Characterization and stratification of the correlates of postpartum depression in sub-Saharan Africa: A systematic review with meta-analysis

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Abstract
Postpartum depression (PPD) is a common mental health challenge in resource-constrained sub-Saharan Africa (SSA). Characterizing its correlates will aid prediction, early detection, and pre-emptive interventions. This review aimed to systematically synthesize and stratify PPD correlates in sub-Saharan Africa. The review was structured as per the Preferred Reporting Item for Systematic Reviews and Meta-Analyses. We included studies that reported the correlates of PPD in SSA. We searched PubMed, Medline, CINAHL, Academic Search Complete, and PsycINFO for relevant peer-reviewed literature. The correlates of PPD constituted the primary outcome. A random effect model was fitted to estimate the pooled correlation coefficient per correlate. The clinical relevance of correlates was stratified based on strength of correlation (r) and recurrence (f). The mean age of the participants was 27.0 ± 6.0 years, and 68.6% of participants had completed at least secondary education. The correlates of PPD in SSA were intimate partner violence (IPV) ((risk weight (rw) = 2.8; r = 0.212 (confidence interval (CI): 0.11–0.31)), poor social support (PSS) (rw = 1.9; r = 0.250 (0.13–0.36)), unwanted pregnancy (UP) (rw = 1.6; r = 0.279 (CI: 0.14–0.41)); I² = 95.89), and maternal age (MA) (rw = 0.96; r = 0.27 (CI: 0.15–0.37)), among others. A cumulative risk weight of ≥0.95 was predictive of PPD and marks the critical point at which preemptive interventions should be instituted. The stratification of risk PPD factors and computation of risk stability index are useful in identifying the clinical significant risk factors. The provision of critical risk point will simplify early detection thus facilitating cost-effectiveness. Of the correlates of PPD in SSA, IPV, PSS, UP, and MA are the most important. Targeted screening and pre-emptive interventions for women with high risk weight may be a reasonable strategy both in the short and long term.

Keywords
depression, perinatal, risk, stratification, sub-Saharan Africa

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Introduction
Postpartum depression (PPD) is often misdiagnosed in women, and as a result, patients are left with no treatment options.¹ This is attributable to a lack of understanding of the diagnosis and treatment of PPD by family health practitioners.² At least 25% of mothers with PPD experience symptoms that extend for more than 6 months.³ In sub-Saharan Africa (SSA) Africa, the pooled prevalence is 16.8%, although a recent and robust yet-to-be-published meta-analysis pegged the SSA African PPD rate at 21.8%.⁴ PPD makes newborn care more difficult and even puts the

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baby at risk of injury. In extreme cases of PPD, mothers have been documented to try to harm their children. Adolescent psychiatric disorder is more common in children whose mothers have PPD. PPD is most frequently diagnosed between a few weeks and about a year following delivery. PPD has been observed to occur up to 4 years following delivery. Early detection and treatment of PPD remain poor in SSA Africa due to a major lack of focus. Fortunately, PPD is both preventable and treatable if it is detected and treated early. PPD early prevention and treatment must be guided by a thorough understanding of the risk factors, as is the case with other disease conditions.

In SSA Africa, several factors have been linked to PPD, including age, education, household income, and unplanned pregnancies. However, the strength and recurrence of these correlates are yet to be ascertained. We expect that policymakers’ attention will be called to the socioeconomic implications of PPD in pursuit of universal health coverage and the African Union Agenda 2063, therefore sparking adequate support for early detection and treatment. We conducted this systematic review to fill in gaps on the correlates of PPD in SSA Africa as part of the efforts to treat and prevent the disease. We aim to provide policymakers in SSA Africa with the most relevant PPD correlates. Hence, the review aimed to systematically characterize and stratify the correlates of PPD in SSA for prediction purposes and early intervention.

Methods
Protocol and registration
This is a systematic review of epidemiological studies aimed at synthesizing the evidence on the correlates of PPD in SSA Africa. The protocol was structured using the Preferred Reporting Item for Systematic Reviews and Meta-Analyses (PRISMA) checklist (Supplementary file). The protocol was registered with the Open Science Framework Registry: https://osf.io/5xzp8.

Eligibility criteria
Studies that reported the correlates of PPD among postpartum women in SSA Africa were included in the review. Articles written and published in English were included. Observational studies that documented the correlates of PPD in SSA Africa irrespective of sample size, study design, sampling technique, test statistics, and whether a control group was employed or not. The correlates of PPD in SSA Africa were the primary outcome. If assessed at least once throughout the study, it was included. Clinical, sociodemographic, and study characteristics were all secondary outcomes.

Sources of information and search strategy
The principal reviewer (MN) developed the search strategy. A variety of combinations of terms from the medical subject headings and free terms from a selected number of key articles were used in the searches. To begin, a PubMed pilot search was carried out to establish the face sensitivity of the search strategy. Eventually, the most sensitive strategy yielded over 6000 papers: ‘Depression [All field] AND (postnatal or postpartum [All field] AND Africa [MeSH Terms]).’ The terms were adapted to the other databases’ syntax and subject headings, including Medline, Academic Search Complete, CINAHL, and PsycINFO. An additional search was done in the references of the selected observational and review articles to further identify relevant studies.

Inclusion and exclusion criteria
The criteria for inclusion comprise peer-reviewed observational studies on PPD conducted in SSA Africa, studies in which PPD was diagnosed after 7 days postpartum solely through the use of a standard instrument (without medical examination/assessment), or studies in which PPD was diagnosed 7 days postpartum through the use of a standard instrument and medical examination/assessment, and studies in which, except for hospital data, random sampling was used. We excluded studies that employed convenience/purposive sampling unless they were hospital studies, and studies in which PPD was diagnosed less than 7 days postpartum solely with the use of a questionnaire-based instrument (without medical examination/assessment). We excluded qualitative and case studies to allow for quantitative and cumulative synthesis.

Study records and data management
The results of the literature search were exported to EndNote 8 for data management and de-duplication, as well as the selection of articles for inclusion. After that, full-text copies of the articles that met the criteria were downloaded. The included studies’ eligibility criteria and screening forms were developed, piloted, and refined.

Procedures for selection and data collection
The title and abstract were simultaneously screened by two independent reviewers (OA and UP). In consultation with the primary reviewer (MN), conflicting points of view were reconciled. The primary reviewer double-checked the preliminary screening results and read the full text of selected studies for further screening using the previously established eligibility criteria. Data extraction was done non-independently by OA and UP, and verified and
updated by MN and MU. Authors were not contacted for primary data and full texts were available. Details of the flow of studies during the selection process were presented using a PRISMA diagram, along with the rationale for exclusion (Figure 1).

**Data items**

The following data items were collected: authors' identities and study characteristics such as study design, region, the timing of diagnosis, sample size, method of assessment, the instrument used, and sampling technique.

**Quality appraisal/risk of bias assessment**

The risk of bias was assessed using a quality assessment checklist developed from Hoy et al.\textsuperscript{14} It evaluates the suitability and adequacy of the methodology, as well as the study’s design, participant recruitment, data collection, analysis, and presentation of findings. It can be used to assess most study designs. The tool is made up of 10 items, with the tenth item being a summary score. The studies were assessed as low risk (0–3), medium or moderate risk (4–6), and high risk (7–8) on a 3-point Likert-type scale (7–9). Twelve (20%) of the included studies
were independently appraised by MN and MU, with a rater agreement of 0.92. The remaining 48 (80%) were assessed by MU.

**Summary measures**

Participants’ ages were summarized using mean and standard deviation. Participants’ level of education was summarized in terms of the percentage that attained post-primary education. We pooled the correlation coefficient for each identified correlate.

**Data synthesis and analysis**

The pooled correlation coefficient was estimated consistent with Borenstein et al.,15 Wang and Liu,16 and Lenhard and Lenhard.17 The pooled correlation coefficient was synthesized using the random effect model. The heterogeneity measure and $I^2$ were calculated following Higgins et al.18 $I^2$ values were interpreted per the Cochrane Handbook for Systematic Reviews of Interventions as follows: 0%–40% may indicate low heterogeneity, 30%–60% may indicate moderate heterogeneity, 50%–90% may indicate substantial heterogeneity, and 75%–100% may indicate considerable heterogeneity.18 We fitted a meta-regression model to identify the sources of heterogeneity. MN and MU conducted the statistical analysis.

**Stratification of correlates**

Towards the stratification of the correlates, we computed risk weight (Rw) as a product of the effect size (r) and frequency/recurrence of correlates. High-risk weight signifies a more economically or clinically important correlate. We ranked correlates as level one, two or three based on their risk weight. Correlates up in the ladder were regarded as being more clinically important than those down the ladder.

**Results**

**Study selection**

A total of 6861 records were identified from PubMed (326), Medline (598), CINHAL (238), Academic Search Complete (5419), PsycINFO (273), and reference list (7). Following de-duplication and title and abstract screening, we eliminated 995 records that were deemed irrelevant, leaving 5866 articles for the title and abstract screening. Ultimately, 43 studies met the eligibility criteria (Figure 1). The 43 studies were also included in the meta-analysis (Table 1).

**Study characteristics and risk of bias**

Of the 46 SSA African countries, 10 were involved in this review. About 68.6% of participants in the included studies had completed at least secondary education. Of the 43 included studies, 9 were conducted in Ethiopia, 6 in South Africa and 5 in Nigeria, and 4 each in Kenya and Uganda. The mean age of the study participants was 27.0 ± 6.0 years. Interestingly, all but one of the included studies possessed a low risk of bias (Table 1).

**Correlates with PPD in SSA Africa**

In this review, 17 factors emerged as the most important correlates of PPD in SSA Africa and were classified into three levels. Level-one correlates occupy the upper quartile and include intimate partner violence (r = 2.8; $r = 0.212$ (confidence interval (CI): 0.11–0.31); OR = 2.2), poor social support (r = 1.92; $r = 0.250$ (0.13–0.361); OR = 2.6), unplanned/unwanted pregnancy (r = 1.62; $r = 0.279$ (CI: 0.14–0.41); $I^2 = 95.89$; OR = 2.9), and maternal age (r = 0.96; $r = 0.27$ (CI: 0.154–0.37); OR = 2.8). Level-two correlates occupy the interquartile range include illness in mother (r = 0.92; $r = 0.225$ (CI: 0.073–0.367); OR = 2.3), being single (r = 0.652; $r = 0.181$ (CI: 0.045–0.312); OR = 1.9), poor socioeconomic status (r = 0.59; $r = 0.21$ (CI: 0.10–0.32); OR = 2.2), and low education (r = 0.51; $r = 0.51$ (CI: 0.41–0.59); OR = 8.4). Level-three correlates occupy the lower quartile and include perinatal death (r = 0.50; $r = 0.28$ (CI: 0.17–0.38); OR = 2.8), undesired infant sex (r = 0.46; $r = 0.16$ (CI: 0.09–0.24); OR = 1.8), Caesarean section (r = 0.43; $r = 0.22$ (CI: 0.13–0.30); OR = 2.2), substance abuse (r = 0.37; $r = 0.30$ (CI: 0.091–0.478); OR = 3.1), antenatal depression (r = 0.365; $r = 0.27$ (0.03 to 0.53); OR = 2.8), poor health of new child (r = 0.34; $r = 0.12$ (0.04–0.21); OR = 1.6), and primiparous (r = 1.3; $r = 0.13$ (−0.21 to 0.43); OR = 1.6). We observed low to substantial heterogeneity ($I^2 = 48.72–96.44$). No publication bias was recorded ($p > 0.05$) (Table 2). A level-one correlate is approximately twice and thrice the risk of a level-two and a level-three correlates, respectively (Table 2).

**Discussion**

**Summary of evidence**

The presence of a level-one correlate namely intimate partner violence, poor social support, unplanned/unwanted pregnancy or maternal age is predictive of PPD. Hence, antenatal women with any one level-one correlate, two level-two correlates or three level-three correlates should be marked for early detection for PPD using valid and sensitive measures such as the Edinburgh postnatal depression scale (EPDS), and possible pre-emptive intervention. Based on the findings of our study, pre-emptive intervention should include conflict resolution, psychotherapy, mobilization for improved social support, and specialized child care and parenting skills.66 Preventive measures include planned parenthood, early girl-child education,
and so on. As part of the strategy to improve social supports, governments at various tiers could promulgate an affordable insurance policy to protect pregnant women, postpartum women and newborns against poor access to healthcare services. Preventive measures and early interventions should be individualized and based on the underlying correlates. Ultrasound could be used to determine baby sex prior to delivery as this could aid counselling in a situation where baby sex is undesired. The availability of data on risk weight of the correlates of PPD in sub-Saharan Africa may reduce cost associated with PPD. Although data on the economic burden of PPD is lacking in Africa, maternal depression cost modern societies billions of dollars per annum. For example, in the United States, the

| S/N | Study ID | Age (years) | Education (%) | Instrument | Postpartum duration | Country | Quality |
|-----|----------|-------------|---------------|------------|---------------------|---------|---------|
| 1   | Abadiga  | 29.6 (9.5)  | 69.0          | EPDS       | Within 12 months    | Ethiopia| Low risk|
| 2   | Abebe et al. | 24.3 (3.8) | 94.9          | EPDS       | Within 6 months     | Ethiopia| Low risk|
| 3   | Abiodun   | 27.9 (5.9)  | 81.9          | EPDS       | 6 weeks             | Nigeria | Low risk|
| 4   | Agbaje et al. | 28.9 (6.2) | 79.4          | EPDS       | 4–12 weeks          | Nigeria | Low risk|
| 5   | Arach et al.  | 25.0 (7.0) | 77.8          | EPDS       | Day 50              | Uganda  | Low risk|
| 6   | Atuhaire et al. | 27 (–)  | 98.6          | DSM-IV     | 6 week              | Uganda  | Low risk|
| 7   | Bitew et al.  | 26.8 (–)  | 61.3          | PHQ        | 4–12 weeks          | Ethiopia| Low risk|
| 8   | Dlamini et al. | 31.5 (–) | –             | EPDS       | Within 6 weeks      | Eswatini| Low risk|
| 9   | Dow et al. | 27.1 (5.3) | 86.4          | EPDS       | Weeks 10 & 14: months 6, 9, 12, 15, 18 | Malawi | Low risk|
| 10  | Duma and Madiba | –         | 96.8%        | EPDS       | 4–6 weeks          | South–Africa| Low risk|
| 11  | Fateyo et al. | –         | 96.8%        | Zung’s scale | 3 & 6 weeks   | Nigeria | Low risk|
| 12  | Gebregziabher et al.  | 27.7 (5.2) | 98.7      | DSM-IV     | 2–14 weeks         | Eritrea | Low risk|
| 13  | Gold et al. | 28.0 (11.0) | 65.4         | PHQ        | 2 weeks             | Ghana   | Low risk|
| 14  | Govender et al. | 17.9 (1.2) | 97.3        | EPDS       | 7 days              | South Africa | Low risk|
| 15  | Holm-Larsen et al.| 25 (–) | 93.0         | EPDS       | Day 40, 2–3yrs      | Tanzania | Low risk|
| 16  | January et al. | 23.73 (6.14) | 70.8% | DSM-5       | Day 7 & 6 weeks    | Zimbabwe | High risk|
| 17  | January et al. | 25.4 (5.6) | 94.0        | EPDS       | Within 12 months    | Zimbabwe | Low risk|
| 18  | January et al. | 25.8 (5.4) | 55.6        | EPDS       | 6–10 weeks          | Zimbabwe | Low risk|
| 19  | January et al. | 24.24 (4.33) | 54.5      | EPDS       | Within 12 weeks     | Uganda   | Low risk|
| 20  | Kakyo et al. | 26.1 (5.8)  | 63.0         | EPDS       | Within 12 months    | Ethiopia | Low risk|
| 21  | Kerie et al. | 28.0 (–)  | 33.5         | EPDS       | 6–16 weeks          | Kenya    | Low risk|
| 22  | Madgehe et al. | 29.2 (6.3) | 32.1        | EPDS       | 2–6 weeks           | Tanzania | Low risk|
| 23  | Mbarak et al. | 27.1 (5.3) | 86.4        | EPDS       | 6 weeks             | South–Africa | Low risk|
| 24  | Minis et al. | 23.4 (4.8)  | 59.5         | SRQ-25     | Within 6 weeks      | Uganda   | Low risk|
| 25  | Nampijja et al. | 28.0 (4.8) | 98.0        | PHQ        | 1–3 months          | Uganda   | Low risk|
| 26  | Necho et al. | 29.85 (6.4) | 79.9        | EPDS       | Within 4 weeks      | Ethiopia | Low risk|
| 27  | Ongeri et al. | 25.5 (–)  | 73.1         | EPDS       | 6–10 weeks          | Kenya    | Low risk|
| 28  | Owweye et al. | 28.5 (5.3) | 82.9        | EPDS       | Within 4 months     | Nigeria  | Low risk|
| 29  | Peltzer et al. | 28.3 (5.7) | 78.3        | EPDS       | 6 & 12 months       | South Africa | Low risk|
| 30  | Ping et al. | 25.1 (6.4)  | 33.3         | EPDS       | week 6              | South Africa | Low risk|
| 31  | Ramachandani et al. | 26.1 (5.6) | 79.2        | PHQ        | Within 7 weeks      | South Africa | Low risk|
| 32  | Rogathi et al. | 26 (–)   | 33.9        | EPDS       | 40 days             | Tanzania | Low risk|
| 33  | Shitu et al. | 30.6 (6.3)  | 6.4          | EPDS       | Within 12 months    | Ethiopia | Low risk|
| 34  | Stellenberg and Abrahams  | –         | –           | EPDS       | 6, 10, 14 weeks     | South Africa | Low risk|
| 35  | Toru et al. | 28.5 (–)  | 64.3         | PHQ        | Within 12 months    | Ethiopia | Low risk|
| 36  | Tungchama et al. | 27.0 (6.0) | 80.6        | EPDS       | 6–8 weeks           | Nigeria  | Low risk|
| 37  | Turan et al. | 24.3 (4.9)  | 11.9         | EPDS       | 6 weeks             | Kenya    | Low risk|
| 38  | Wemakor and Mensah | 27.9 (8.2) | –           | CES-D      | Within 5 years      | Ghana    | Low risk|
| 39  | Weobong et al. | 22.5 (–)  | 44.0         | PHQ        | 4 weeks             | Ghana    | Low risk|
| 40  | Wubetu et al. | 26.5 (4.5) | 66.0        | EPDS       | Within 6 weeks      | Ethiopia | Low risk|
| 41  | Yator et al. | 31.0 (5.2)  | 81.3         | PHQ        | 8 weeks             | Kenya    | Low risk|

EPDS: Edinburgh Postnatal Depression Scale; DSM-IV: Diagnostic & Statistical Manual for Mental Disorders, Fourth Edition; PHQ: Patient Hospital Questionnaire; DSM-5: Diagnostic & Statistical Manual for Mental Disorders, Fifth Edition; SRQ-25: Self Rating Questionnaire-25; CES-D: Center for Epidemiological Studies Depression Scale.
cost of maternal depression was an astounding $14.2 billion – an average of $32,000 per mom.\[^62\] This is especially in countries saddled with crises of mental health and health insurance with no pre-emptive measures.\[^63\] Despite the lack of data on the economic burden of PPD in Africa, the cost of maternal healthcare is approximately twice those of mothers without maternal depression.\[^64\] Hence, we advocate for preemptive intervention facilitated through early detection aided by the risk category of the emerging correlates as here discussed.

**Level-one correlates.** Intimate partner violence, poor social support, unplanned pregnancy, and maternal age are the most important correlates of PPD in sub-Saharan Africa. Our finding is consistent with Dadi et al.\[^6\] in which intimate partner increased risk of PPD by approximately threefold. Marital problems such as intimate partner conflict and abusive relationships are consistent sources of stress throughout the postpartum period.\[^48,65\] Mechanisms employed by intimate partner violence include in physical and social isolation, as well as psychological injury resulting in low self-esteem and miserable living.\[^65,66\]. Consistent with our study, mothers with poor social support were 2.5 times more likely than their peers to suffer from PPD.\[^68\] Women who did not receive adequate support from close family members during birth or in the care of their newborn were shown to be less satisfied, stressed, and at a higher risk of depression.\[^69\] Regarding the role of unplanned pregnancy in genesis of PPD, lack of preparation for childbirth and inability to cope with pregnancy, labour, and the postpartum period have been implicated.\[^70\] Low levels of preparation may leave mothers feeling anxious, helpless, and unable (or unwilling) to cope with the changes and challenges (including financial and social stressors) that babies bring.\[^22\] The role of maternal age in the genesis of PPD was impacted by education. In settings where early girl-child schooling is uncommon, a very young age constitute a risk of PPD due to very immature coping strategies,\[^54\] whereas advanced maternal age is a risk for PPD in societies where early girl-child education is attainable. This could be attributed to a lack of peer support as a result of deviations from social norms surrounding maternal age, obstetrical problems, and multiple births, all of which are linked to an increased risk of complications.\[^71\]

**Table 2.** Correlates of PPD in SSA.

| Factors                      | N  | r   | CI          | I^2 | OR   | Eggers t value | p value | Risk weight (rw) | Risk category |
|------------------------------|----|-----|-------------|-----|------|----------------|---------|------------------|---------------|
| IPV/conflict                 | 17 | 0.212 | 0.112–0.308 | 94.02 | 2.20 | 0.033 | 0.974 | 2.80 | Level 1          |
| Poor social support          | 13 | 0.250 | 0.133–0.361 | 92.38 | 2.55 | 0.528 | 0.608 | 1.92 | Level 1          |
| Unwanted pregnancy           | 11 | 0.279 | 0.140–0.408 | 95.88 | 2.87 | 1.197 | 0.261 | 1.62 | Level 1          |
| Maternal age                 | 7  | 0.268 | 0.154–0.374 | 91.60 | 2.74 | 1.261 | 0.263 | 0.96 | Level 1          |
| Illness in Mother            | 12 | 0.225 | 0.073–0.367 | 94.97 | 2.31 | 0.527 | 0.610 | 0.92 | Level 2          |
| Single motherhood            | 10 | 0.181 | 0.045–0.312 | 92.09 | 1.95 | 0.704 | 0.502 | 0.65 | Level 2          |
| Poor SES                     | 13 | 0.213 | 0.096–0.324 | 93.81 | 2.21 | 0.321 | 0.754 | 0.59 | Level 2          |
| Low education                | 3  | 0.507 | 0.414–0.589 | 48.72 | 8.45 | 1.048 | 0.485 | 0.51 | Level 1          |
| Stillbirth                   | 5  | 0.276 | 0.168–0.378 | 87.45 | 2.83 | 0.779 | 0.492 | 0.50 | Level 3          |
| Undesired sex                | 9  | 0.164 | 0.087–0.240 | 68.36 | 1.83 | 0.106 | 0.918 | 0.46 | Level 3          |
| Caesarean section            | 3  | 0.216 | 0.128–0.301 | 0.000 | 2.23 | 0.452 | 0.730 | 0.43 | Level 3          |
| Substance abuse              | 3  | 0.297 | 0.091–0.478 | 93.73 | 3.09 | 1.102 | 0.469 | 0.37 | Level 3          |
| Antenatal depression         | 3  | 0.274 | –0.029–0.531 | 96.44 | 2.81 | 0.206 | 0.871 | 0.37 | Level 3          |
| Poor health of child         | 9  | 0.124 | 0.036–0.209 | 92.46 | 1.57 | 1.707 | 0.132 | 0.34 | Level 3          |
| Primiparous                  | 4  | 0.126 | –0.206–0.431 | 93.32 | 1.59 | 0.006 | 0.996 | 0.13 | Level 3          |

CI: confidence interval; SES: socioeconomic status; OR: odds ratio; Level 1: risk weight in the upper quartile (rw = 0.95); Level 2: risk weight in the interquartile range (0.50–0.94); Level 3: risk weight in the lower quartile (0.37–0.49).
depression is among mothers with lower socioeconomic status. Women with poor socioeconomic status may be disadvantaged due to a lack of financial resources and inadequate health insurance, resulting in stress. Since up to 80% of the sub-Saharan African population does not have access to free medical treatment, declining socioeconomic indicators and rising healthcare costs place a heavier strain on patients and their families.

**Level-three correlates.** Stillbirth, unwanted infant sex, caesarean section, and poor health of child constitute level-three correlates. Any pregnant mother with any three of the level-three correlates should be regarded as candidate for early detection and pre-emptive interventions. Consistent with Arach et al., our study shows that mothers who had experienced perinatal death were approximately 3 times as likely to develop PPD as mothers who had not experienced perinatal death. Chronic sadness characterized with spells of pervasive melancholy, sorrow, or other grief-related experiences could explain why women who experienced perinatal loss had an increased risk of postnatal depression. We found C-section a relevant correlate of PPD in SSA. It is said to be initiated by surgical trauma and the financial burden of the procedure and stigmatization for surgery in Africa, particularly in Nigeria. Consistent with our finding, dissatisfaction with child gender constituted a risk for PPD as reported in several studies conducted in SSA Africa. Some studies, however, found no link between PPD and dissatisfaction with the gender of the child. Hence, there could be cultural factors causing this discrepancy in findings, as the importance of gender changes across different cultures. Regarding the role of poor health of the new child in occurrence of PPD in SSA, the risk of PPD was 3–4 times higher in mothers with infants suffering from illness that limit the ability to breastfeed and sleep. Infant sickness increases mother’s stress level while reducing her ability to sleep. Mothers of babies who have problems sleeping were about four times more likely to be depressed compared with mothers with healthy newborns. Hence, putative pathways that mediate PPD in these mothers may include maternal sleeplessness and exhaustion. One limitation in this study was the failure to account for the role of sub-ethnic disparity in the development of PPD. However, it is reasonable to argue that ethnic-related difference in development and occurrence of PPD may be insignificant across sub-Saharan African settings.

**Implications for policy and practice**

To stem the growing tide of PPD in SSA, psychotherapy, conflict resolution, and/or social support including specialized child care training should be offered to expectant mothers with any two of the level-two correlates, and expectant mothers with any three of the level-three correlates with level one. To reduce cost and improve care efficiency, targeted PPD screening of at-risk pregnant women should be promoted. Preventive measures and early interventions should be individualized and based on the underlying correlates.

**Conclusion**

There are three levels of PPD correlates in SSA. Level-one correlates are the most important and include intimate partner violence, poor social support, unplanned pregnancy, maternal age, and illness in the mother. A cumulative risk weight of ≥0.95 was predictive of PPD and marks the critical point at which preemptive interventions should be instituted. Targeted support and pre-emptive interventions for women with high risk weight may be a reasonable strategy both in the short and long term.

**Declarations**

**Ethics approval and consent to participate**

No ethical approval was sought because the study is a systematic review, with all data retrieved from published literature.

**Consent for publication**

Not applicable.

**Author contribution(s)**

Martins Nweke: Conceptualization; Data curation; Formal analysis; Methodology; Software; Writing – original draft; Writing – review & editing.

Maryjane Ukwuoma: Data curation; Formal analysis; Investigation; Writing – review & editing.

Ada C. Adiuku-Brown: Methodology; Resources; Software; Writing – review & editing.

Princewill Ugwu: Investigation; Methodology; Software; Writing – review & editing.

Elizabeth Nseka: Conceptualization; Methodology; Resources; Software; Writing – review & editing.

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**Competing interests**

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Availability of data and materials

All the data used to strengthen the results of this study are fully available without restriction.

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**Supplemental material**

Supplemental material for this article is available online.

**References**

1. Gjerdingen DK and Yawn BP. Postpartum depression screening: importance, methods, barriers, and recommendations for practice. *J Am Board Fam Med* 2007; 20(3): 280–288.

2. Groh CJ. Depression in rural women: implications for nurse practitioners in primary care settings. *J Am Assoc Nurse Pract* 2013; 25(2): 84–90.

3. Beck CT, Records K and Rice M. Further development of the postpartum depression predictors inventory-revised. *J Obstet Gynecol Neonatal Nurs* 2006; 35(6): 735–745.

4. Nweke M, Adiuku AC, Nseka E, et al. Prevalence postpartum depression in sub-Saharan Africa: a systematic review with meta-analysis (Unpublished). [https://figshare.com/articles/journal_contribution/Prevalence_postpartum_depression_in_sub-Saharan_Africa_a_systematic_review_with_meta-analysis/2085829](https://figshare.com/articles/journal_contribution/Prevalence_postpartum_depression_in_sub-Saharan_Africa_a_systematic_review_with_meta-analysis/2085829)

5. Verbeek T, Bockting CL, Van Pampus MG, et al. Postpartum depression predicts offspring mental health problems in adolescence independently of parental lifetime psychopathology. *J Affect Disord* 2012; 136(3): 948–954.

6. Dadi AF, Miller ER and Mwanri L. Postnatal depression and its association with adverse infant health outcomes in low- and middle-income countries: a systematic review and meta-analysis. *BMC Preg Childbirth* 2020; 20(1): 416.

7. Seyfried LS and Marcus SM. Postpartum mood disorders. *Int Rev Psychiatr* 2003; 15(3): 231–242.

8. Sockol LE. A systematic review of the efficacy of cognitive behavioral therapy for treating and preventing perinatal depression. *J Affect Disord* 2015; 177: 7–21.

9. Fitekson E, Kim S, Baker AS, et al. Treatment of postpartum depression: clinical, psychological and pharmacological options. *Int J Womens Health* 2010; 3: 1–14.

10. Chabrol H, Teissedre F, Saint-Jean M, et al. Prevention and treatment of post-partum depression: a controlled randomized study on women at risk. *Psychol Med* 2002; 32(6): 1039–1047.

11. Wisner KL, Sit DK, McShea MC, et al. Onset timing, thoughts of self-harm, and diagnoses in postpartum women with screen-positive depression findings. *JAMA Psychiatr* 2013; 70(5): 490–498.

12. Cantilino A, Zambaldi CF, de Albuquerque TLCd Paes JA, et al. Postpartum depression in Recife - Brazil: prevalence and association with biosocidemographic factors. *J Bras Psiquiatr* 2010; 59(1): 1–9.

13. Shamseer L, Moher D, Clarke M, et al. Preferred reporting items for systematic review and meta-analysis protocols (PRISMA-P) 2015: elaboration and explanation. *BMJ* 2015; 350: g7647.

14. Hoy D, Brooks P, Woolf A, et al. Assessing risk of bias in prevalence studies: modification of an existing tool and evidence of interrater agreement. *J Clin Epidemiol* 2012; 65(9): 934–939.

15. Borenstein M, Hedges LV, Higgins JPT, et al. *Introduction to meta-analysis.* Hoboken, NJ: John Wiley & Sons, 2009.

16. Wang KS and Liu X. Statistical methods in the meta-analysis of prevalence of human diseases. *Biostat Epidemiol* 2016; 2: 20–24.

17. Lenhard W and Lenhard A. Calculation of effect sizes – psychometrica, 2015, [http://www.psychometrica.de/effect-size.htm](http://www.psychometrica.de/effect-size.htm)

18. Higgins JPT, Thomas J, Chandler J, et al. (eds). Cochrane handbook for systematic reviews of interventions (Version 6.2), 2021, [https://training.cochrane.org/handbook/archive/v6.2](https://training.cochrane.org/handbook/archive/v6.2)

19. Abadiga M. Magnitude and associated factors of postpartum depression among women in Nekemte Town, East Wollega Zone, West Ethiopia, 2019: a community-based study. *PLoS ONE* 14(11): e0224792.

20. Abebe A, Tesfaw G, Mulat H, et al. Postpartum depression and associated factors among mothers in Bahir Dar Town, Northwest Ethiopia. *Ann Gen Psychiatr* 2019; 18: 19.

21. Abiodun OA. Postnatal depression in primary care populations in Nigeria. *Gen Hosp Psychiatr* 2006; 28(2): 133–136.

22. Agbaje OS, Anyanwu JI, Umoke PIC, et al. Depressive and anxiety symptoms and associated factors among postnatal women in Enugu-North Senatorial District, South-East Nigeria: a cross-sectional study. *Arch Public Health* 2019; 77: 1.

23. Arach AAO, Nakasuja N, Nankabirwa V, et al. Perinatal death triples the prevalence of postpartum depression among women in Northern Uganda: a community-based cross-sectional study. *PLoS ONE* 2020; 15(10): e0240409.

24. Atohuairo C, Brennanlan M, Cumber SN, et al. The magnitude of postpartum depression among mothers in Africa: a literature review. *Pan Afr Med J* 2020; 37: 89.

25. Bitew T, Hanlon C, Medhin G, et al. Antenatal predictors of incident and persistent postnatal depressive symptoms in rural Ethiopia: a population-based prospective study. *Reprod Health* 2019; 16(1): 28.

26. Dlamini LP, Mahanya S, Dlamini SD, et al. Prevalence and factors associated with postpartum depression at a primary healthcare facility in Eswatini. *S Afr J Psychiatr* 2019; 25: 1404.

27. Dow A, Dube Q, Pence BW, et al. Postpartum depression and HIV infection among women in Malawi. *J Acquir Immune Defic Syndr* 2014; 65(3): 359–365.

28. Duma N and Madiba T. The prevalence of peripartum depression and its relationship to mode of delivery and other factors among mothers in Ixopo, KwaZulu-Natal, South Africa. *S Afr J Psychol* 2020; 50(4): 530–539.

29. Fatoye FO, Adeyemi AB and Oladimeji BY. Postpartum depression following normal vaginal delivery among Nigerian women. *Psychol Rep* 2004; 94(3 Pt 2): 1276–1278.

30. Gebregziabher NK, Netsereab TB, Fessaha YG, et al. Prevalence and associated factors of postpartum depression among postpartum mothers in central region, Eritrea:
a health facility based survey. *BMC Public Health* 2020; 20(1): 1614.

31. Gold KJ, Spangenberg K, Wobil P, et al. Depression and risk factors for depression among mothers of sick infants in Kumasi, Ghana. *Int J Gynaecol Obstet* 2013; 120(3): 228–231.

32. Govender D, Naidoo S and Taylor M. Antenatal and postpartum depression: prevalence and associated risk factors among adolescents’ in KwaZulu-Natal, South Africa. *Depress Res Treat* 2020; 2020: 5364521.

33. Holm-Larsen CE, Madsen FK, Rogathi JJ, et al. Postpartum depression and child growth in Tanzania: a cohort study. *BJOG* 2019; 126(5): 590–598.

34. January J and Chimbari MJ. Prevalence and factors associated with postnatal depression among women in two rural districts of Manicaland, Zimbabwe. *S Afr J Psychiatr* 2018; 24: 1176.

35. January J, Chivanhu H, Chiwara J, et al. Prevalence and the correlates of postnatal depression in an urban high density suburb of Harare. *Cent Afr J Med* 2015; 61(1–4): 1–4.

36. January J, Mutamba N and Maradzika J. Correlates of postnatal depression among women in Zimbabwean semi-urban and rural settings. *J Psychol Afr* 2017; 27(1): 93–96.

37. Kakyo TA, Muliria JK, Mbalinda SN, et al. Factors associated with depressive symptoms among postpartum mothers in a rural district in Uganda. *Midwifery* 2012; 28(3): 374–379.

38. Kerie S, Memberu M and Niguse W. Prevalence and associated factors of postpartum depression in Southwest, Ethiopia, 2017: a cross-sectional study. *BMC Res Notes* 2018; 11(1): 623.

39. Madeghe BA, Kimani VN, Vander Steep A, et al. Postpartum depression and infant feeding practices in a low income urban settlement in Nairobi-Kenya. *BMC Res Notes* 2016; 9(1): 506.

40. Mbarak B, Kilewo C, Kuganda S, et al. Postpartum depression among women with pre-eclampsia and eclampsia in Tanzania; a call for integrative intervention. *BMC Preg Childbirth* 2019; 19(1): 270.

41. Mnisi B, Makin J, Lindeque BG, et al. Postnatal depressive features in mothers of neonates admitted to a neonatal unit at Steve Biko Academic Hospital: the role of sociodemographic and psychosocial factors. *S Afr J Obstet Gynaecol* 2019; 25(3): 89–94.

42. Nakku JE, Nakasi G and Mirembe F. Postpartum major depression at six weeks in primary health care: prevalence and associated factors. *Afr Health Sci* 2006; 6(4): 207–214.

43. Nampijja M, Natamba B, Mpungo R, et al. The burden and risk factors for postnatal depression and depressive symptomatology among women in Kampala. *Trop Doct* 2019; 49(3): 170–177.

44. Necho M, Belete A and Zenebe Y. The association of intimate partner violence with postpartum depression in women during their first month period of giving delivery in health centers at Dessie Town, 2019. *Ann Gen Psychiatr* 2020; 19: 59.

45. Ongeri L, Wanga V, Otieno P, et al. Demographic, psychosocial and clinical factors associated with postpartum depression in Kenyan women. *BMC Psychiatr* 2018; 18(1): 318.

46. Owoeye AO, Aina OF and Morakinyo O. Risk factors of postpartum depression and EPDS scores in a group of Nigerian women. *Trop Doct* 2006; 36(2): 100–103.

47. Pelzter K, Rodriguez VJ, Lee TK, et al. Prevalence of prenatal and postpartum depression and associated factors among HIV-infected women in public primary care in rural South Africa: a longitudinal study. *AIDS Care* 2018; 30(11): 1372–1379.

48. Pingo J, Van den Heuvel LL, Vythylingum B, et al. Probable postpartum hypomania and depression in a South African cohort. *Arch Womens Ment Health* 2017; 20(3): 427–437.

49. Ramchandani PG, Richter LM, Stein A, et al. Predictors of postnatal depression in an urban South African cohort. *J Affect Disord* 2009; 113(3): 279–284.

50. Rogathi JJ, Manongi R, Mushii D, et al. Postpartum depression among women who have experienced intimate partner violence: a prospective cohort study at Moshi, Tanzania. *J Affect Disord* 2017; 218: 238–245.

51. Shitu S, Geda B and Dheresa M. Postpartum depression and associated factors among mothers who gave birth in the last twelve months in Ankesha district, Awi Zone, North West Ethiopia. *BMC Preg Childbirth* 2019; 19(1): 435.

52. Stellenberg EL and Abrahams JM. Prevalence of and factors influencing postnatal depression in a rural community in South Africa. *Afr J Prim Health Care Fam Med* 2015; 7(1): 874.

53. Toru T, Chemir F and Anand S. Magnitude of postpartum depression and associated factors among women in Mizan Aman Town, Bench Maji Zone, Southwest Ethiopia. *BMC Preg Childbirth* 2018; 18(1): 442.

54. Tungchama FP, Obindo JT, Armuya’u AY, et al. Prevalence and sociodemographic correlates of postpartum depression among women attending postnatal and/or Children’s Welfare Clinics in a Tertiary Hospital, Jos, Nigeria. *Sahel Med J* 2018; 21(1): 23–30.

55. Turan B, Stringer KL, Onono M, et al. Linkage to HIV care, postpartum depression, and HIV-related stigma in newly diagnosed pregnant women living with HIV in Kenya: a longitudinal observational study. *BMC Preg Childbirth* 2014; 14: 400.

56. Wemakor A and Mensah KA. Association between maternal depression and child stunting in Northern Ghana: a cross-sectional study. *BMC Public Health* 2016; 16(1): 869.

57. Weobong B, Ten Asbroek AH, Soremekun S, et al. Antenatal and postnatal depression and infant feeding practices in a low income urban settlement in Nairobi-Kenya. *BMC Res Notes* 2016; 9(1): 506.

58. Werner E, Miller M, Osborne LM, et al. Preventing postpartum depression: review and recommendations. *Arch Womens Ment Health* 2015; 18(1): 41–60.
61. Gelaw SM and Bisrat H. The role of ultrasound in determining fetal sex. *Ethiop J Health Dev* 2011; 25(3): 216–221.
62. Clark M. Maternal depression costs society billions each year, new model finds, 2019, https://ccf.georgetown.edu/2019/05/31/maternal-depression-costs-society-billions-each-year-new-model-finds/
63. Zaker J. The hidden financial costs of postpartum depression, 2021, https://www.parents.com/parenting/money/the-financial-costs-of-postpartum-depression/
64. Cleary S, Orangi S, Garman E, et al. Economic burden of maternal depression among women with a low income in Cape Town, South Africa. *BJPsych Open* 2020; 6(3): e36.
65. Hanlon C, Whitley R, Wondimagegn D, et al. Postnatal mental distress in relation to the sociocultural practices of childbirth: an exploratory qualitative study from Ethiopia. *Soc Sci Med* 2009; 69(8): 1211–1219.
66. Kabir ZN, Nasreen HE and Edhborg M. Intimate partner violence and its association with maternal depressive symptoms 6-8 months after childbirth in rural Bangladesh. *Glob Health Action* 2014; 7: 24725.
67. Kita S, Haruna M, Matsuzaki M, et al. Associations between intimate partner violence (IPV) during pregnancy, mother-to-infant bonding failure, and postnatal depressive symptoms. *Arch Womens Ment Health* 2016; 19(4): 623–634.
68. Desta M, Memiah P, Kassie B, et al. Postpartum depression and its association with intimate partner violence and inadequate social support in Ethiopia: a systematic review and meta-analysis. *J Affect Disord* 2021; 279: 737–748.
69. Al Dallal FH and Grant IN. Postnatal depression among Bahraini women: prevalence of symptoms and psychosocial risk factors. *East Mediterr Health J* 2012; 18(5): 439–445.
70. Tolossa T, Fetensa G, Yilma MT, et al. Postpartum depression and associated factors among postpartum women in Ethiopia: a systematic review and meta-analysis, 2020. *Public Health Rev* 2020; 41: 21.
71. McMahon CA, Boivin J, Gibson FL, et al. Older first-time mothers and early postpartum depression: a prospective cohort study of women conceiving spontaneously or with assisted reproductive technologies. *Fertil Steril* 2011; 96(5): 1218–1224.
72. Liabsuetrakul T, Vittayanont A and Pitamungup J. Clinical applications of anxiety, social support, stressors, and self-esteem measured during pregnancy and postpartum for screening postpartum depression in Thai women. *J Obstet Gynaecol Res* 2007; 33(3): 333–340.
73. Chee CY, Lee DT, Chong YS, et al. Confinement and other psychosocial factors in perinatal depression: a translational study in Singapore. *J Affect Disord* 2005; 89(1–3): 157–166.
74. Abdollahi F, Zarghami M, Azhar MZ, et al. Predictors and incidence of post-partum depression: a longitudinal cohort study. *J Obstet Gynaecol Res* 2014; 40(12): 2191–2200.
75. Eakes GG, Burke ML and Hainsworth MA. Middle-range theory of chronic sorrow. *Image J Nurs Sch* 1998; 30(2): 179–184.
76. Goker A, Yanikkerem E, Demet MM, et al. Postpartum depression: is mode of delivery a risk factor. *ISRN Obstet Gynecol* 2012; 2012: 616759.
77. Adama ND, Foumane P, Olen JPK, et al. Prevalence and risk factors of postpartum depression in Yaounde, Cameroon. *Open J Obstet Gynecol* 2015; 5(11): 608–617.
78. Mohammed ES, Mosalem FA, Mahfouz EM, et al. Predictors of postpartum depression among rural women in Minia, Egypt: an epidemiological study. *Public Health* 2014; 128(9): 817–824.
79. Adewuya AO. Early postpartum mood as a risk factor for postnatal depression in Nigerian women. *Am J Psychiatr* 2006; 163(8): 1435–1437.
80. Coleman PK. Resolution of unwanted pregnancy during adolescence through abortion versus childbirth: individual and family predictors and consequences. *J Youth Adolescence* 2006; 35(6): 903–911.