Prevalence and incidence of probable perinatal depression among women enrolled in Option B+ antenatal HIV care in Malawi

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ABSTRACT

Background: Perinatal depression is a common condition of pregnancy and the postpartum period. Depression negatively affects engagement in HIV care, but systematic screening for perinatal depression is not done in most sub-Saharan African countries. Estimating the burden and timing of perinatal depression can help inform medical programs with the current scale-up of HIV care for pregnant women.

Methods: Women (n = 299) initiating antiretroviral therapy for HIV were recruited from a government antenatal clinic in Malawi in 2015–2016 into a cohort study. Probable perinatal depression was assessed at enrollment and at 6 weeks and 3, 6, and 12 months postpartum with the Edinburgh Postnatal Depression Scale (EPDS) and Patient Health Questionnaire-9 (PHQ-9). We estimated point prevalence and incidence of depression as well as concordance between EPDS and PHQ-9 scores.

Results: One in ten women screened positive for probable antenatal depression, whereas 1–6% screened positive postpartum. Sensitivity analyses to account for loss to follow-up suggested that postpartum depression prevalence could have ranged from 1–11%. At postpartum time points, 0–3% of participants screened positive for incident probable depression. EPDS and PHQ-9 scores were concordant for 96% of assessments during antenatal and postpartum visits.

Limitations: Lack of diagnostic psychiatric evaluation precludes actual diagnosis of major depression, and social desirability bias may have contributed to low postpartum scores.

Conclusions: Probable depression was more common during the antenatal period than postpartum among our participants. Given the association between depression and negative HIV outcomes, screening for depression during pregnancy should be integrated into antenatal HIV care.

1. Introduction

Perinatal depression, defined as depression which occurs during pregnancy or the first 12 months postpartum, is common, affecting at least one in ten women (Gaynes et al., 2005). When untreated, perinatal depression can lead to poor outcomes for both mothers and infants. Mothers may experience poor quality of life, impaired functioning, less responsivity and sensitivity to their infants, and death due to suicide (Aaron et al., 2015). Infants of mothers with untreated perinatal depression experience increased risk of low birth weight (Evans et al., 2007), preterm birth (Field et al., 2006; Wisner et al., 2009), behavioral difficulties (Field et al., 2006), malnutrition (Anoop et al., 2004), social interaction difficulties (Luoma et al., 2001; Martins and Gaffan, 2000), and insecure attachment and colic (Akman et al., 2006; Campbell et al., 2004; NICHD Early Child Care Research Network, 1999).

Currently, screening for perinatal depression is not conducted systematically during antenatal, postpartum, or well-child care appointments in most countries in sub-Saharan Africa. Prevalence estimates of perinatal depression in sub-Saharan Africa are higher than most global estimates: in the general population, the estimated prevalence is 11% antenatally and 18% postpartum, and among women living with HIV, approximately 23% suffer symptoms in the antenatal and in the

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postpartum periods (Sawyer et al., 2010; Sowa et al., 2015). Early recognition of perinatal depression among HIV-positive women is imperative given that some women with perinatal depression may not follow through with optimal ART care (Turan et al., 2014), and could benefit from mental health treatment. Malawi, a country in south eastern Africa, has been a leader in the treatment as prevention model of HIV care, particularly through the "Option B+" antiretroviral treatment (ART) program for pregnant and postpartum women (Cohen et al., 2011; World Health Organisation (WHO), 2012). The Option B+ model of perinatal HIV care was endorsed as a WHO policy in 2013, and many countries in sub-Saharan Africa have adopted Option B+ (WHO, 2013). Despite the rapid scale-up of Option B+ for pregnant and postpartum women, perinatal depression has not been assessed longitudinally where Option B+ is active. Implementing systematic screening for perinatal depression in Option B+ HIV care would require data on when during the perinatal period women suffer from the condition.

In the current paper, we estimate the prevalence and incidence of probable perinatal depression through 12 months postpartum among women initiating HIV antiretroviral therapy through the Option B+ program in Malawi. We identify the most commonly reported depression symptoms, consider the influence of missing data on our estimates, and explore factors that might affect measurement of depression severity in this context.

2. Methods

2.1. Study setting and population

Participants were recruited from a government antenatal clinic in Lilongwe, Malawi in 2015-2016. Per the Malawi standard of care for opt-out HIV testing, all women who sought antenatal care were offered HIV testing with two rapid tests (Alere Determine™ and Unigold™). Pregnant women who tested positive for HIV and initiated antiretroviral therapy (tenofovir/lamivudine/efavirenz) through the Option B+ prevention of maternal to child transmission of HIV program were invited to enroll in a cohort study (ClinicalTrials.gov identifier: NCT02249962). More women were available for recruitment than the study could enroll, so study nurses approached as many women with an HIV diagnosis as possible each day to describe what participation in the study would entail and invite them to enroll. Women who chose not to participate or were ineligible received routine antenatal and HIV care through the government clinic. During the enrollment period, over 16,000 women sought antenatal care at Bwaila hospital, of which $n = 935$ tested newly positive for HIV, and study nurses were able to approach about 50% of those women. Of women approached who did not enroll, about 20% were not interested in participating, about 40% had other reasons for not participating, and 40% were ineligible. Eligibility criteria included: pregnant, age ≥ 18 years (or 16–17 years and married), planned to give birth in Lilongwe, and provided informed consent. Study nurses conducted all interviews one-on-one with participants in Chichewa, the predominant local language, in a private room adjacent to the clinic. All women received ART through the study, as well as primary care for them and their infants. Study visits occurred monthly for 6 months, then quarterly thereafter, with depression assessments occurring at enrollment (antenatal), and at week 6 and months 3, 6, and 12 postpartum. All depression assessments were conducted by study nurses aloud because a significant portion of study participants had limited literacy. Study nurses received training on how to administer all study questionnaires, including the depression assessments, but none of the nurses had mental health backgrounds. Most participants were newly diagnosed with HIV; a small portion had a previous positive HIV test but had not yet started ART.

2.2. Measures

At each time point, participants' depression severity was evaluated with the Edinburgh Postnatal Depression Scale (EPDS) and the Patient Health Questionnaire-9 (PHQ-9). The EPDS contains 10 questions about depressive symptoms in the past 7 days, and was designed to detect depression while women are pregnant or postpartum (Cox et al., 1987; Gibson et al., 2009). Anxiety symptoms may be more prominent in perinatal depression compared to major depression that occurs at other times in life (Lee et al., 2007), and the EPDS contains three questions about anxiety symptoms. Each item on the EPDS is scored from 0 to 3, giving an overall score range of 0–30. A previous study validated the EPDS in Chichewa (Stewart et al., 2013), and recommended a score threshold of 6 rather than the typical 13 for a dichotomous cut-point to indicate probable depression (sensitivity: 76.3%, specificity: 74.1%). Thus, in our analyses, women who scored ≥ 6 on the EPDS screened positive for probable depression.

The PHQ-9 is a 9-question instrument that assesses depression in adults, and asks about how often each symptom has occurred in the past 2 weeks. Responses to each item range from 0 (symptom occurred zero days in the past two weeks) to 3 (nearly every day), for an overall score range of 0 to 27. A score of 10 or more is traditionally used as indicative of major depression that requires treatment, with a score of 5–9 suggestive of mild depression (Yawn et al., 2009; Zhong et al., 2014). In the current analyses, a score of 5 or greater on the PHQ-9 was considered a positive screen for probable depression to be consistent with the lower threshold used for the EPDS. The PHQ-9 was translated and back-translated in Chichewa and has been used in multiple neighboring countries, but to date, no validation study of the PHQ-9 has been published in Malawi (Cholera et al., 2014; Hanlon et al., 2015; Pence et al., 2012). Prevalent probable depression was defined as screening positive on the EPDS or PHQ-9 at any given time point during study participation, whereas incident postpartum depression was defined as a positive EPDS or PHQ-9 screen during the postpartum period among women who were previously classified as not meeting depression criteria during the antenatal period. Any woman scoring ≥ 6 on the EPDS, ≥ 5 on the PHQ-9, or who endorsed suicidal ideation was counseled by a study provider and offered a referral to local mental health services.

At enrollment, participants were asked whether they had ever experienced verbal or physical intimate partner violence (IPV), or if they or their immediate family members had a history of depression or anxiety. The self-reported personal history of depression or anxiety was asked as "Do you have any past history of depression or anxiety?", and an analogous question was asked about family history. No information was available on actual clinical diagnoses of psychiatric conditions for participants or their family members.

2.3. Statistical analysis

We present the raw prevalence and incidence proportions for each time period for the PHQ-9 and EPDS with an exact 95%CI. We compared participants' PHQ-9 and EPDS scores to determine how often scores were concordant positive (PHQ-9 ≥ 5 and EPDS ≥ 6), concordant negative (PHQ-9 < 5 and EPDS < 6), or discordant (PHQ-9 ≥ 5/EPDS < 6, or EPDS ≥ 6/PHQ-9 < 5). We calculated Cohen's kappa statistic, proportions of negative and positive agreement, and the prevalence and bias adjusted kappa given that the prevalence of positive probable depression was very low (Byrt et al., 1993; Cohen, 1960). We further categorized each EPDS and PHQ-9 score into no, mild, moderate, or severe symptoms based on score categories from previous studies (Kroenke et al., 2001; Yawn et al., 2009) and compared concordance of EPDS and PHQ-9 scores at a given clinic visit to understand how the symptom severity endorsed for each instrument aligned. From this comparison, we calculated a kappa statistic and weighted kappa (Fleiss et al., 2003). The most and least commonly endorsed items on the EPDS and PHQ-9 are noted as proportions of people who scored > 0

on that item. Three women died during postpartum follow-up (from non-psychiatric or suicide causes) and five women withdrew from the study; their completed EPDS and PHQ-9 scores are included, but they are not in the analysis for the postpartum time points after their deaths or study withdrawal.

2.4. Sensitivity analysis

Although loss to follow-up was in the expected range, in order to gain a fuller understanding of the potential bias introduced by missing data on prevalence estimates, we completed a sensitivity analysis to estimate the prevalence of probable depression we would have observed with complete data. There were two broad reasons for missing data: 1) the participant did not come to the clinic during that study protocol defined visit window, or 2) the participant attended the visit but was not asked the PHQ-9 or EPDS questions due to an error on the part of the study staff. One common reason for the PHQ-9 or EPDS questions not being asked at an attended visit was an adverse birth outcome (miscarriage, stillbirth, or neonatal death). All women, regardless of pregnancy outcome, were supposed to be asked the EPDS and PHQ-9 questions at the same time points. However, operationally the administration of the EPDS and PHQ-9 was linked to the infant's week 6 and month 3, 6 and 12 visits; thus, when no infant was present the depression questions were not asked.

In the sensitivity analysis, we estimated the plausible range of probable postpartum depression prevalence we would have observed with complete data. For all scenarios, we assumed that the prevalence of probable postpartum depression among women who attended clinic with a live infant but were *not* asked the EPDS/PHQ-9 was the same as the observed prevalence among women who completed the EPDS/PHQ-9. To account for the other two groups of missing data (women who attended clinic without a live infant, and women who did not attend clinic), we considered the following three scenarios of low, intermediate, and high depression: 1) In the lowest prevalence scenario, we estimated that women who did not attend clinic had a prevalence of probable depression half that of women who answered the EPDS/PHQ-9 but women with non-live infants who attended clinic had a prevalence equal to that of women who did have scores at that visit; 2) In the intermediate prevalence scenario, women who did not attend clinic or attended but had a non-live infant had a prevalence of probable depression twice as high as women who answered the EPDS/PHQ-9; and 3) In the highest prevalence scenario, women who did not attend clinic or attended but had a non-live infant had a prevalence of probable depression five times as high as women who answered the EPDS/PHQ-9. In our “lowest prevalence” scenario 1, we did not assign a lower probable depression prevalence to the women who had non-live infants based on previous literature that suggests pregnancy losses and infant deaths may be associated with increased maternal depression. (Farren et al., 2016; Gold et al., 2016; Hogue et al., 2015; Toffol et al., 2013) Three women died during postpartum follow-up and five women withdrew from the study; their completed EPDS and PHQ-9 scores are included, but they are not in the analysis for the postpartum time points after their deaths or study withdrawal.

All analyses were conducted in SAS version 9.4 (SAS Institute, Cary, NC, USA).

2.5. Ethical approval

Both the University of North Carolina at Chapel Hill institutional review board and the Malawi National Health Sciences Research Committee approved the S4 study.

3. Results

From May 2015 to June 2016, 299 pregnant women living with HIV were enrolled and initiated ART. Participants had a median age of 26 years (IQR 22–30 years) and presented to antenatal care at a median gestational age of 22 weeks (IQR 18–26 weeks) (Table 1). Most women (94%, $n = 282$) enrolled with a WHO clinical stage of HIV of 1, and 6% ($n = 17$) had stage 2 or 3. Many women (38%, $n = 115$) self-reported a history of depression or anxiety, and 16% ($n = 47$) of women reported a family history of depression or anxiety. One-fifth of participants (19%, $n = 57$) reported ever experiencing physical or verbal intimate partner violence.

Table 1
Participant demographics ($n = 299$).

Characteristic at enrollment	Median (IQR)	Total *N* (%)
Age in years	26 (22–30)	
Weeks gestation	22 (18–26)	
Marital status		
Currently married		263 (88)
Not currently married		36 (12)
Education attained		
None/some primary		172 (58)
Finished at least primary		122 (42)
Employment status		
Unemployed		190 (64)
Employed		109 (36)
Current pregnancy intendedness		
Intended		132 (44)
Not intended		167 (66)
Ever experienced IPV		
No		242 (81)
Yes		57 (19)
Participant history of depression or anxiety		
No		184 (62)
Yes		115 (38)
Family history of depression or anxiety		
No		252 (84)
Yes		47 (16)
WHO HIV Clinical Stage		
Stage 1		282 (94)
Stage 2–4		17 (6)

3.1. Prevalence and incidence of probable perinatal depression

The prevalence of probable perinatal depression at each time point was similar between the EPDS and PHQ-9 (Table 2 and Fig. 1). At antenatal enrollment, 10% (95%CI 7–14%) ($n = 30$) of women screened positive on the EPDS and 13% (CI 9–17%) ($n = 38$) on the PHQ-9. Postpartum, using the EPDS, the prevalence of probable postpartum depression was 2% (CI 1–6%) ($n = 4$) at 6 weeks, 1% (CI 0–4%) ($n = 2$) at 3 months, 3% (CI 1–7%) ($n = 7$) at 6 months, and 6% (CI 3–10%) ($n = 12$) at 12 months. Postpartum prevalence using the PHQ-9 was 2% (CI 0–5%) ($n = 3$), 2% (0–4%) ($n = 3$), 2% (CI 1–5%) ($n = 5$), and 3% (CI 1–7%) ($n = 7$) at the same time points. Scores on both the EPDS and PHQ-9 were lower at all postpartum time points than at enrollment (antenatal).

Table 2
Prevalence of screening positive for depressive symptoms on the EPDS or PHQ-9 at enrollment and postpartum time points.

Time point	EPDS ≥ 6 Prevalence (95% CI)	PHQ-9 ≥ 5 Prevalence (95% CI)
Enrollment ($n = 299$)	10% (7–14%)	13% (9–17%)
Postpartum week 6 ($n = 174$)	2% (1–6%)	2% (0–5%)
Postpartum month 3 ($n = 193$)	1% (0–4%)	2% (0–4%)
Postpartum month 6 ($n = 215$)	3% (1–7%)	2% (1–5%)
Postpartum month 12 ($n = 211$)	6% (3–10%)	3% (1–7%)

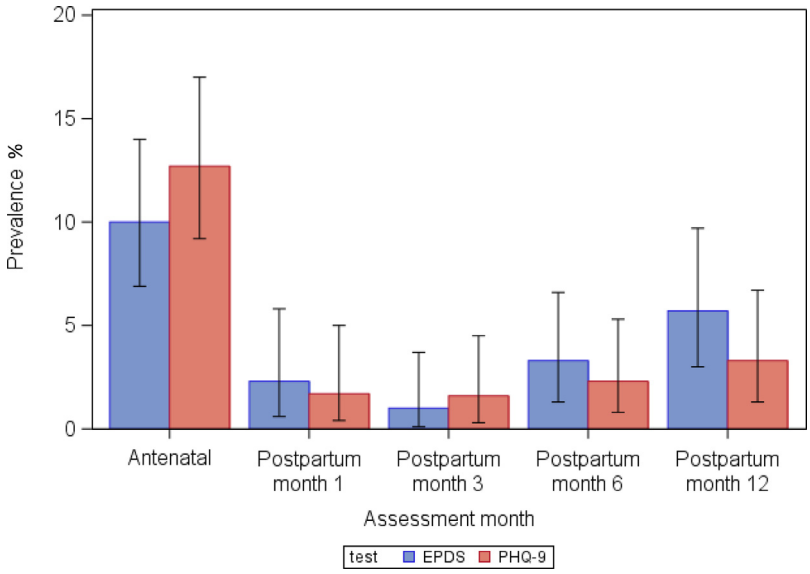

Fig. 1. Prevalence of probable depression and 95% confidence intervals.

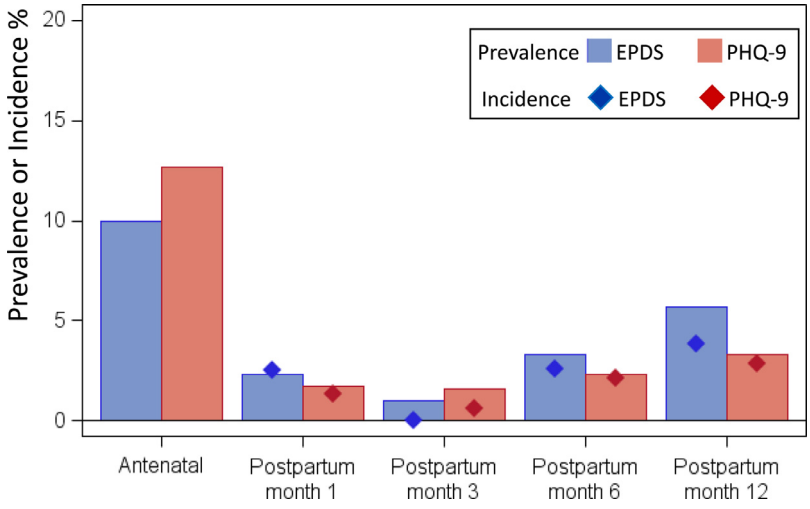

Fig. 2. Prevalence and incidence of probable perinatal depression.

Few women had incident probable postpartum depression (EPDS or PHQ-9 scores above the threshold following scores below the threshold at previous time points). For the EPDS, 16 participants had incident probable postpartum depression: 2.5% (n = 4) at week 6, 0% at month 3, 2.6% (n = 5) at month 6, and 3.8% (n = 7) at month 12 (Fig. 2). Estimated incidence was similar with the PHQ-9: 1.3% (n = 2) at week 6, 0.6% (n = 1) at month 3, 2.2% (n = 4) at month 6, and 2.8% (n = 5) at month 12.

All participants had EPDS and PHQ-9 scores at enrollment, but only 66% (n = 793 of 1196) of expected postpartum EPDS and PHQ-9 scores were collected (range: 58% at postpartum week 6 to 72% at postpartum month 6). At each postpartum time point, approximately one in six participants (17%) was missing depression scores because the woman did not attend clinic. Ten percent of participants attended clinic but were not asked the EPDS or PHQ-9 due to study staff error, and 6% attended clinic but were not asked because the infant was not alive due to miscarriage, stillbirth, or neonatal death. In the "lowest prevalence" scenario of our sensitivity analysis, the point prevalence of probable postpartum depression ranged from 1.0% to 5.1% on the EPDS, and 1.4% to 3.0% on the PHQ-9 (Fig. 3). In our "intermediate prevalence" scenario, the point prevalence of probable postpartum depression ranged from 1.3% to 7.0% on the EPDS and 1.9% to 4.1% on the PHQ-9 across the postpartum period. Our "highest prevalence" scenario yielded an EPDS prevalence range of 1.9–11.1% and PHQ-9 range of 2.9–6.5% across the postpartum period.

3.2. *Agreement between the EPDS and PHQ-9*

The EPDS and PHQ-9 scores had high concordance when using the dichotomous cut-points: 92.6% had concordant negative scores, and 2.7% had concordant positive scores. Of those with discordant scores, 2.3% of participants had an EPDS score ≥ 6 but a PHQ-9 score < 5, and 2.4% had a PHQ-9 score ≥ 5 but an EPDS score < 6. The Cohen's kappa statistic was 0.52, and the prevalence and bias adjusted kappa was 0.91. The proportion of negative agreement across assessments was 0.98, whereas the proportion of positive agreement was 0.54. Comparing categories of depressive symptom severity (none, mild, moderate, severe) between the EPDS & PHQ-9, 80% of participants had concordant scores (Table 3). About 10% of participants endorsed no symptoms on the EPDS but endorsed mild symptoms on the PHQ-9, and about 7% of participants endorsed mild symptoms on the EPDS but endorsed no symptoms on the PHQ-9. The Cohen's kappa statistic was 0.45, and the weighted kappa was 0.53.

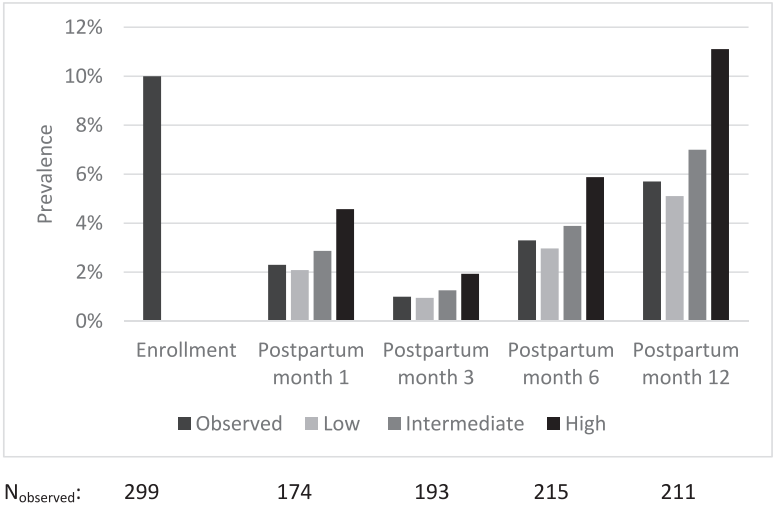

Fig. 3. Sensitivity analysis of probable depression prevalence at postpartum time points on the EPDS, accounting for missing data.

Table 3
Concordance of EPDS & PHQ-9 scores when using categories based on no, mild, moderate, or severe depressive symptoms.

Depressive symptom severity	None EPDS: 0	Mild EPDS: 1-5	Moderate EPDS: 6-9	Severe EPDS: 10+	TOTAL
None PHQ-9: 0	69.1%	5.9%	0.7%	0%	75.7%
Mild PHQ-9: 1-4	9.2%	8.3%	1.6%	0%	19.1%
Moderate PHQ-9: 5-9	0.6%	1.6%	1.4%	0.6%	4.2%
Severe PHQ-9: 10+	0%	0.2%	0%	0.7%	0.9%
TOTAL	79.0%	15.9%	3.7%	1.4%	100%

Kappa = 0.45; weighted kappa = 0.53

3.3. Commonly endorsed depressive symptoms

The most frequently endorsed items on the EPDS were "things have been getting on top of me," which 9.1% (n = 99) of participants cited, and feeling sad or miserable (8.8%, n = 96) (supplementary data, Table 4). The least common symptom was thoughts of self-harm (1.3%, n = 14). Three items on the EPDS measure anxiety symptoms (items 3, 4, and 5), which were endorsed by 7.0%, 3.5% and 2.5% of participants, respectively. On the PHQ-9, the most commonly endorsed symptom was depressed mood (11.5%, n = 126), with the somatic symptoms of fatigue, change in appetite, or sleep disturbances the next most common (10.0%, 9.9%, and 8.2%, respectively). The least frequently endorsed item on the PHQ-9 was psychomotor agitation (1.9%, n = 21), and 2.4% (n = 26) of participants endorsed thoughts of being better off dead or suicidal ideation.

4. Discussion

Our study measured probable perinatal depression on the EPDS and PHQ-9 during the antenatal and 12-month postpartum period among women living with HIV in Malawi who enrolled in the Option B+ ART program. We estimated about one in eight women suffered from probable depression antenatally, while only about 1–6% of women met criteria postpartum.

Overall, our antenatal and postpartum prevalence estimates for probable depression were lower than expected based on prior literature. Our estimate of 10–13% probable antenatal depression prevalence fell at the low end of the range of prior estimates from other sub-Saharan African countries (8.3–48.7%) (Adewuya et al., 2007; Peltzer et al., 2016), and below a prevalence estimate among women living with HIV in Africa (23.4%) (Sowa et al., 2015). For probable postpartum depression, our prevalence estimates (2–5%) were lower than the estimated 22.5% prevalence among women living with HIV in sub-Saharan Africa (Sowa et al., 2015), even in a sensitivity analysis with a potentially strong assumption that participants who were lost to follow up or who had an adverse birth outcome had a prevalence of probable depression five times as high as the participants who answered the EPDS and PHQ-9 questions at a postpartum time point. Of note, the prevalence of antenatal depression may vary by pregnancy trimester and over the postpartum period, with some data showing lower prevalence postpartum than antenatal (Gavin et al., 2005). Multiple possibilities exist to explain our estimates. Our participants might have been particularly optimistic and resilient, given that they were women who agreed to enroll in a study with continued participation despite recently receiving an HIV diagnosis and confirmation that they were pregnant – a potentially complicated time for social and health reasons. We do not have attitudinal data to compare the women who agreed to participate in our study and those who refused participation but were eligible.

The low prevalence and incidence of perinatal depression, particularly postpartum, must be interpreted in light of the instruments (both screening tools) and the context. Screening tools have imperfect sensitivity and specificity, even if validated in the local language. The EPDS and the PHQ-9 may not be adequately capturing the burden of probable perinatal depression in our population due to imperfect translation of words or concepts into the Chichewa versions. "Depression" itself may mean something different to women in Malawi, and may manifest in ways outside of the scope of the EPDS or PHQ-9. Cognitive interviews on women's comprehension of the questions on the EPDS and PHQ-9, and on the concept of depression would be particularly informative. Not all of our participants were fully literate, so study staff read the EPDS and PHQ-9 questions aloud to all participants and recorded their answers, but the questions and differentiating between answer choices might have been confusing to participants. In a similar setting in Uganda, the performance of a clinician-administered PHQ-9 was high (Akena et al., 2013). It is possible that study nurse training for EPDS and PHQ-9 administration and interpretation in our setting was inadequate and could have contributed to the observed scores.

In our context, fewer women screened positive for probable depression postpartum than antenatally, yet many women endorsed situations indicative of psychosocial vulnerability, such as personal or family history of depression or anxiety, and history of IPV. The lower postpartum scores could reflect multiple processes. Women may have

under-reported their symptoms in part because most health care visits focus on the mother antenatally but on the infant postpartum. Social desirability bias may have also played a role, in which participants may have answered what they thought the interviewer wanted to hear: it is common in Malawi to say that "things are fine" or that "I have managed," which could have led to participants under-reporting depressive symptoms. Additionally, among new mothers, the prevalence of probable perinatal depression was higher postpartum than antenatally, which was in contrast to women with prior children, who had higher antenatal prevalence compared to postpartum. We did not evaluate these differences statistically due to sample size. Further information on the accuracy of the perinatal depression prevalence, the importance of other psychosocial factors, and on the cost-effectiveness of depression treatment will be important for discussions about adopting perinatal depression screening in Malawi. In sum, our results suggest the need for data from the local context to determine the optimal process, timing, and setting for implementing screening initiatives.

Specifically considering depression services as part of HIV care, depression could be assessed during HIV testing, ART refill visits, and the perinatal period. Depression is treatable, reduces HIV care engagement among non-pregnant adults in higher-resource settings (Beer and Skarbinski, 2014; Chibanda et al., 2014; Ciesla and Roberts, 2001; Gonzalez et al., 2011; Ickovics et al., 2001; Kacanek et al., 2010; Kessler et al., 2003; Leserman, 2008; Lyketsos et al., 1993; Pence et al., 2007; Whetten et al., 2013), and has a negative or null association with engagement in HIV care in sub-Saharan African settings (Chibanda et al., 2014; Cholera et al., 2017; Cichowitz et al., 2017; Nakimuli-Mpungu et al., 2012; Yotebieng et al., 2017). Among perinatal women living with HIV, consistent use of ART is important to achieve viral suppression and minimize risk of transmitting HIV to infants (Jourdain et al., 2007). Systematically screening for and treating depression could provide an opportunity to enhance both HIV and mental health outcomes for persons suffering from depression. However, depression service implementation would require a careful and sustainable approach given that many clinics in resource-limited settings are busy, with staff who would be asked to add another item to their routine care provision. Mental health training for staff and resources for persons suffering from depression would be necessary and are current gaps in some countries that have integrated mental health services into primary care (Baron et al., 2016). Additionally, in the current era of 'test and treat', in which all persons living with HIV are eligible for ART, community-based health workers trained in mental health care may be an important consideration to help reach individuals who delay or fail to initiate ART, or those who miss ART refill appointments, as they may have mental health concerns that could benefit from support. In our study, we could not collect depression scores from women who did not attend visits, and these women may have had a higher (or lower) burden of depression than the observed women.

Both the EPDS and PHQ-9 scores provided similar results regarding probable depression. The EPDS has been validated in Malawi, whereas the PHQ-9 has not but has been used in research and clinical settings, and has been validated in several other sub-Saharan African populations (Cholera et al., 2014; Hanlon et al., 2015; Pence et al., 2012; Stewart et al., 2013). On both tools, one of the most frequently endorsed symptoms was that of depressed mood or sadness, and one of the least frequently endorsed symptoms was that of self-harm or suicidal ideation. Many participants endorsed the somatic symptoms present on the PHQ-9 (but absent from the EPDS), which can be important manifestations of depressive symptoms (Andersen et al., 2015; Halbreich et al., 2007; Nylen et al., 2013; Williamson et al., 2015). However, significant physiological and social changes occur during pregnancy and the postpartum period; these changes may influence somatic depressive symptoms of energy level, sleep quality, and appetite. Thus, some women may have endorsed the PHQ-9 somatic symptoms due in part to physiological and social changes related to pregnancy and a new infant.

Thoughts of self-harm or of being better off dead were noted by more participants on the PHQ-9 than when asked about self-harm alone on the EPDS. The wording of the question on the PHQ-9 is broader in that it includes thoughts of self-harm or that the person would be better off dead, rather than only thoughts of self-harm as asked on the EPDS. Additionally, the PHQ-9 asks about a longer time period (past 2 weeks), whereas the EPDS asks about the past 7 days. It is possible that both the different time period and the scope of the question influenced participants' responses to these questions.

The EPDS features three questions about anxiety symptoms that can be used as an anxiety sub-scale (Brouwers et al., 2001; Matthey et al., 2013). The prominence of anxiety symptoms is one way in which perinatal depression may be considered different from non-perinatal major depression (Gaynes et al., 2005; Meltzer-Brody, 2011). Antenatally, the anxiety symptoms were between the 3rd and 9th most commonly endorsed items, and postpartum they were between the 4th and 9th most common. The symptom of "blaming myself unnecessarily when things go wrong" was the leading anxiety symptom noted by the women at any time point. But anxiety symptoms were less frequently endorsed among the women than "things have been getting on top of me" or being sad.

Limitations: Unfortunately, our study did not feature any diagnostic or inter-rater reliability assessments for the depression scores, so we are unable to quantify the extent to which measurement error may have influenced our estimates. Assignment of patients to providers at each time point was essentially random; participants were not triaged to certain providers based on suspected depression status. For capacity building and administration fidelity, future research on depression could consider periodic refresher training of study staff or clinic providers on how to administer and interpret the EPDS and PHQ-9 as well as nested validation or calibration sub-studies. Our sensitivity analysis to account for unobserved depression scores may not have fully captured the true burden of depression at the postpartum time points, which may be higher among women who had adverse pregnancy outcomes, or those who were lost to follow up soon after enrollment. We do not have detailed information about why women missed certain postpartum visits, or why some failed to return after enrollment.

In summary, in a sample of women living with HIV and engaged in HIV care through Option B+, we found that one in ten women antenatally and one in twenty postpartum screened positive for probable depression. Although our estimates of perinatal depression were lower than in some comparable populations, a large proportion of the women reported characteristics consistent with heightened mental health vulnerability, including history of depression and anxiety, family history, and IPV. Efforts to scale up Option B+ treatment programs should give careful consideration to the psychosocial supports that patients will need to remain successfully engaged in care for the long term.

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Conflicts of interest

Mina Hosseinipour has participated in an HIV prevention advisory meeting for Viiv health care.

None of the other authors have any actual or potential conflicts of interest to disclose.

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Supplementary materials

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