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Review article

Perinatal depressive disorder prevalence in Africa: A systematic review and Bayesian analysis

Francky Teddy Endomba [a,b], Aude Laetitia Ndoadoumgue [c,1], Clarence M. Mbanga [d,a], Jan René Nkeck [e,a], Gregory Ayissi [f,a], Celestin Danwang [g,a], Jean Joel Bigna [h,*]

[a] Health Economics & Policy Research and Evaluation for Development Results Group, Yaoundé, Cameroon
[b] Psychiatry Internship Program, University of Bourgogne, 21000 Dijon, France
[c] School of Health and Related Research, The University of Sheffield, Sheffield, UK
[d] School of Public Health, Université Libre de Bruxelles (ULB), Brussels, Belgium
[e] Department of Internal Medicine, Faculty of Medicine and Biomedical Sciences, University of Yaoundé I, Yaoundé, Cameroon
[f] Department of Obstetrics and Gynaecology, Faculty of Medicine and Biomedical Sciences, University of Yaoundé I, Yaoundé, Cameroon
[g] Epidemiology and Biostatistics Unit, Institut de Recherche Expérimentale et Clinique, Université catholique de Louvain, Brussels, Belgium
[h] Department of Epidemiology and Public Health, Centre Pasteur of Cameroon, Yaoundé, Cameroon

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ABSTRACT

Objective: To curb the burden of perinatal depression (PND) in Africa, it is important to have an accurate estimate of its burden in the continent. Hence, we determined the prevalence of (major) depressive disorder in the perinatal period in Africa.

Methods: We searched PubMed, EMBASE, Africa Index Medicus, and Africa Journal Online, to identify studies reporting the prevalence of (major) depressive disorder in the perinatal period in Africa, between January 1st 2000 and February 17th 2020. PND prevalence was estimated using Bayesian modelling.

Results: We identified 154 studies (192 data points; 113,147 women). In pregnant women, the prevalence of depressive disorder was 22.8% (95%Credible interval [CrI]: 21.5–24.1) among women with no specific condition and 31.9% (95%CrI: 30.2–33.6) among those with HIV. In post-partum, the prevalence was 21.2% (95%CrI: 20.0–22.5), 30.0% (95%CrI: 28.2–31.8), and 44.6% (95%CrI: 35.9–53.8) among women with no specific condition, with HIV, and with poor pregnancy outcomes, respectively.

Conclusions: This study depicted a high prevalence of PND in Africa. This prevalence varied across pre-defined clinical profiles. HIV-infected women or those with poor pregnancy outcomes having a higher prevalence of depression. This highlights the need for more attention and preventive interventions geared towards these subgroups.

1. Introduction

Depressive disorder is one of the most frequent mental health diseases worldwide and only second to cardiovascular diseases as that with the most burden [1]. According to the World Health Organization (WHO), depressive disorder affects more than 300 million people (4.4% of the global population), and its prevalence in the African region is estimated at 9% in the general population (29.9 million cases) [2]. Despite being a global public health concern, there is some heterogeneity in the prevalence and burden of depression across different populations.. For instance, pregnant and postpartum women are more likely to experience clinical depression compared to the general population [1–4].

The fifth edition of the Diagnostic and Statistical Manual of Mental Health Disorders (DSM-V) classifies perinatal depression as a major depressive disorder identified during pregnancy or within four weeks postpartum [5]. However, perinatal depression (PND), is often considered a nonpsychotic depressive state, and its definition extended to within one year postpartum [6]. Worldwide, approximately 6.5–12.9% and 17.7–19.2% of women have antenatal and postpartum depression respectively [7,8]. According to the WHO, in developing countries the prevalence of depression is 15.6% during pregnancy and 19.8% after

* Corresponding author.
E-mail address: bignarimjj@yahoo.fr (J.J. Bigna).
[1] Contributed equally.

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child birth [9]. A recently published systematic review and meta-analysis revealed that antenatal depression was higher in low-income countries compared to middle-income ones. This study also reported PND as a risk factor for low birth weight and preterm births [10]. In effect, PND may favour mother ill-being (negative parenting behaviour and maternal suicides) and/or may negatively affect child health (developmental and behavioural issues) [3,11], both of which are Sustainable Development Goals (SDG) targets [12]. This underscores the need to effectively to address PND.

PND is associated with psychological factors (past history of mental health disease or trauma), socio-cultural determinants (weak social support), low socioeconomic status, unintended pregnancies, poor pregnancy outcomes, and chronic conditions such as the human immunodeficiency virus (HIV) infection [3,13–16]. As suggested by previous studies, Africa is one of the regions with the highest burden of the above mentioned PND related risk factors. However, due to cultural features and stigma, PND remains a taboo in the African community and a "neglected disease" in the healthcare systems of the continent [16–18]. It is important that all these parameters be taken into account, in an effort to develop interventions tailored to address PND concerns specific to the African continent. Prior to that, however, it is necessary to have an accurate estimate of the burden of PND in Africa. Consequently, we aimed to estimate, via a systematic review with Bayesian analysis, the prevalence of (major) depressive disorder in the antenatal and postpartum periods in Africa. We specifically investigated the prevalence in pregnant and postpartum women living with HIV, those with poor pregnancy outcomes, and those without any other specific condition.

2. Methods

2.1. Search strategy and selection criteria

This systematic review and Bayesian analysis meta-analysis was conducted according to the Joanna Briggs Institute guidelines [19], and reported according to the preferred reporting items for systematic reviews and meta-analyses (PRISMA) guidelines [20].

We considered cross-sectional, case-control, and cohort studies reporting the prevalence (or enough data to compute this estimate) of (major) depressive disorder in pregnant women, or women in the postpartum period living in Africa. Studies conducted in African women living outside Africa were not considered.

We searched PubMed, Excerpta Medica Database (EMBASE), Africa Index Medicus, and Africa Journal Online to identify all relevant records published between January 1st, 2000 and February 17th, 2020; with no language restrictions. The search strategy in EMBASE is available in the Appendix (Supplementary Table 1). This search strategy was adapted for use with the other databases. To supplement the bibliographic database search and identify potential additional data sources, we scrutinized the reference list of all relevant original and review papers.

Titles and abstracts of articles retrieved from literature search were independently screened by two investigators (FTE and JJB). The full-texts of potentially eligible articles were then obtained and further assessed for final inclusion. Disagreements were resolved through consensus.

2.2. Data collection and management

A preconceived and standardized data extraction form was used for data collection. Information collected included: last name of first author, country in which the study was conducted, year of publication, recruitment period, study design, setting (hospital versus community based), sampling method, timing of data collection, response rate, mean or median age of the population, number of pregnant women, number of women in puerperal period, definition of the puerperal period, the number of women with (major) depressive disorder, and the method used to ascertain depressive disorder. We classified women into depressive and major depressive disorders according to the definition(s) and/or the screening tool(s) reported by each included study. The term "poor pregnancy outcomes" were used as reported by original studies, and these outcomes included neonatal death, in-utero death, miscarriage, preterm birth, low birth weight, small for gestational age, and low Apgar scores. In the case of multinational studies or studies in which multiple screening tools were used; data were separated to show the estimate within individual countries or per tool used. Three pairs of investigators (FTE, CD, ALN, JRN, CMM, GA) independently extracted data from individual studies, with disagreements being resolved through consensus.

These investigators (FTE, CD, ALN, JRN, CMM, GA) independently assessed the methodological quality of included studies using the tool developed by the Joanna Briggs Institute [15], with disagreements being resolved through discussion and consensus. The assessed items included sampling method (probability-based versus non-probability based), response rate ($\geq$80% response rate or $\geq$80% of target sample size reached [the latter for studies using respondent-driven sampling] vs $<$80%), timing of data collection, homogeneity of procedure for investigating PND in participants, and study precision. Studies were considered of higher precision if 194 participants or more were included. This which was judged as an acceptable level of precision assuming a prevalence of 14.8% with a precision of 0.05.

2.3. Data synthesis and analysis

Bayesian analysis was chosen to synthetize data. The Bayesian framework helped to estimate the probability of equal prevalence between HIV-infected women, women with poor pregnancy outcomes, and women with no specific condition. We used a hierarchical model in which the sampling method (probability-based versus non-probability-based sampling) – *'sampling'* and the region of the study – *'region'* was included as random-effect terms. Prevalence from each study was nested in regional (Eastern, Southern, Central, Northern, and Western Africa) levels. As such, estimates on the prevalence of depressive disorder for each region was informed by the region's own data. The probability-based sampling was used for prediction. The period during which depressive disorder screening was done (pregnancy or post-partum period) – *'period'*, the women's clinical profile (no specific condition, with HIV infection, with poor pregnancy outcome) – *'profile'*, and the tool used to screen (major) depressive disorder – '*tool'* was entered into the model as fixed-effect terms. For this study, we reported prevalence estimates using the tool tailored for pregnant women and women in the post-partum period; the Edinburgh Postnatal Depression Scale (EPDS) [21].

$$logit\ (p) = \beta_0 + \beta_1(period) + \beta_2(profile) + \beta_3(tool) + (region) + (sampling)$$

Where β represents the coefficients, and p represents the prevalence.

We performed Bayesian modelling using the *brms* package of the statistical software R (version 3.6.1, The R Foundation for statistical computing, Vienna, Austria) [22]. We predicted the regional and sub-regional prevalence of PND using a Bayesian generalized non-linear multilevel modelling with a binomial family and a logit link. We used the Markov chain Monte Carlo (MCMC) algorithm with informative priors. Convergence was monitored and 5000 post-burn-in samples were obtained from the posterior distribution of model parameters, which were then used to obtain the posterior distributions of (major) depressive disorder prevalence. The reported credible intervals (CrI) represent the 2.5–97.5 percentiles of the posterior distributions. We estimated the R^2 to have the explained variance in the fitted model for prediction [23].

3. Results

3.1. The review process and study characteristics

We initially identified 1268 records. We finally retained 154 published between 2003 and 2020. The 154 studies included 192 prevalence data, with a total of 113,147 women (Supplementary Fig. 1). The reference list of included studies is available in the Appendix (Additional reference list). According to the women's clinical profile, 157 (with 101,686 women), 31 (10,785 women), and four (676 women) prevalence data were from women with no specific condition, HIV-infected women, and women with poor pregnancy outcomes respectively. Most of the studies were from the Eastern (n = 81), Southern (n = 48), Western (n = 39), Northern (20), and Central African (n = 4) regions. Most of the studies used the EPDS for investigating depressive disorder (n = 103). Individual characteristics of each study are presented in Supplementary Table 2.

Regarding methodological quality, 52 studies used a probabilistic sampling method, while the remaining 102 used non-probabilistic sampling. Timing of data collection was prospective in 147 studies, retrospective in 6 studies, and unclear in one study. The response rate was acceptable in sixty-eight studies, not described in 74 studies, and low in 12 studies. Almost all studies used the same procedure for diagnosing PND in participants, except in one where it was unclear. The precision was acceptable in 123 studies and low in 31 studies (Supplementary Table 3).

3.2. Prevalence of (major) depressive disorder in Africa

The R^2 of the Bayesian model for depressive disorder and major depressive disorder was 71.9% and 94.6% respectively. Table 1 presents the prevalence of (major) depressive disorder in Africa. Among pregnant women without a specific condition and those living with HIV, the prevalence of depressive disorder was 22.8% (95%CrI: 21.5–24.1) and 31.9% (95%CrI: 30.2–33.6), respectively. For women in the post-partum period, the prevalence of depressive disorder was 21.2% (95%CrI: 20.0–22.5), 30.0% (95%CrI: 28.2–31.8), and 44.6% (95%CrI: 35.9–53.8) in women without a specific condition, those with HIV infection, and women with poor pregnancy outcomes, respectively.

In postpartum women, the prevalence of depressive disorder was significantly higher in; HIV infected women compared to those with no special health problems (< 0.0001), women with poor pregnancy outcomes versus those with no specific health concerns (0.013), and women with poor pregnancy outcomes versus HIV infected women (0.0001). All expected values under the null hypothesis lie outside the 95% confidence intervals of the posterior distribution.

Concerning major depressive disorders (MDD), the prevalence was 30.4% (95%CrI: 29.0–31.8) and 30.9% (95%CrI: 29.2–32.6) for pregnant women with no special health problems and HIV infected pregnant women, respectively. In the post-partum period, the prevalence was 23.3% (95%CrI: 22.0–24.6), 23.7% (95%CrI: 22.1–25.3) and 32.5% (95%CrI: 28.2–36.8), among women with no special health concern, those living with HIV and those with poor pregnancy outcomes, respectively. There was no significant difference in the prevalence of major depressive disorders in HIV infected women compared to women with no particular health problems (0.916). The prevalence was, however, significantly higher in women with poor pregnancy outcomes compared to those with no specific condition (0.001), and in women with poor pregnancy outcomes versus HIV infected women was (< 0.0001). All expected values under the null hypothesis were outside the 95% confidence interval of the posterior distribution, except for HIV infected women versus women with no particular health problems.

3.3. Regional prevalence of (major) depressive disorder

Table 1 presents the prevalence of depressive disorders and major depressive disorders in each region of Africa. For depressive disorder during pregnancy, the prevalence varied from 21.1% in Eastern Africa to 35.4% in Central Africa among women without a specific condition, and from 28.1% in Eastern Africa to 44.6% in Central Africa among those with HIV infection. For depressive disorder in the post-partum period, the prevalence varied from 17.2% in Eastern Africa to 30.0% in Central Africa among women without a specific condition;23.3% in Eastern Africa to 38.6% in Central Africa among those with HIV infection;, and from 36.8% in Eastern Africa to 54.0% in Central Africa among women with poor pregnancy outcomes.

Table 1
Prevalence of perinatal depressive disorders and major depressive disorders in Africa.

	Depressive disorders			Major depressive disorders		
Region	Prevalence, %	LCI	UCI	Prevalence, %	LCI	UCI
General pregnant women	*22.8*	*21.5*	*24.1*	*30.4*	*29*	*31.8*
Central	35.4	29.2	41.4	32.1	27.6	37.1
Eastern	21.1	19.8	22.3	24.9	23.5	26.4
Northern	31.8	29.2	34.5	29.3	26.7	32.0
Southern	27.9	26.0	29.7	35.2	33.6	36.9
Western	30.7	28.6	32.7	29.1	26.6	31.8
Pregnant women and HIV	*31.9*	*30.2*	*33.6*	*30.9*	*29.2*	*32.6*
Central	44.6	37.7	50.5	29.1	24.9	33.7
Eastern	28.1	26.6	29.8	22.4	20.6	24.3
Northern	40.6	37.4	43.8	26.5	23.7	29.4
Southern	36.1	34.2	38.0	32.1	30.3	33.9
Western	39.4	37.0	41.7	26.3	23.6	29.1
General post-partum women	*21.2*	*20*	*22.5*	*23.3*	*22*	*24.6*
Central	30.0	24.4	35.4	27.7	23.6	32.3
Eastern	17.2	16.0	18.4	21.2	19.9	22.6
Northern	26.6	24.4	29.0	25.1	22.9	27.5
Southern	23.1	21.5	24.7	30.6	28.7	32.6
Western	25.7	24.0	27.4	25.0	22.5	27.6
Post-partum women and HIV	*30*	*28.2*	*31.8*	*23.7*	*22*	*25.3*
Central	38.6	32.3	44.3	25.0	21.2	29.2
Eastern	23.3	21.8	25.2	19.0	17.4	20.6
Northern	34.7	31.7	37.9	22.6	20.2	25.1
Southern	30.6	28.7	32.6	27.7	25.8	29.6
Western	33.6	31.5	35.8	22.4	19.9	25.1
Women with poor pregnancy outcome	*44.6*	*35.9*	*53.8*	*32.5*	*28.2*	*36.8*
Central	54.0	41.1	64.5	41.9	35.1	49.0
Eastern	36.8	27.3	43.1	33.7	29.3	38.3
Northern	50.5	39.6	57.8	38.7	33.2	44.4
Southern	45.6	35.2	52.5	45.4	40.2	50.6
Western	49.1	38.5	56.1	38.6	33.0	44.2

LCI: lower credible interval; UCI: upper credible interval.

For major depressive disorder during pregnancy, the prevalence varied from 24.9% in Eastern Africa to 35.2% in Southern Africa among women without a specific condition, and from 22.4% in Eastern Africa to 32.1% in Southern Africa among those with HIV infection. Concerning major depressive disorder in the post-partum period, the prevalence varied between regions from 21.2% in Eastern Africa to 30.6% in Southern Africa among women without a specific condition, 19.0% in Eastern Africa to 27.7% in Southern Africa among those with HIV infection, and from 33.7% in Eastern Africa to 45.4% in Southern Africa among those with poor pregnancy outcomes.

4. Discussion

This Bayesian analysis of the prevalence of (major) depressive disorders in Africa using 192 data points from 113,147 pregnant and post-

partum women, showed that two to four in 10 women experienced depressive or major depressive disorders. The prevalence was higher among women with HIV infection or with poor pregnancy outcomes. There was heterogeneity in the distribution of the prevalence across different regions of Africa, with the prevalence being higher in Central and Southern Africa, and lower in Eastern Africa.

Overall, the prevalence of PND obtained in this study is higher than those reported in Europe, North America and some East Asian countries. In the United States (US), according to the 2004–2005 National Epidemiology Survey on Alcohol and Related Conditions, and the 2012 US Pregnancy Risk Assessment Monitoring System survey, the estimated prevalence of depressive disorder among pregnant and postpartum women varied between 9.8% and 14.8% [24,25]. In a cross-sectional study of self-reported antenatal and postpartum depression using the EPDS in 12 European countries, the prevalence varied between 4.3% and 7.6% [26]. A systematic review of 35 Japanese studies revealed a prevalence of 5% for both antenatal and postnatal depression [27]. A retrospective cohort study which included 17,564 women in Australia, reported a prevalence of 6.2% and 3.3% for antenatal and postpartum depressive disorder [28].

The high prevalence of PND revealed by this study could be explained by a higher burden of PND related risk factors (medical conditions, socio-economic features, socio-cultural and behavioural characteristics) in Africa. For instance, Africa is the region with the highest burden of HIV infection [15,29], with evidence suggesting that HIV-infection increases the risk of PND [30–32]. Another example is anaemia, which is also more prevalent in Africa compared to other regions, with evidence demonstrating an association between anaemia and risk of PND [33,34]. High prevalence of PND in Africa may also be explained by low level of income and low levels of nutritional status [8,35–37]. Indeed, it has been reported that pregnant women in Africa have nutritional insufficiency [36,37], and poor nutritional status (especially regarding vitamin D, iron, selenium, zinc and fatty acids); known to be associated with PND [38,39].

Socio-cultural considerations could also be a crucial component for the high prevalence of PND (especially postnatal depression) in Africa compared to developed countries [17,40]. A significant difference in PND prevalence exists between western (techno-centric) and non-western (ethno-kinship) cultures, the former having a higher prevalence of PND [16–18]. Among ethno-kinship cultures (as for instance in sub-Saharan Africa), there is a social stigma associated with perinatal depression (especially postpartum depression), making it less likely for women experiencing psychological issues of motherhood to spontaneously express their distress [17,41]. Other possible explanations which could be emphasized are intimate partner violence (IPV) [42], dietary habits [43], and fertility rates, all of which are higher in Africa compared to other regions [8]. There are regions around the world (notably with ethno-kinship cultural profiles) showing similar trends in PND prevalence. This especially includes some Asian and Latin American populations [44–48].

Numerous factors can explain the variation in PND prevalence found across sub-regions of the continent. The prevalence of MDD was higher in Southern and Central Africa. These regions are those with the highest burden of HIV infection in the continent [49]. Another explanation could be the difference in the cultural perception of mental health problems (physical symptoms being on the foreground in some cultures) [40,50]. However, much is left to do to understand the difference in the distribution of PND according to cultural heterogeneity. Likewise, adherence/compliance to health systems [40,51], as well as postpartum practices could in part explain this variability [40,50]. The higher perinatal MDD prevalence we found in Southern and Central Africa when compared to other regions (especially Northern Africa) could also be related to alcohol consumption. It has been previously reported that a bidirectional link exists between alcohol consumption (as well as binge drinking) and depressed mood among pregnant and postpartum women [52,53], and sub-Saharan Africans have a higher rate of alcohol consumption in general population [54,55]. The high levels of intimate partner violence during antenatal and postnatal periods, as reported for instance among South African women, might also contribute to the heterogeneity we found for MDD [56,57].

The findings of this study have important implications for clinical practice, public health policy making, and research. Given that the prevalence of PND is high in the continent; community-based screening of PND should be discussed. However, in the context of low financial resources, alongside weak health systems, this strategy may not be feasible. Prior to mass screening considerations, cost-effective prevention measures may be implanted in combination with health promotion activities, including improving the population's knowledge, attitudes, and practices regarding PND. Healthcare workers taking care of pregnant and postpartum women (especially those living with HIV and those with poor pregnancy outcomes), should bear in mind whenever possible to provide them with a personalized psychological assessment, using locally validated screening tools or structured clinical interviews. While awaiting findings from two ongoing cluster randomized controlled trials on depression among pregnant women living with HIV in Tanzania and Uganda [58,59], there is a need for other high-quality context-specific interventional studies, given the considerable differences in cultures, religion, sociodemographic profile and HIV burden, among pregnant women across the African continent.

This study should however be interpreted in the light of some drawbacks. Various regions and countries of the continent were disproportionally represented; no study was nationally representative; and few studies used a probabilistic sampling method. For instance, only four data points were available from Central Africa. Consequently, the generalizability of results at the regional scale may not be appropriate. The EPDS can reliably measure perinatal depression symptom severity or screen for probable postnatal depression in African countries [60], but not all studies used a validated tool to identify women with PND. In addition, the cut-offs considered were not the same across studies [61,62]. There was also the presence of heterogeneity according to the language used which was not taken into account when constructing the model. A systematic review revealed that most of the local languages of the EPDS in low- and middle-income-countries did not meet all criteria for formal validation of a screening instrument [62]. Despite these limitations, this systematic review and Bayesian analysis helps to fill the gap on the burden of PND in Africa, by providing a clear and up-to-date summary of existing data on the prevalence of PND. Moreover, we used rigorous methodological and statistical procedures to obtain, pool and synthetize available data. Finally, a significant 94% of the variation in the prevalence of depressive disorders recorded, was explained by the constructed model.

In conclusion, this Bayesian analysis demonstrated that depressive disorder and MDD are frequent among pregnant and postpartum women living in Africa. There was considerable heterogeneity across the clinical profile of the women and the African sub-regions assessed, with the Central and Southern Africa sub-regions, as well as women with HIV or poor pregnancy outcomes, having higher prevalence's of PND.; These sub groups could be deserving of more attention and preventive interventions.

Contributors

Conception and design: JJB, FTE. Literature search: JJB. Studies selection: FTE, ALN, JRN, CMM, GA, CD, JJB. Data extraction: FTE, ALN, JRN, CMM, GA, CD. Data management, synthesis and analysis: JJB. Writing of the first draft: JJB, FTE. Critical revision: FTE, ALN, JRN, CMM, GA, CD, JJB. Approved the final version: All authors. Guarantor of the review: JJB.

Data sharing and data availability

All data generated for this study are in the manuscript and its

supporting files.

Declaration of Competing Interest

We declare no competing interests.

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None.

Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.genhosppsych.2021.01.006.

References

[1] GBD 2015 Risk Factors Collaborators. Global, regional, and national comparative risk assessment of 79 behavioral, environmental and occupational, and metabolic risks or clusters of risks, 1990–2015: a systematic analysis for the Global Burden of Disease Study 2015. Lancet Lond Engl 2016;388(10053):1659–724.
[2] World Health Organization. Depression and other common mental disorders. Geneva: World Health Organization; 2017.
[3] Gelaye B, Rondon MB, Araya R, Williams MA. Epidemiology of maternal depression, risk factors, and child outcomes in low-income and middle-income countries. Lancet Psychiatry 2016;3(10):973–82.
[4] Mersha AG, Abebe SA, Sori LM, Abegaz TM. Prevalence and associated factors of perinatal depression in Ethiopia: a systematic review and meta-analysis. Depress Res Treat 2018;2018:1813834.
[5] (Accessed April 26, 2020) American Psychiatric Association. Diagnostic and Statistical Manual of Mental Disorders. 5th ed. American Psychiatric Association; 2013. https://doi.org/10.1176/appi.books.9780890425596.
[6] Langan RC, Goodbred AJ. Identification and management of peripartum depression. Am Fam Physician 2016;93:852–8.
[7] Gavin NI, Gaynes BN, Lohr KN, Meltzer-Brody S, Gartlehner G, Swinson T. Perinatal depression: a systematic review of prevalence and incidence. Obstet Gynecol 2005;106(5 Pt 1):1071–83.
[8] Hahn-Holbrook J, Cornwell-Hinrichs T, Anaya I. Economic and health predictors of national postpartum depression prevalence: a systematic review, meta-analysis, and meta-regression of 291 studies from 56 countries. Front Psych 2017;8:248.
[9] 9. WHO. Maternal mental health. *WHO*. https://ww.who.int/mental_health/maternal-child/maternal_mental_health/en/ (Accessed September 12, 2020).
[10] Fekadu Dadi A, Miller ER, Mwanri L. Antenatal depression and its association with adverse birth outcomes in low and middle-income countries: a systematic review and meta-analysis. PLoS One 2020;15(1).
[11] Mukherjee S, Trepka MJ, Pierre-Victor D, Bahelah R, Avent T. Racial/ethnic disparities in antenatal depression in the United States: a systematic review. Matern Child Health J 2016;20(9):1780–97.
[12] 12. WHO. Sustainable Development Goal 3: Health. WHO. http://www.who.int/topics/sustainable-development-goals/targets/en/ (Accessed April 25, 2020).
[13] Hutchens BF, Kearney J. Risk factors for postpartum depression: an umbrella review. J Midwifery Womens Health 2020;65(1):96–108.
[14] Biaggi A, Conroy S, Pawlby S, Pariante CM. Identifying the women at risk of antenatal anxiety and depression: a systematic review. J Affect Disord 2016;191:62–77.
[15] Bigna JJ, Tounouga DN, Kenne AM, et al. Epidemiology of depressive disorders in people living with HIV in Africa: a systematic review and meta-analysis: burden of depression in HIV in Africa. Gen Hosp Psychiatry 2019;57:13–22.
[16] (1745506519844044) Slomian J, Honvo G, Emonts P, Reginster J-Y, Bruyère O. Consequences of maternal postpartum depression: a systematic review of maternal and infant outcomes. Womens Health Lond Engl 2019;15.
[17] Hansotte E, Payne SI, Babich SM. Positive postpartum depression screening practices and subsequent mental health treatment for low-income women in Western countries: a systematic literature review. Public Health Rev 2017;38:3.
[18] Dadi AF, Akalu TY, Baraki AG, Wolde HF. Epidemiology of postnatal depression and its associated factors in Africa: a systematic review and meta-analysis. PLoS One 2020:15(4).
[19] Munn Z, Moola S, Lisy K, et al. Chapter 5: systematic reviews of prevalence and incidence. In: Aromataris E, Munn Z, editors. Joanna Briggs Institute Reviewer's Manual. The Joanna Briggs Institute; 2017.
[20] Liberati A, Altman DG, Tetzlaff J, et al. The PRISMA statement for reporting systematic reviews and meta-analyses of studies that evaluate healthcare interventions: explanation and elaboration. BMJ 2009;339:b2700.
[21] Cox JL, Holden JM, Sagovsky R. Detection of postnatal depression. Development of the 10-item Edinburgh postnatal depression scale. Br J Psychiatry J Ment Sci 1987;150:782–6.
[22] Bürkner P-C. Advanced Bayesian multilevel modeling with the R package brms. R J 2018;10(1):395–411.
[23] Gelman A, Goodrich B, Gabry J, Vehtari A. R-squared for Bayesian regression models. Am Stat 2019;73(3):307–9.
[24] Hoertel N, López S, Peyre H, et al. Are symptom features of depression during pregnancy, the postpartum period and outside the peripartum period distinct? Results from a nationally representative sample using Item Response Theory (IRT). Depress Anxiety 2015;32(2):129–40.
[25] Ko JY, Rockhill KM, Tong VT, Morrow B, Farr SL. Trends in postpartum depressive symptoms — 27 states, 2004, 2008, and 2012. MMWR Morb Mortal Wkly Rep 2017;66:153–8.
[26] Lupattelli A, Twigg MJ, Zagorodnikova K, et al. Self-reported perinatal depressive symptoms and postnatal symptom severity after treatment with antidepressants in pregnancy: a cross-sectional study across 12 European countries using the Edinburgh Postnatal Depression Scale. Clin Epidemiol 2018;10:655–69.
[27] Takegata M, Ohashi Y, Lazarus A, Kitamura T. Cross-national differences in psychosocial factors of perinatal depression: a systematic review of India and Japan. Healthc Basel Switz 2017:5(4).
[28] Ogbo FA, Eastwood J, Hendry A, et al. Determinants of antenatal depression and postnatal depression in Australia. BMC Psychiatry 2018;18(1):49.
[29] GBD 2017 HIV collaborators. Global, regional, and national incidence, prevalence, and mortality of HIV, 1980–2017, and forecasts to 2030, for 195 countries and territories: a systematic analysis for the Global Burden of Diseases, Injuries, and Risk Factors Study 2017. Lancet HIV 2019;6(12):e831–59.
[30] Zhu Q-Y, Huang D-S, Lv J-D, Guan P, Bai X-H. Prevalence of perinatal depression among HIV-positive women: a systematic review and meta-analysis. BMC Psychiatry 2019;19(1):330.
[31] Kapetanovic S, Christensen S, Karim R, et al. Correlates of perinatal depression in HIV-infected women. AIDS Patient Care STDS 2009;23(2):101–8.
[32] Bailey H, Malyuta R, Semenenko I, et al. Prevalence of depressive symptoms in pregnant and postnatal HIV-positive women in Ukraine: a cross-sectional survey. Reprod Health 2016;13:27.
[33] 33. World Health Organization. The global prevalence of anaemia. Geneva: World Health Organization; 2011.
[34] Kang SY, Kim H-B, Sunwoo S. Association between anemia and maternal depression: a systematic review and meta-analysis. J Psychiatr Res 2020;122:88–96.
[35] Klawetter S, McNitt C, Hoffman JA, Glaze K, Sward A, Frankel K. Perinatal depression in low-income women: a literature review and innovative screening approach. Curr Psychiatry Rep 2020;22(1):1.
[36] Desyibelew HD, Dadi AF. Burden and determinants of malnutrition among pregnant women in Africa: a systematic review and meta-analysis. PLoS One 2019:14(9).
[37] Lindsay KL, Gibney ER, McAuliffe FM. Maternal nutrition among women from sub-Saharan Africa, with a focus on Nigeria, and potential implications for pregnancy outcomes among immigrant populations in developed countries. J Hum Nutr Diet Off J Br Diet Assoc 2012;25(6):534–46.
[38] Aghajafari F, Letourneau N, Mahinpey N, Cosic N, Giesbrecht G. Vitamin D deficiency and antenatal and postpartum depression: a systematic review. Nutrients 2018;10(4).
[39] Sparling TM, Nesbitt RC, Henschke N, Gabrysch S. Nutrients and perinatal depression: a systematic review. J Nutr Sci 2017;6:e61.
[40] Evagorou O, Arvaniti A, Samakouri M. Cross-cultural approach of postpartum depression: manifestation, practices applied, risk factors and therapeutic interventions. Psychiatry Q 2016;87(1):129–54.
[41] Sawyer A, Ayers S, Smith H. Pre- and postnatal psychological wellbeing in Africa: a systematic review. J Affect Disord 2010;123(1–3):17–29.
[42] Zhang S, Wang L, Yang T, et al. Maternal violence experiences and risk of postpartum depression: a meta-analysis of cohort studies. Eur Psychiatry J Assoc Eur Psychiatr 2019;55:90–101.
[43] Silva DFO, Cobucci RN, Gonçalves AK, Lima SCVC. Systematic review of the association between dietary patterns and perinatal anxiety and depression. BMC Pregnancy Childbirth 2019;19(1):1–13.
[44] Mu T-Y, Li Y-H, Pan H-F, et al. Postpartum depressive mood (PDM) among Chinese women: a meta-analysis. Arch Womens Ment Health 2019;22(2):279–87.
[45] Upadhyay RP, Chowdhury R, Salehi A, et al. Postpartum depression in India: a systematic review and meta-analysis. Bull World Health Organ 2017;95(10):706–717C.
[46] Veisani Y, Delpisheh A, Sayehmiri K, Rezaeian S. Trends of postpartum depression in Iran: a systematic review and meta-analysis. Depress Res Treat 2013;2013:291029.
[47] Mahendran R, Puthussery S, Amalan M. Prevalence of antenatal depression in South Asia: a systematic review and meta-analysis. J Epidemiol Community Health 2019;73(8):768–77.
[48] Wolf AW, De Andraca I, Lozoff B. Maternal depression in three Latin American samples. Soc Psychiatry Psychiatr Epidemiol 2002;37(4):169–76.
[49] 49. UNAIDS data. UNAIDS. https://www.unaids.org/en/resources/documents/2019/2019-UNAIDS-data; 2019 (Accessed May 2, 2020).
[50] Sweetland AC, Belkin GS, Verdeli H. Measuring depression and anxiety in sub-Saharan Africa. Depress Anxiety 2014;31(3):223–32.
[51] Ng'oma M, Meltzer-Brody S, Chirwa E, Stewart RC. "Passing through difficult times": Perceptions of perinatal depression and treatment needs in Malawi - A qualitative study to inform the development of a culturally sensitive intervention. PLoS One 2019;14(6):e0217102.
[52] Leis JA, Heron J, Stuart EA, Mendelson T. Associations between depressive and anxious symptoms and prenatal alcohol use. Matern Child Health J 2012;16(6):1304–11.
[53] Garman EC, Schneider M, Lund C. Perinatal depressive symptoms among low-income South African women at risk of depression: trajectories and predictors. BMC Pregnancy Childbirth 2019;19.

[54] Popova S, Lange S, Probst C, et al. Actual and predicted prevalence of alcohol consumption during pregnancy in the WHO African Region. Trop Med Int Health TM IH 2016;21(10):1209–39.
[55] Peltzer K, Pengpid S. Maternal alcohol use during pregnancy in a general national population in South Africa. South Afr J Psychiatry SAJP J Soc Psychiatr South Afr 2019:25(0).
[56] Groves AK, Moodley D, McNaughton-Reyes L, Martin SL, Foshee V, Maman S. Prevalence and rates of intimate partner violence among South African women during pregnancy and the postpartum period. Matern Child Health J 2015;19(3):487–95.
[57] Schneider M, Baron E, Davies T, Munodawafa M, Lund C. Patterns of intimate partner violence among perinatal women with depression symptoms in Khayelitsha, South Africa: a longitudinal analysis. Glob Ment Health 2018;5.
[58] Smith Fawzi MC, Siril H, Larson E, et al. Healthy options: study protocol and baseline characteristics for a cluster randomized controlled trial of group psychotherapy for perinatal women living with HIV and depression in Tanzania. BMC Public Health 2020;20(1):80.
[59] Wagner GJ, McBain RK, Akena D, et al. Maternal depression treatment in HIV (M-DEPTH): study protocol for a cluster randomized controlled trial. Medicine (Baltimore) 2019;98(27):e16329.
[60] Tsai AC, Scott JA, Hung KJ, et al. Reliability and validity of instruments for assessing perinatal depression in african settings: systematic review and meta-analysis. PLoS One 2013;8(12).
[61] Shrestha SD, Pradhan R, Tran TD, Gualano RC, Fisher JRW. Reliability and validity of the Edinburgh postnatal depression scale (EPDS) for detecting perinatal common mental disorders (PCMDs) among women in low-and lower-middle-income countries: a systematic review. BMC Pregnancy Childbirth 2016;16:72.
[62] Matthey S, Henshaw C, Elliott S, Barnett B. Variability in use of cut-off scores and formats on the Edinburgh Postnatal Depression Scale: implications for clinical and research practice. Arch Womens Ment Health 2006;9(6):309–15.