PREVALENCE AND TOOLS FOR ASSESSMENT OF POSTPARTUM DEPRESSION: A SYSTEMATIC REVIEW AND META-ANALYSIS

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LIST OF ABBREVIATION

95% CI	95% Confidence Interval
AAFP	American Academy Of Family Physician
ACA	Affordable Care Act
ACOG	American College Of Obstetricians And Gynecologists
APA	American Psychiatric Association
BDI	Beck Depression Inventory
DSM-5	Diagnostic And Statistical Manual Of Mental Disorders-5
EPDS	Edinburgh Postnatal Depression Scale
GNI	Gross National Income
HDRS	Hamilton Depression Rating Scale
HIV	Human Immunodeficiency Virus
LQ	Leverton Questionnaire
MeSH	Medical Subject Headings
MINI	Mini International Neuropsychiatric Interview
OR	Odd Ratio
PDPIR	Postpartum Depression Predictors Inventory-Revised
PDSS	Postpartum Depression Screening Scale
PHQ9	Patient Health Questionnaire 9
PRIME	Primary Care Evaluation of Mental Disorders
PRISMA	Preferred Reporting Items For Systematic Reviews And Meta-Analyses
RR	Relative Risk
SCID	Structured Clinical Interview For DSM
SRQ-20	Self-Reporting Questionnaire 20
USPSTF	Us Preventive Services Task Force
WESP	World Economic Situation and Prospect Report
WHO	World Health Organization

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ABSTRAK

Latar Belakang: Pertubuhan Kesihatan Sedunia menganggarkan bahawa kemurungan akan menjadi punca utama disabiliti menjelang tahun 2030. Kemurungan postpartum sering dianggap sebagai tindakbalas normal selepas kelahiran tetapi prevalen bagi penyakit ini dilaporkan terus meningkat diseluruh dunia. Kajian sistematik dan meta-analisis ini bertujuan untuk mengukur prevalen kemurungan postpartum terkini dan skala yang digunakan untuk menyaring penyakit ini.

Metodologi: Pengkalan data ujian terkawal berdaftar di MEDLINE, PUBMED, SCOPUS, ScienceDirect dan Google Scholar telah digunakan untuk pencarian artikel yang melaporkan prevalen kemurungan postpartum dan telah diterbitkan dari tahun 2010 hingga 2020.

Keputusan: Secara keseluruhan, prevalen kemurungan postpartum di seluruh dunia dianggarkan pada 20.60% (95% CI: 19.31%, 21.88%). Prevalen kemurungan postpartum adalah dilaporkan tinggi di negara sedang membangun pada 23.29% (95% CI:21.45%, 25.12%) berbanding dengan negara membangun pada 11.35% (95% CI:9.88%, 12.82%). Prevalen didapati lebih tinggi sekiranya kondisi ini disaring pada tempoh 12 bulan postpartum di negara sedang membangun (25.35%; 95%CI:18.63%, 32.06%) dan seawal empat minggu di negara membangun (18.53%; 95%CI: 12.91%, 24.14%). Prevalen kemurungan postpartum yang tinggi dilaporkan dikalangan imigran (22.4%), tentera (83.0%), ibu dengan komplikasi antenatal (45.88%), ibu dengan komplikasi neonatal (78.4%), dan mangsa keganasan domestik (27.9%). *Edinburgh Postnatal Depression Scale* (EPDS) digunakan secara tunggal untuk menyaring kemurungan postpartum dalam 83.1% dari kajian dimana 130 dari 142 kajian ini menetapkan skor kemurungan postpartum pada 10 dan keatas.

Kesimpulan: Prevalen kemurungan postpartum diseluruh dunia dilaporkan terus meningkat dan perkara ini mencetuskan kebimbangan memandangkan kondisi ini boleh memberi kesan

buruk pada kesihatan ibu dan anak. Saringan bagi penyakit ini perlu dilakukan pada tempoh masa yang sesuai menggunakan alat yang mudah digunakan di fasiliti kesihatan. Isu berkaitan seksual dan reproduktif, serta keganasan rumahtangga perlu dititikberatkan semasa kursus pra-perkahwinan kerana masalah ini berisiko tinggi menyebabkan kemurungan postpartum pada masa akan datang.

ABSTRACT

Background: The World Health Organization (WHO) projected depression to be the leading cause of disability by 2030. Previously under-reported and often disregarded as normal physiology after childbirth, the prevalence of postpartum depression has been steadily increasing and recognized as a public health concern. This review aimed to estimate the updated global prevalence of postpartum depression and identify the screening tools used to assess this condition.

Methodology: MEDLINE, Google Scholars, PUBMED, SCOPUS and ScienceDirect databases were searched for articles from year 2010–2020 that reported the prevalence of postpartum depression. A total of 172 studies were included in this review.

Result: The overall global pooled prevalence of postpartum depression was increasing in recent years from 2010-2020 at 20.60% (95% CI: 19.31%, 21.88%); higher in developing countries (23.29%, 95%CI: 21.45%, 25.12%) compared to developed countries (11.35%, 95% CI: 9.88%, 12.82%). The overall prevalence was highest at 25.35% (95% CI:18.63%, 32.06%) when screened up to 12 months postpartum in developing countries, and at 18.53% (95%CI: 12.91%, 24.14%) when screened within four weeks postpartum in developed countries. A high prevalence was reported among military personnel (83.0%), mothers with neonatal complications (78.4%), mother with antenatal complications (45.88%), victims of domestic violence (27.9%), and immigrants (22.4%). Edinburgh Postnatal Depression Scale (EPDS) alone was utilized to detect this condition in 83.1% of the studies in which 130 out of 142 of these studies used a cut-off points value of ten or higher.

Conclusion: The increasing prevalence of postpartum depression is a significant concern globally showing that it affects the mother's health and has dire impacts on the children's

health. All mothers should be screened for postpartum depression at an appropriate time interval. Issues about sexual and reproductive health, women's rights, and violence must be incorporated into the well-established premarital course to reduce the risk of getting this condition incited by domestic violence.

Review registrations

PROSPERO CDR42021234267

Keywords:

maternal depression, postnatal depression, postpartum depression, prevalence

CHAPTER 1: INTRODUCTION

1.1 Study background

The World Health Organization (WHO) projected depression to be the leading cause of disability by 2030 (Galea and Frokjaer, 2019). The burden of this condition is higher for females of child-bearing age than males, while postpartum depression has been increasingly recognized as a public health concern (Shidhaye, Shidhaye & Phalke, 2017). Postpartum depression is classified by the fifth edition of the Diagnostic and Statistical Manual of Mental Disorders (DSM-5) as a major depressive disorder identified within four weeks of puerperium (Moraes et al., 2017). Still, some experts have extended it to within a year after childbirth (Langan and Goodbred, 2016). It affected 13% of women in developed countries in the early 2000s (Gavin et al., 2005), rising to over 19% a decade later (O'hara and McCabe, 2013). Postpartum depression has been known to cause maternal sleep disturbances, lacking energy, reduced concentration, interruption of maternal-infant bonding, family dysfunction, and even suicide (Langan and Goodbred, 2016). This condition not only has adverse effects on the maternal health-related quality of life. Children of postpartum depressive mothers had adverse outcomes, including failure to thrive, stunting, and adverse psychological conditions in the long term (Slomian et al., 2019).

The exact aetiology of postpartum depression is not yet fully understood. Several theories have been postulated as the causative factors, including reducing estrogen levels during the puerperium, pituitary dysfunction, thyroid disorders, abnormal maternal neurotransmitters, and genetic predisposition (Langan and Goodbred, 2016).There were many risk factors for this disorder, including peripartum depression and anxiety, gestational diabetes mellitus (Azami et al., 2019), single mother,

adolescence, advanced maternal age (Langan and Goodbred, 2016), stressful life events and current abuse (Hutchens and Kearney, 2020).

Postpartum depression is often overlooked and regarded as a normal response after giving birth due to reducing hormones during the puerperium resulting in late detection or underestimation (Langan and Goodbred, 2016). As such, the role of family physicians in recognizing this condition in a primary health care setting is undoubtedly vital. As its burden increases with increasing global recognition, many have come forth with different tools and initiatives in preventing, screening, and diagnosing this condition at an earlier stage (Moore Simas et al., 2019). Compared to the gold standard structured clinical interviews, a self-report approach is more befitting in a clinic setting especially in the pandemic era in which direct contact with patients is limited. Many countries integrate screening for postpartum depression as part of perinatal care. For example, Australia and New Zealand have published national recommendations stating that it is the provider's responsibility to be aware of the risks of postpartum depression, to be able to recognize the condition and to make the appropriate referrals for mental health treatment (Hansotte, Payne & Babich, 2017). Meanwhile, in the USA, the Patient Protection and Affordable Care Act (ACA) was launched in 2010 and contains language for providing support services to women and research support for postpartum depression (Hansotte, Payne & Babich, 2017). The timing for screening is also crucial as 80% of women would experience maternal blues which is defined as low mood and mild depressive symptoms that are transient, self-limiting and often develop within their first week of postpartum that could be mistaken as postpartum depression (Howard et al., 2014; Smith et al., 2016). As such, several studies recommended multi-point screening at different time intervals instead of single-point or early screening (França and McManus, 2018).

There are many tools used to facilitate the screening for postpartum depression, such as Edinburgh Postpartum Depression Scale (EPDS), Postpartum Depression Screening Scale (PDSS), Patient Health Questionnaire 9 (PHQ9), Depression Anxiety Stress Score (DASS), and Beck Depression Inventory-II (BDI-II) among others (Ukatu, Clare & Brulja, 2018). Currently, there is no recommendation regarding the best screening tool for detecting postpartum depression (Bhusal et al., 2016b; Ukatu, Clare & Brulja, 2018).

1.2 Rationale of the study

Reviews on postpartum depression are extensive, but most were focusing on risk factors and are confined to a particular region or specific country (Dadi et al., 2020; Tolossa et al., 2020; Edwards, Le & Garnier-Villarreal, 2021). Some were also excluding some subgroups such as immigrants, primiparous, or minorities as they did not reflect the general population (Hahn-Holbrook, Cornwell-Hinrichs & Anaya, 2018; Shorey et al., 2018). and Villegas et al. (2011) extensively reviewed articles published over 30 years. Norhayati et al. (2015) reported the magnitude of postpartum depression between 2005 to 2014 that was measured only by self-report questionnaires. As such, reports depicting global prevalence and sociodemographic diversity, as well as the variety of instruments used for postpartum depression, are scarce (Shorey et al., 2018). A global perspective would be beneficial for a better understanding of this condition. Studies related to postpartum depression have been increasing exponentially since 2018 in which new primary research could provide new pieces of evidence and insights (Bai et al., 2021).

Besides, attributed to the various strategies and interventions applied to various parts of the world by the health care system, the stigma surrounding mental health conditions, especially depression has reduced over the past decade (Zhang et al.,

2019b). The stigma of mental health has been identified as one of the major barriers to seek for help that would influence the prevalence of postpartum depression reported (Villegas et al., 2011). Estimating the differences in prevalence between developed and developing countries is of benefit as socioeconomic status has been consistently reported as the predictor for postpartum depression in which higher prevalence is observed among developing countries due mainly due to poverty, inadequate postpartum care, and lower educational status (Hansotte, Payne & Babich, 2017). The economic landscape has remarkably changed over the past decade (UN, 2019). Hence, there is a need for a renewed effort to understand the burden of this condition occurring in the past decade. This review aimed to estimate the global prevalence of postpartum depression and identify the various screening tools used to assess postpartum depression within the last ten years from 2010-2020.

CHAPTER 2

OBJECTIVES AND OUTCOMES OF THE STUDY

2.1 General objective

To estimate the global prevalence of postpartum depression and identify the screening tools used to screen for this condition.

2.2 Specific objectives

2.2.1 To estimate the global prevalence of postpartum depression between 2010 to 2020.

2.2.2 To estimate the specific prevalence of postpartum depression based on economic status and special populations between 2010 to 2020.

2.2.3 To estimate the specific prevalence of postpartum depression screened at different time interval between 2010 to 2020.

2.2.4 To identify the tools used to screen postpartum depression and different cut-off points used between 2010 to 2020

CHAPTER 3

MANUSCRIPT

3.1 Title Page

Prevalence and Tools for Assessment of Postpartum Depression: A Systematic Review And Meta-Analysis

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Keywords:

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3.2 ABSTRACT

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3.4 MATERIALS AND METHODS

3.4.1 Data source and searches

A systematic review and meta-analysis of studies were conducted to assess the prevalence of postpartum depression and the screening tools used in the studies. It followed the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines (Moher et al., 2009). A systematic search was performed in the Google Scholar, MEDLINE, PUBMED, ScienceDirect and SCOPUS databases for articles between 2010-2020. The search was done using the text word and Medical Subject Headings (MeSH) search teams: “prevalence”, “postpartum depression”, “postnatal depression”, “maternal depression”, “perinatal depression”, “postnatal”, “postpartum” and “depression”. The search terms were flexible and tailored to various electronic databases.

3.4.2 Study selection

All studies published from 2010 were retrieved to assess their eligibility for inclusion in this study. We included the articles from the past decades to incorporate evidence from new primary studies as well as new approaches for screening this condition. In addition, the prevalence of this condition is largely affected by stigma which was found to be markedly reducing in the past decade. Hence this review would provide an updated estimation of global prevalence within the past ten years. The search was restricted to full-text and English-language articles. To find additional potentially eligible studies, reference lists of included citations were cross-checked.

In DSM-5 postpartum depression is diagnosed under "depressive disorder with peripartum onset", in which "peripartum onset" is defined as any time either during pregnancy or within the four weeks following delivery. However, in this study, postpartum depression is defined as an "episode of nonpsychotic depression according to standardized diagnostic criteria with onset within 1 year of childbirth" (Steward, 2012).

Studies with cross-sectional, case-control, and cohort designs published in English from January 2010 until December 2020 conducted in the community or the health institution levels were included. The inclusion criteria included studies that i) reported the prevalence of postpartum depression anytime in the first year postpartum, ii) measured the prevalence of postpartum depression using standardized validated instruments or clinically structured interviews, and iii) assessed mothers with no previous psychiatric illness. We included studies conducted anytime in the first year postpartum because it is commonly used in the empirical literature (Yim et al., 2015). We also included peripartum studies but only postpartum data were extracted. The studies were excluded if they reported postpartum psychosis or bipolar disorder as the

outcome, or if we were unable to differentiate postpartum depression from these outcomes. Case series or reports, conference papers, proceedings, articles available only in abstract form, editorial reviews, letters of communications, commentaries, systematic reviews, and qualitative studies were excluded.

3.4.3 Data extraction and quality assessment

All records identified by our search strategy were exported to EndNote software. Duplicate articles were removed. Two independent reviewers screened the titles and abstracts of the identified articles. The full texts of eligible studies were obtained and read thoroughly to assess their suitability. A consensus discussion was held in the event of a conflict between the two reviewers, and a third reviewer was consulted. The search method was presented in the PRISMA flow chart showing the included and excluded studies with reasons for exclusion. A critical appraisal was done to assess the data quality by using the Joanna Briggs Institute Meta-Analysis for cross-sectional, case-control, and cohort studies (Munn et al., 2020). The risk of bias was considered low when more than 70% of the answers were “yes”, moderate when 50–69% of the responses were “yes”, and high when less than 50% of the answers were “yes”. Studies that showed a high or moderate risk of bias were excluded from the review (Appendix).

3.4.4 Data analysis

The data were extracted into Microsoft Excel. This included first author, year of publication, study location, study design, setting, study population, sample size, screening tools used, postpartum depression definition, the time interval at screening and prevalence of postpartum depression. If there were multiple prevalence reported in the same studied population, we merged the data by averaging the prevalence

measured over different time points to estimate the overall prevalence, but all data was included in the sub-analysis of prevalence at a different time interval.

The primary outcome of this study was the prevalence of postpartum depression worldwide and based on country classification. Other outcomes measured included the estimation of the prevalence of postpartum depression measured at different time intervals and among subpopulations. Another analysis was carried out for special populations that did not reflect the general population such as immigrants, military personnel, domestic violence victim and other minorities. The type of screening tools used for postpartum depression was also observed.

The prevalence was reported in a pooled prevalence estimate using a random effect model for all analyses. Studies were classified according to the place of study into developed or developing countries based on the report by United Nation (UN, 2019). We performed a meta-analysis to generate the overall pooled prevalence estimates which were further stratified according to the country classification based on the World Economic Situation and Prospect Report (WESP) that reflected the basic economic country condition (UN, 2019). Countries were classified into developed or developing countries based on the economic status that were systematically monitored for the WESP report with regards to per capita gross national income (GNI), a human assets index and an economic vulnerability index (UN, 2019). Sub-group analysis was performed based on the screening done at different time intervals. We also identified different special populations studied in the reports and performed separate analyses for these subgroups. The analysis was performed with Review Manager (RevMan) software version 5.4 (Nordic Cochrane Centre) for Windows.

3.4.5 Assessment of heterogeneity and risk of bias

To assess the between-study heterogeneity, we calculated the estimated 95% prediction interval for the difference in prevalence (Borenstein et al., 2017), and the *I*2 statistic based on the guidelines: 0% to 40% might not be significant; 30% to 60% may represent moderate heterogeneity; 50% to 90% may represent substantial heterogeneity, and 75% to 100% would be considerable heterogeneity (Higgins, López-López & Aloe 2020). Sensitivity analysis was performed to assess the robustness of results by sequentially excluding each study and rerunning the analysis. We also conducted a separate analysis excluding studies with the lowest quality ratings to determine if the meta-analytic estimates were influenced by potential methodological weaknesses. Publication bias was evaluated with funnel plot.

3.5 RESULTS

3.5.1 Description of studies

A total of 5424 articles were retrieved through an electronic search using the search terms, of which 4217 were eligible for the title and abstract assessment after removing 1207 duplicate records. Of the 4217 articles screened for eligibility, 3966 were excluded after evaluating their titles and abstracts. A total of 251 articles underwent full-text assessment for eligibility, of which 35 were excluded due to the reasons listed in Figure 1. In this review, 216 articles underwent quality assessment, of which 172 with good quality and low risk of bias studies were included contributing to 220 data points; the remaining poor-quality articles were excluded. Lastly, 172 articles with a total of 156687 populations were included in the analysis.

Out of the included studies, 136 studies were cross-sectional, five were case-control, and 31 were cohort. A total of 149 studies with 174 data points were included

to estimate the overall prevalence as well as based on country classification (Table 1), and 183 data points for prevalence were measured at different time intervals. There were 23 studies done among special populations included in this review contributing to 37 data points (Table 2). A variety of countries were represented in this systematic review and meta-analysis.

As depicted in Table 3, 58 studies (33.7%) were published between 2018-2020. Over half (56.4%) of the studies included were carried out in Asia continent (Table 3). Based on the WESP report of the United Nations (UN, 2019), 129 studies of the general population were conducted in developing countries, while 20 were conducted in developed countries. Another 23 studies were conducted among special postpartum population including immigrant (n = 12), mother with medical/antenatal complication (n = 5), victims of domestic violence (n = 1), military personnel (n = 1), women with postnatal/neonatal complication (n = 3), and insured mother (n = 1). All studies consisted of women in the postpartum period, not more than 12 months, regardless of parity. The smallest sample size was 34 (Gulamani et al., 2013b), and the largest was 17648 (Nelson et al., 2013).

3.5.2 The prevalence of postpartum depression

As depicted in the Figure 2, the pooled prevalence of postpartum depression in developed and developing countries was 20.60% (95% CI: 19.31%, 21.88%). As shown in Table 3, it was significantly higher in developing countries 23.29% (95% CI: 21.45%, 25.12%) in comparison to developed countries 11.35% (95% CI: 9.88%, 12.82%; P<0.001). The prevalence of postpartum depression in the included studies varied from 1.7% to 68.5%. The prevalence varies considerably across studies (I^2 = 98%). In some 95% of all population, the true prevalence would fall in the approximate range of 17.7% to 23.8%.

A significant difference was found between assessments carried out at different time intervals mainly in developed countries (Figure 3). In developing countries, the highest overall prevalence was reported at 25.35% (95% CI: 18.63%, 32.06%) when the screening is carried out up to 12 months postpartum (Figure 4). Still, it was consistently high when screened at a different interval ranging from 20.44% to 25.35%. However, in developed countries, 18.53% (95% CI: 12.91%, 24.14%) of postpartum depression were screened as early as four weeks postpartum but decreased to 4.01% (95% CI: 0.58%, 7.44%) within four to six weeks postpartum before steadily increasing afterwards from 10.49% (95% CI: 8.41%, 12.57%) at six to eight weeks up to 13.95% (95% CI: 7.91%, 20.00%) at 12 months postpartum (Figure 5).

3.5.3 Postpartum depression among special population

As shown in Figure 6, there were 12 studies done among immigrants in various countries with an overall pooled prevalence of 22.44% (95% CI: 17.93%, 26.96%). Six studies (Hutto et al., 2011; Lucero et al., 2012; Shellman et al., 2014; Alhasanat, 2017; Kim and Dee, 2018; Alhasanat et al., 2018) were done among immigrants who resided in the United States of America (USA), while four studies were done in Canada (Dennis et al., 2016; Ganann et al., 2016; Dennis, Merry & Gagnon 2017; Dennis et al., 2018). One study (Mohammad et al., 2018) focused on postpartum depression symptoms among Syrian refugees living in Jordan, and the prevalence was high (49.6%). Another study among immigrants in Norway showed a relatively low prevalence of 7.6% (Yap and Stray-Pedersen, 2011). The pooled prevalence of postpartum depression among mothers with antenatal complication was estimated to be 45.88% (95% CI: 28.11%, 63.66%). A high prevalence of postpartum depression was reported in a study done among military personnel at 83.0% (Moh'd Yehia, Callister & Hamdan-Mansour, 2013), mothers with the neonatal complication at

78.4% (Jayasinghe and Abeysena, 2019), and among mothers with intimate partner violence at 27.9% (Faisal-Cury et al., 2013). A much lower prevalence was studied among women with private health insurance at 7.3% (Soffer et al., 2019) and among mother that underwent Caesarean section at 7.21% (Zaconeta et al., 2013; Asif et al., 2020a).

3.5.4 Screening tools for postpartum depression

The different screening tools at various cut-off point values reported in respective studies are summarized in Table 4. About 92.44 % (n = 159) of the studies reported using a single tool involving nine different tools, while only 5.23% (n = 9) used combinations of two to three other tools. The majority of the studies (83.1%) used only EPDS as a screening tool in their analyses. There were only four studies that used only structured clinical interviews as diagnostic tools (Cantilino et al., 2010; Desai, Mehta, & Ganjiwale, 2012; Gebregziabher et al., 2020; Zainal et al., 2012), while two studies (Chibanda et al., 2010; Nakić Radoš, Tadinac, & Herman, 2013) used both screening and diagnostic tools in their respective studies. The prevalence of postpartum depression from 6 studies that used diagnostic criteria was 11.74% (95%CI: 7.07%, 16.40%). About 130 out of 142 studies that utilized EPDS alone as a screening method used a cut-off points value of ten or higher; out of these, 60 studies used cut-off points value of 13 or higher. The cut-off points used in developed countries were ranging from ≥9 to ≥13 whereas a wider range of values was used in developing countries (Table 4).

3.5.5 Sensitivity analysis and publication bias

We examined the robustness of meta-analytic findings by removing each study in sequence and reanalysing the remaining data set in which a new analysis was

produced for each study removed. No study affected the meta-analytic estimate of more than 1.5%.

Removing studies with the lowest quality ratings decreased the meta-analytic estimate of the prevalence of postpartum depression by only 2.2 % (from 20.60 % to 20.15%). The pattern of differences across periods, measurement methods, and study locations remained essentially unchanged in direction and magnitude. A funnel plot (Figure 7) was generated using RevMan 5.4 to test for publication bias. Based on the visual representation of the funnel plot, the asymmetric pattern indicated possible publication bias.

3.6 DISCUSSION

Postpartum depression is the most common mental health disorder occurring after childbirth and is increasing at an alarming trend (Caparros-Gonzalez et al., 2017). As the global population continue to increase with rapid socio-economic growth, postpartum depression has been gaining attention with studies related to postpartum depression have increased exponentially in this recent years (Bai et al., 2021). This study depicted a global pooled prevalence of postpartum depression at 20.6% (95% CI: 19.31%, 21.88%). This is higher than the overall prevalence reported in 2018 by a previous review that analysed the studies using EPDS reported between 1985-2015 at 17.7% (95% CI: 10.57%, 13.56%) (Hahn-Holbrook, Cornwell-Hinrichs & Anaya, 2018), and another review that included the studies using self-report and symptom scales between 1980-2015 at 11.9% (95% CI: 11.40%, 12.50%) (Woody et al., 2017); indicating the increasing prevalence of this condition worldwide. As observed in this review, the EPDS is becoming the most widely used scale to identify postpartum depression. About 83.1% of the studies only used EPDS for screening that is higher

compared to a review that included studies done within 2005-2014 that reported the use of the same tool at 71.6% (Norhayati et al., 2015).

Although the prevalence of postpartum depression is influenced by the instruments used, the EPDS was developed in the 1980s (Marshall and Bethell, 2006), has been extensively validated, showing good agreements with other diagnostic measures for postpartum depression and has been widely used since (Shrestha et al., 2016). Hence the increasing prevalence of postpartum depression especially in developing countries in the past decade may be attributed to other factors such as the decreasing stigma and increasing familiarity with depression that would significantly affect the recognition and reporting of this condition (Thorsteinsson, Loi & Moulynox, 2014). It is well studied that self- and perceived-stigma for depression would influence the help-seeking behaviour of the affected individuals in which reluctance to seek medical attention would contribute to under-reporting of this condition (Barney et al., 2006; Villegas et al., 2011). More initiatives to combat stigma for mental illness were reported over the past decade especially in developing countries in which the perceptions towards postpartum depression were found to be improving (Kohls et al., 2017; Zhang et al., 2019b). Increasing efforts to screen and treat psychiatric illness in the communities were also observed (Zhang et al., 2019b).

The prevalence generated based on the socio-economic status of the country is significantly higher in developing countries at 23.29% compared to developed countries at 11.35%. The difference is mainly attributable to variation in socio-cultural and socioeconomic environments, including religious customs, actual or perceived level of health and social support, nutrition, household income, stress, attitudes regarding pregnancy and motherhood, gender bias, and perception of mental health as a disease (Desta et al., 2021b). A lower level of education that is often

associated with developing countries compared to developed countries (Hanushek, 2013), is reported to be a risk factor for postpartum depression (Tebeka et al., 2021). Whereas, risk factors for postpartum depression often reported in developed countries are stressful live events, lack of breastfeeding, child health care stress, intention of coming back to work, sexual and psychological abuse as well as migration status (Norhayati et al., 2015). However, it is interesting to note that whilst the prevalence reported for the developed countries in this review is comparable to the previous report at 11.35%, the number is increasing for developing countries which was previously reported at 13.1% (Woody et al., 2017). Significant heterogeneity was observed across the countries studied, mainly attributable to socio-economic inequality, variation in maternal-child health indexes and policies, as well as diverged employment pattern throughout the nations (Hahn-Holbrook, Cornwell-Hinrichs & Anaya, 2018).

Although many previous studies suggested that the first three months of the postpartum period is the high-risk period for developing postpartum depression (Shorey et al., 2018), our meta-analysis supported the importance of extending screening up to 12 months postpartum. Nevertheless, significant differences between the fluctuation of the rates of postpartum depression screened at different time intervals, particularly in developed countries suggest possible various risk factors or mechanisms contributing to this condition in the early and late postpartum period that need to be explored further to consider multiple screening at a different interval. Different postpartum traditions and beliefs may influence the development of postpartum depression at different time intervals. In developing countries where cultural belief is still highly regarded, the prevalence was continuously reported to be high within the first 8 weeks of postpartum (Norhayati et al., 2015). In several social and cultural backgrounds, women are relieved from work or household chores for

about a few months after birth to recuperate which the task was taken over by other family members or helpers (Clare and Yeh, 2012). A non-adherence to this practice may exacerbate the depression as this kind of support must already be expected (Clare and Yeh, 2012). However, the prevalence of postpartum depression was consistently high throughout the 12 months of the postpartum period in developing countries that have limited resources, hence, a one-time screening would be adequate while multiple screening could be limited to abnormal initial screening or when indicated (Knights et al., 2016).

A high prevalence of postpartum depression was reported among special populations, indicating the need to identify the susceptible population that may require extra measures. However, the reports on special populations were lacking with only 23 included studies discussing the prevalence of postpartum depression among those; the most reported subpopulation studied were the immigrants. About 12 articles analysed this condition among immigrants compared to native-born mothers, recording an overall prevalence of 22.4%. Half of the studies were carried out in the United States. According to World Health Organization, the USA has the highest number of immigrants, with 48 million in 2015 (Pison, 2019). The four studies of postpartum depression among immigrants in Canada involved participants who immigrated to Canada from various countries. Statistics showed that as of 2019, Canada has the eighth largest immigrant population in the world, while foreign-born people make up 21% of Canada's population (Pison, 2019). Risk factors for immigrants along with refugees include premigration stress, painful memories, and traumatic experience during migration (Clare and Yeh, 2012). During the post-migration period, stressors may include unemployment and underemployment, housing difficulties, language barriers, difficulty adapting to the host cultures and legal