum Depression

In the 27 studies available for the meta-analysis, the prevalence of PPD ranged from 5.0% to 26.32%. Based on a random-effects model-based meta-analysis conducted on all data points, overall PPD prevalence was estimated to be 14% (95% CI: .12–.15, I^2 = 98.1%, p<.0001) (Figure 3). Subgroup analysis revealed that the prevalence of PPD in developing countries (15.0%) was significantly higher than the prevalence of depression in developed countries (12.0%). In addition, among different countries/regions, the prevalence of PPD in China was the highest (21.4%); this was significantly higher than the prevalence in the United States (8.6%) and Japan (14.0%) (Table 3).

3.4 | Risk Factors for Postpartum Depression

The meta-analysis identified six risk factors associated with PPD from the 33 studies: gestational diabetes mellitus, depression during pregnancy, giving birth to boys, history of depression during pregnancy, history of depression and receipt of epidural anaesthesia during delivery. The odds of PPD were higher among women with than without gestational diabetes mellitus (OR = 2.71, 95% CI 1.78–4.14, I^2 = 0.0%) (Figure 1). A history of depression (OR = 3.09, 95% CI 1.62–5.93, I^2 = 86.5%) (Figure 1) and depression during pregnancy (OR = 2.40, 95% CI 1.96–2.93, I^2 = 96.7%) (Figure 1) were associated with increased odds of PPD. Pregnant women who gave birth to boys (OR = 1.62; 95% CI 1.28–2.05; I^2 = 0.0%) (Figure 1) had a higher risk of PPD. Women who received epidural anaesthesia during delivery (OR = .81, 95% CI .13–4.87, I^2 = 90.1%) (Figure 1) or who had a history of depression during pregnancy (OR = 4.82, 95% CI 1.32–17.54, I^2 = 74.9%) (Figure 1) were more likely to suffer from PPD.

3.5 | Publication bias and sensitivity analysis

A funnel plot evaluation with Egger's method indicated the 27 studies of the prevalence of PPD lacked publication bias (P for Egger test = .309) (Figure 4).

4 | DISCUSSION

Twenty-seven studies were included in the present meta-analysis, which involved 133,313 subjects; the pooled prevalence of PPD was 14.0%. This meta-analysis showed that 12 weeks postpartum was the period with the highest prevalence of PPD. Additionally, the study's findings revealed that developing countries, especially China (21.4%), have a higher incidence of PPD than developed countries. Gestational diabetes, depression during pregnancy, history of depression, giving birth to boys, receiving epidural anaesthesia during childbirth, and history of depression during pregnancy were found to increase the risk of PPD.

4.1 | Prevalence of postpartum depression

Postpartum depression is the most common mental disorder during the puerperium and has become a global public health problem (Wisner et al., 2006). The current meta-analysis showed that the pooled prevalence of PPD was 14%, roughly in line with previous studies (Nisar et al., 2020; Shorey et al., 2018). At the same time, the current meta-analysis showed that 12 weeks postpartum was the most common time point for PPD, which is consistent with the results of Norma et al. (Upadhyay et al., 2017). However, during the overall 24-week postpartum screening period, the prevalence of PPD ranged from 12.9% to 17.4%, which revealed a higher prevalence. This finding is noteworthy: there is an increased risk of PPD for pregnant women for half a year or even longer after delivery. Our meta-analysis indicated that developing countries have a higher prevalence (15.0%) of PPD than developed countries (12.0%). This estimate of the prevalence of PPD in developing countries is consistent with the results of previous studies (19% in Africa and 22% in India) (Dadi et al., 2020; Upadhyay et al., 2017), which showed that nearly one-fifth of postpartum women suffer from depression. However, in China, the prevalence of PPD was as high as 21.4%, which may be attributed to China's limited screening, intervention, and evaluation of

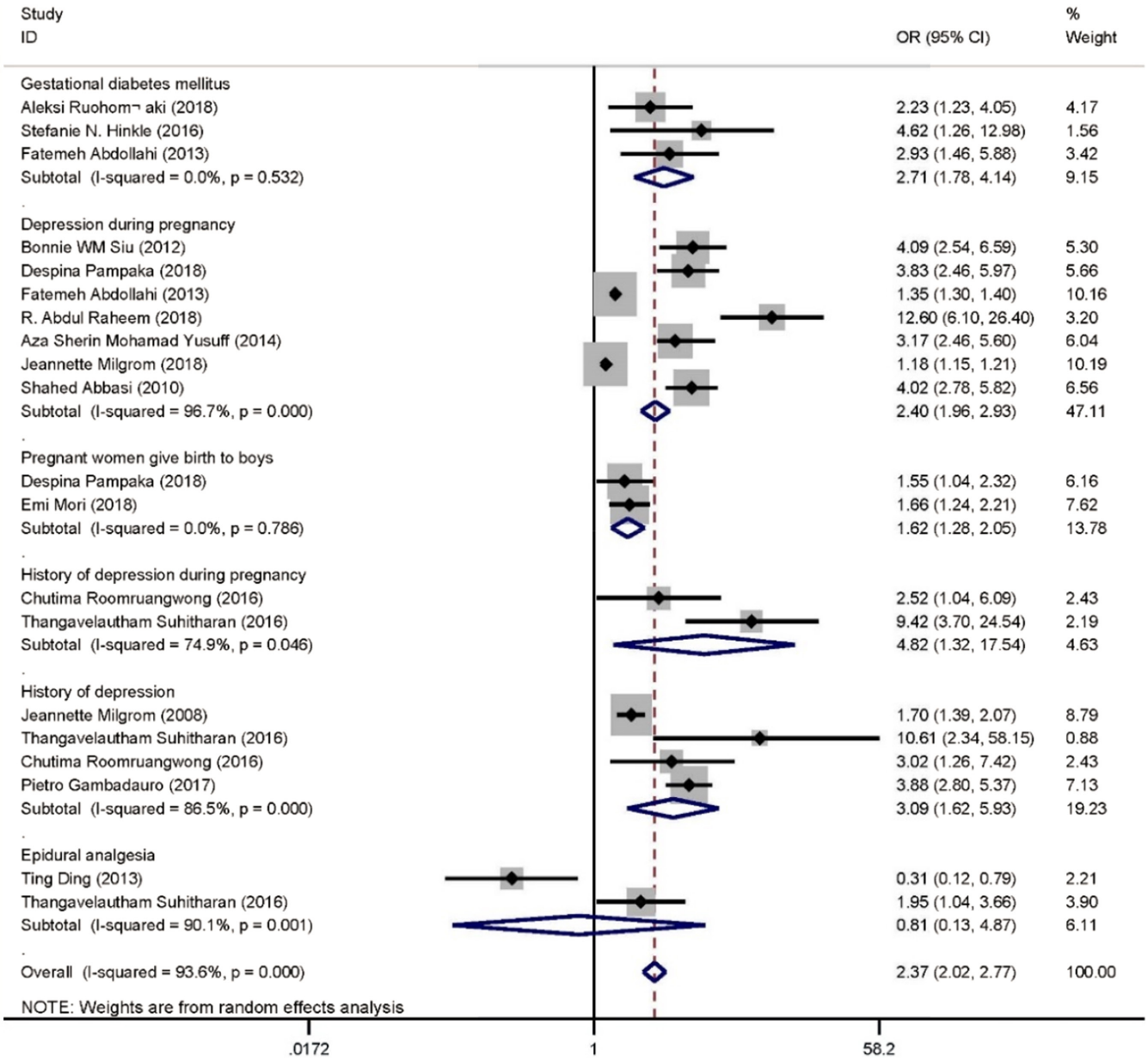

FIGURE 1 Forest plot of risk factors for postpartum depression

Note: Gestational diabetes mellitus: E-value 2.71, 95%CI (1.78 4.14); depression during pregnancy: E-value 2.40, 95%CI (1.96 2.93); pregnant women give birth to boys: E-value 1.62, 95%CI (1.28 2.05); history of depression during pregnancy: E-value 4.82, 95%CI (1.32 17.54); history of depression: E-value 3.09, 95%CI (1.62 5.93); epidural anaesthesia during delivery: E-value .18, 95%CI (.13 4.87) [Colour figure can be viewed at wileyonlinelibrary.com]

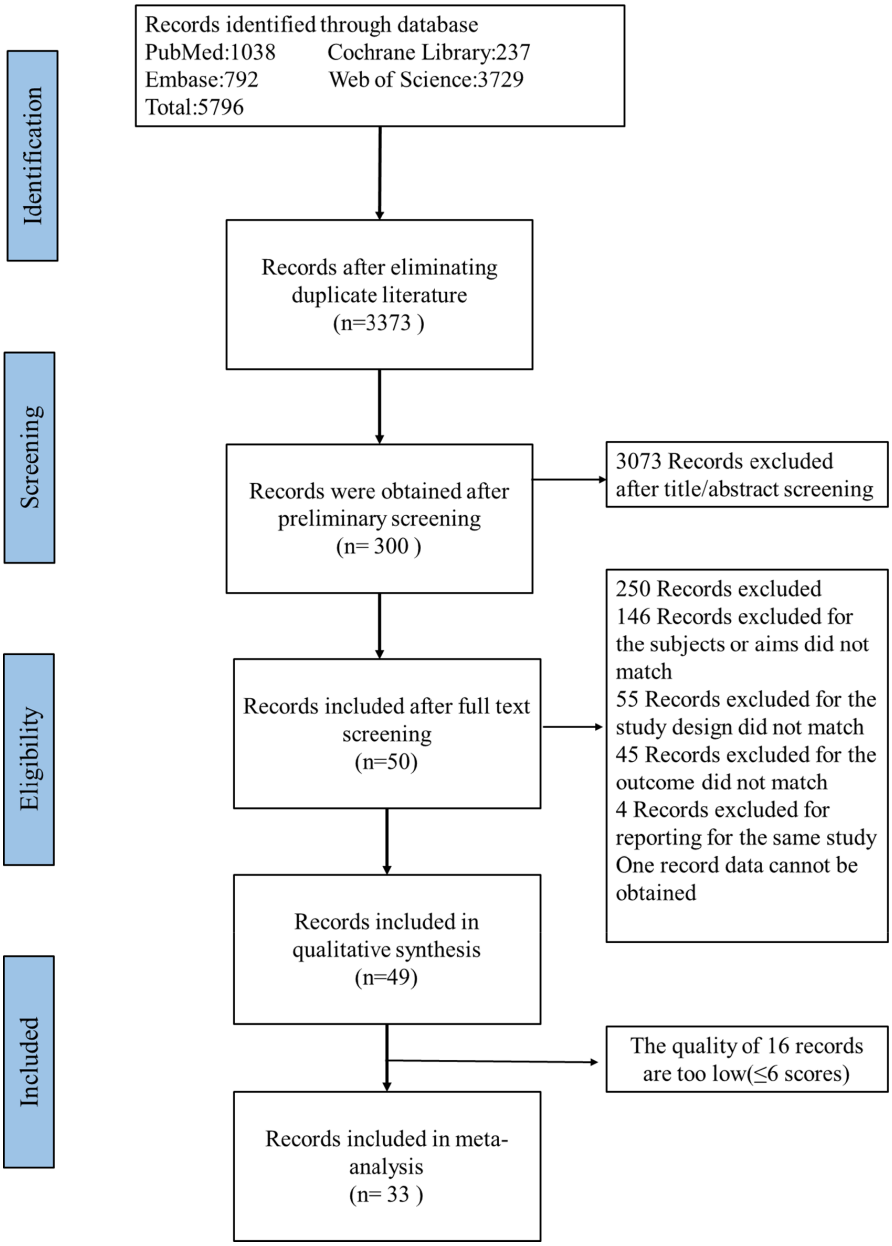

FIGURE 2 Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) flow diagram for the study selection process [Colour figure can be viewed at wileyonlinelibrary.com]

perinatal depression. China's 'Guidelines for Health Care Before and During Pregnancy (2018)' recommended that during the first prenatal examination, obstetricians should assess pregnant women's mental state to prevent the occurrence of psychological problems during pregnancy and after delivery. However, specific process specifications and implementation strategies for perinatal depression screening, intervention and evaluation in perinatal care guidelines have not been formed.

The presence of PPD was assessed using the Edinburgh Postpartum Depression Scale (EPDS) in all included reviews. The American Academy of Family Physicians, the American Academy of Pediatrics, and the American College of Obstetricians and Gynecologists recommend using the Edinburgh Postpartum Depression Scale to screen all postpartum women for depression (Maurer et al., 2018; O'Connor et al., 2016). Screening tools offer health care professionals additional information for the assessment of both risk factors and PPD among pregnant women. Screening and intervention and evaluation of PPD should be strengthened to actively reduce the prevalence of PPD and promote pregnant women's mental health.

4.2 | Risk factors for postpartum depression

In the current review, gestational diabetes mellitus, depression during pregnancy, giving birth to boys, history of depression during pregnancy, history of depression, and epidural anaesthesia during delivery were strongly associated with increased odds of PPD.

The findings of the present meta-analysis indicated that having gestational diabetes mellitus significantly increased the risk of PPD, consistent with the previous meta-analysis of gestational diabetes mellitus and PPD (Anderson et al., 2001; de Groot et al.,

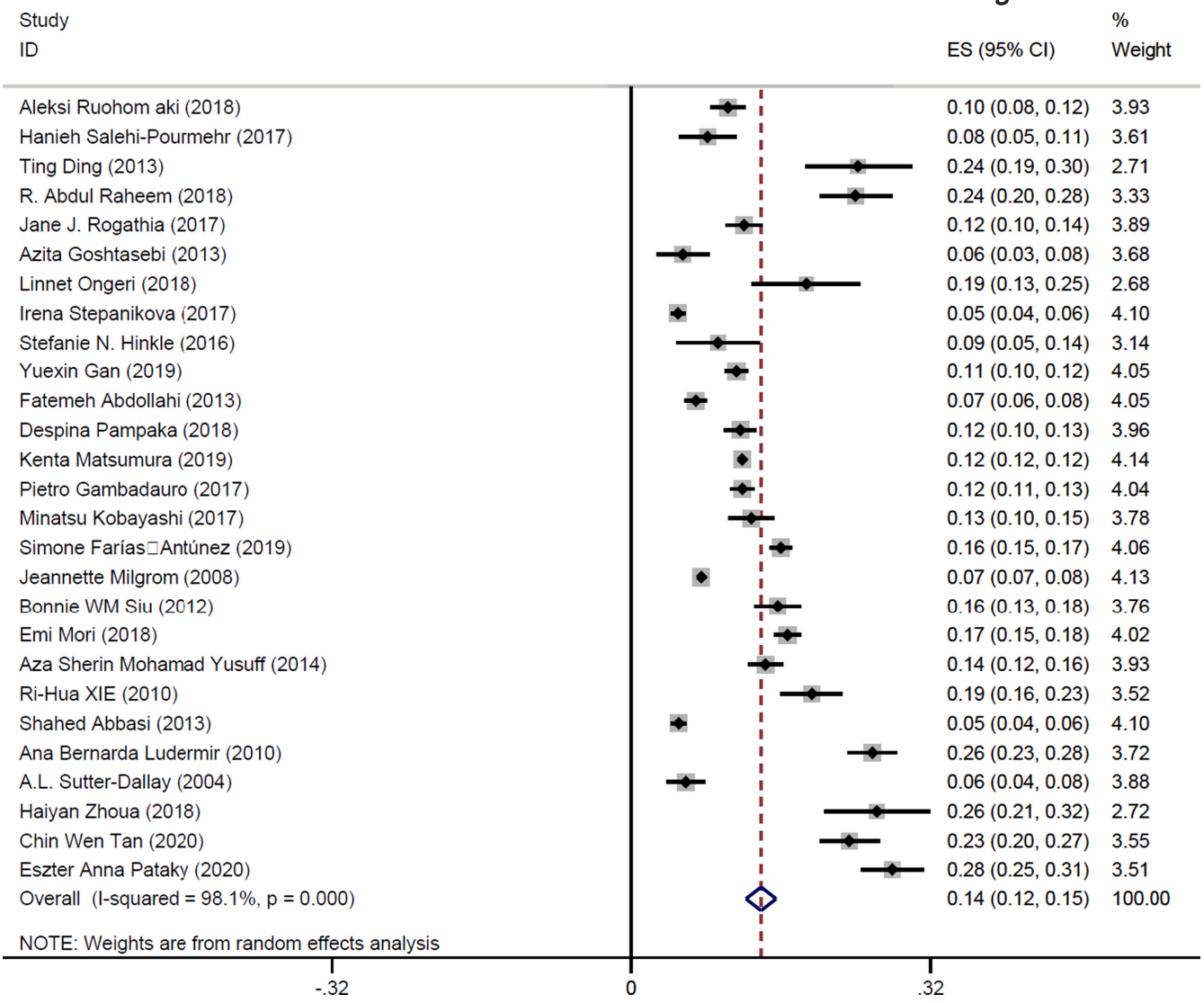

FIGURE 3 Prevalence of postpartum depression (N = 29, random effect) [Colour figure can be viewed at wileyonlinelibrary.com]

2001). Plausible explanation mechanisms for the relationship between gestational diabetes mellitus and PPD may include the effect of hyperglycaemia and hormones on the thyroid and stress axis, and the response to the stress burden of chronic diseases during pregnancy and the postpartum period (Lustman et al., 2000; Zhang et al., 2005). Based on our meta-analysis results, screening and treatment of gestational diabetes mellitus could be expected to significantly reduce the incidence of PPD. Crowther et al. (Crowther et al., 2005) conducted a randomised controlled trial that randomly assigned patients with gestational diabetes to receive dietary advice, blood glucose monitoring and insulin therapy (intervention group), or routine care as needed. At three months postpartum, data on the women's mood and quality of life, available for 573 women, revealed lower rates of depression and higher scores in the intervention group. The treatment of gestational diabetes could thus potentially reduce the prevalence of PPD, but further high-quality research is needed to verify.

The current meta-analysis reported that a history of depression and depression during pregnancy was associated with increased PPD. These findings were supported by a systematic review and meta-analysis on antenatal risk factors for PPD (Becker et al., 2016; Šebela et al., 2018). The results of a meta-analysis of more than 14,000 subjects and subsequent follow-up studies of nearly 10,000 subjects found that depression during pregnancy, anxiety during pregnancy, stressful life events during pregnancy or the early puerperium, low levels of social support, and previous history of depression were the strongest predictors of PPD. In this study, we determined from synthesising the evidence that a history of depression during pregnancy is closely related to PPD. Women with a history of depression during pregnancy, therefore, require close monitoring. Additionally, a study reported that potential risk factors for a history of depression could also indirectly increase the chance of PPD by increasing the frequency of caesarean section (Eckerdal et al., 2018). To date, the specific mechanism of how a history of depression leads to PPD is still unclear, and further research is needed. However, these findings indicated that pregnant women with a history of depression or depression during pregnancy might

TABLE 3 Subgroup analyses by Economic level, Country/Region and Postpartum time

	No. of studies	Sample	Depression	prevalence	95%CI		P	I^2 (%)
					lower	higher		
Economic level								
Developing countries	16	15196	2302	17.0	.14	.20	<.001	96.4
Developed country	13	113819	13258	11.0	.088	.132	<.001	98.8
Country/Region								
United States	3	4482	323	8.6	.035	.137	<.001	95.9
China	6	4696	748	21.4	.152	.276	<.001	95.9
Japan	3	88850	11219	14.0	.110	.170	<.001	94.0
Singapore	2	1130	214	18.1	.079	.281	<.001	95.3
Iran	3	2300	159	7.0	.06	.08	.457	0
others	12	24406	2476	14.0	.12	.16	<.001	98
Postpartum time								
2 weeks	2	2273	223	13.0	.009	.251	<.001	97.9
4 weeks	3	4213	333	13.9	.059	.218	<.001	97.7
6 weeks	9	17403	1687	15.3	.112	.195	<.001	97.5
8 weeks	3	2350	298	12.9	.095	.126	.003	82.7
12 weeks	2	1999	309	17.4	.059	.289	<.001	97.4
24 weeks	7	86103	11962	13.6	104	.168	<.001	98.6

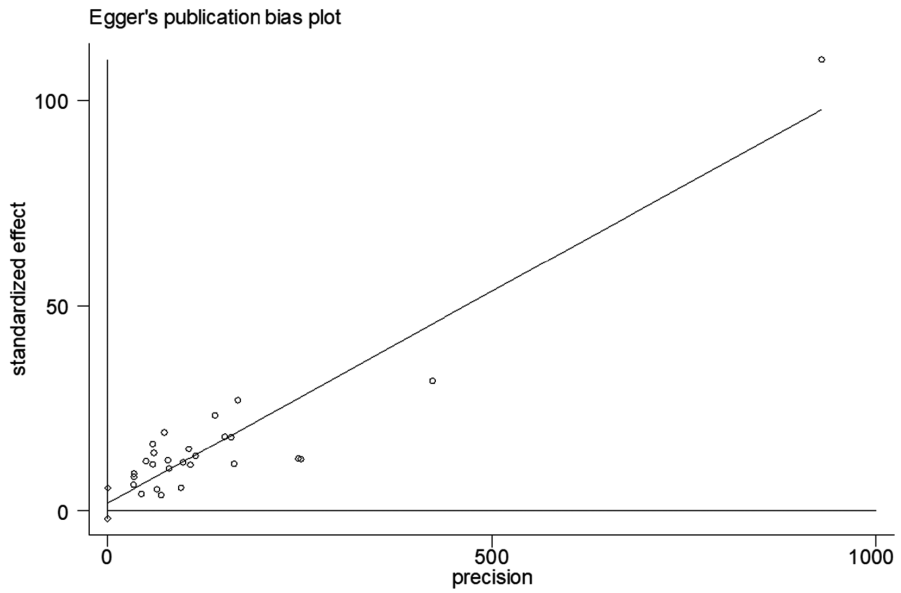

FIGURE 4 The funnel plot assesses publication bias by Egger's method

need increased frequency of screening and testing for PPD to prevent the occurrence of PPD.

The current meta-analysis revealed that pregnant women giving birth to boys were at higher risk of PPD than women giving birth to girls. Previous studies supported our meta-analysis findings on the increased risk of PPD when pregnant women give birth to boys (Mori et al., 2018; Pampaka et al., 2019). However, one other meta-analysis of the sex of the baby and the risk of PPD showed that women giving birth to a girl was associated with a higher risk of developing PPD than those giving birth to a boy (Ye et al., 2020). The possible reasons are as follows: (a) Most of the literature in the Ye et al. meta-analysis came from China and reported that pregnant women who give birth to girls were more likely to suffer from PPD. The phenomenon of patriarchal preference has always existed, and the influence of traditional culture and the one-child policy has led to gender preference in China. (b) Furthermore, as Hall and Holden reported (Hall & Holden, 2008), they examined cognition, emotion and postnatal women's situation and found that mothers whose babies were boys had more negative appraisals. Whether a woman gives birth to a boy or a

girl is associated with PPD is still controversial. Further research is needed to confirm the relationship between the sex of the infant and PPD.

The review also revealed that receipt of epidural anaesthesia during childbirth was associated with an increase in the risk of PPD; this is inconsistent with a previous systematic review on the association between labour epidural analgesia and PPD (Almeida et al., 2020). Although individual studies have demonstrated a significant correlation between epidural analgesia and PPD, we included only two analysis articles. The sample size is relatively small, and the overall correlation is not enormously significant. Therefore, further research is needed to determine the correlation between epidural anaesthesia and PPD.

5 | LIMITATIONS

There are several limitations in the current study. First, an in-depth analysis of some risk factors for PPD was not possible because not all were reported in the original research. Second, the degree of heterogeneity of the included studies was relatively high, which might be caused by differences in methodology, research period, country type and other unexplained differences. Third, the languages included in the meta-analysis were limited to English and Chinese. Excluding articles published in other languages might compromise the comprehensiveness of the included literature.

6 | CONCLUSION

In conclusion, the present systematic review demonstrated that the pooled prevalence of PPD was 14%. Such a high prevalence indicates the need to raise public awareness of PPD, especially in developing countries such as China. Gestational diabetes mellitus, depression during pregnancy, giving birth to boys, history of depression during pregnancy, history of depression and epidural anaesthesia during delivery were risk factors for PPD. These findings suggest that the future screening and management of PPD should focus on risk factors affecting this condition, particularly controllable factors such as gestational diabetes, history of depression and history of depression during pregnancy. Research on the risk factors for PPD can provide nurses with a theoretical basis for managing and treating women with PPD.

6.1 | Relevance to Clinical Practice

Depression has always been an important research focus in mental health care. PPD, as it occurs specifically after childbirth, causes severe and complicated harm to women and babies. According to research reports, many factors affect PPD, and intricate factors pose a considerable challenge to the timely, effective, and accurate screening and treatment of PPD in women. This systematic review and meta-analysis identified six significant risk factors for PPD, which provides nurses with a theoretical basis for managing and treating women with PPD to effectively improve the screening rate, intervention rate, and referral rate of women with PPD.

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COMPETING INTERESTS

We have no competing interests.

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