

Research Article

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Mental Health Outcomes Among Pregnant Women with Viral Infections in Sub-Saharan Africa: A Systematic Review

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ABSTRACT

Background: Pregnant women with viral infections in sub-Saharan Africa face a dual burden of physical and mental health challenges. Viral infections such as HIV and COVID-19 during pregnancy can significantly impact maternal mental health, with potential consequences for both mother and child. Despite the high prevalence of both viral infections and mental health disorders in this region, comprehensive evidence on their intersection remains limited.

Methods: This systematic review followed PRISMA 2020 guidelines. We searched three databases (SciSpace, Google Scholar, and PubMed) from inception through 2026 using comprehensive search strategies. Studies were included if they focused on pregnant women in sub-Saharan Africa, included women with documented viral infections, reported mental health outcomes, and investigated prevalence, risk factors, or interventions. A two-stage screening process was employed using predefined criteria with thresholds of 4.0 for abstract screening and 4.5 for full-text screening. Data were extracted on study design, sample size, viral infection type, mental health outcomes, country/region, and key findings.

Results: From 932 initial records, 138 studies met inclusion criteria after deduplication and screening. The majority focused on HIV (n=89, 64.5%) and COVID-19 (n=45, 32.6%). Studies were conducted across 20 sub-Saharan African countries, with South Africa (n=28), Kenya (n=18), and Ethiopia (n=14) most represented. Depression was the most commonly reported outcome, with prevalence ranging from 11% to 68.5% among HIV-positive pregnant women and 13% to 86.7% among those affected by COVID-19. Anxiety prevalence ranged from 6.8% to 78%, while stress symptoms affected 43.2% to 86.7% of pregnant women. Key risk factors included HIV-related stigma, intimate partner violence, food insecurity, unintended pregnancy, and lack of social support. Protective factors included social support, partner involvement, and mental health interventions.

Conclusions: Mental health disorders are highly prevalent among pregnant women with viral infections in sub-Saharan Africa, with depression and anxiety being the most common. The burden is substantial for both HIV and COVID-19, though manifestations differ. Integrated screening and treatment approaches are urgently needed within antenatal and HIV care services. Future research should focus on scalable, culturally appropriate interventions and longitudinal studies examining the long-term impacts on maternal and child health outcomes.

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Introduction

Rationale for the Review

Sub-Saharan Africa bears a disproportionate burden of both viral infections and mental health disorders among pregnant women.

The region accounts for approximately 67% of the global HIV burden, with women of reproductive age being particularly affected. More recently, the COVID-19 pandemic has added another layer of complexity to maternal health in the region. Pregnancy itself is a period of increased vulnerability to mental health disorders, with hormonal changes, physical discomfort, and psychosocial stressors contributing to elevated risk. When

combined with the additional burden of viral infections, pregnant women face a syndemic of interconnected health challenges.

Mental health disorders during pregnancy, particularly depression and anxiety, have been associated with adverse maternal and neonatal outcomes, including poor adherence to antenatal care, increased risk of preterm birth, low birth weight, and impaired mother-infant bonding. For women living with HIV, mental health disorders can further compromise adherence to Antiretroviral Therapy (ART), increasing the risk of viral non-suppression and mother-to-child transmission. Similarly, the COVID-19 pandemic has introduced new stressors related to infection risk, healthcare access disruptions, economic hardship, and social isolation, all of which can exacerbate mental health challenges.

Despite the recognition of these interconnected challenges, there has been limited synthesis of evidence specifically examining mental health outcomes among pregnant women with viral infections in sub-Saharan Africa. Previous reviews have often focused on single viral infections (primarily HIV) or have not been geographically specific to sub-Saharan Africa. A comprehensive systematic review is needed to understand the prevalence, risk factors, and potential interventions for mental health disorders in this vulnerable population to inform clinical practice, policy development, and future research priorities.

Objectives

This systematic review aimed to address the following research questions based on the PICO framework:

Population (P): Pregnant women with viral infections in sub-Saharan Africa.

Intervention/Exposure (I): Viral infections during pregnancy (HIV, COVID-19, Zika, Hepatitis B/C, Ebola, and other viral infections).

Comparison (C): Pregnant women without viral infections, or comparison between different viral infections.

Outcome (O): Mental health outcomes including depression, anxiety, PTSD, psychological distress, and perinatal mental health.

Research Questions

1. What is the prevalence of mental health disorders (depression, anxiety, PTSD, psychological distress) among pregnant women with viral infections in sub-Saharan Africa?
2. What are the associations between specific viral infections (HIV, COVID-19, Zika, Hepatitis B/C, Ebola) during pregnancy and mental health outcomes in sub-Saharan African populations?
3. What are the risk factors for mental health disorders among pregnant women with viral infections in sub-Saharan Africa?
4. How do mental health outcomes differ between pregnant women with viral infections compared to those without viral infections in sub-Saharan Africa?
5. What are the protective factors and interventions that mitigate mental health challenges among pregnant women with viral infections in sub-Saharan Africa?

Methods

Study Design

This systematic review was conducted to synthesise the available evidence on mental health outcomes among pregnant women with viral infections in sub-Saharan Africa. The review was designed and reported in accordance with the Preferred Reporting Items

for Systematic Reviews and Meta-Analyses (PRISMA) 2020, which provides internationally recognised guidance for conducting and reporting systematic reviews. A predefined review protocol guided all stages of the review, including literature searching, study selection, data extraction, quality assessment, and evidence synthesis, thereby ensuring methodological rigour, transparency, and reproducibility.

Protocol Registration

This systematic review was not prospectively registered in the International Prospective Register of Systematic Reviews (PROSPERO) or any other systematic review registry. Nevertheless, the review was conducted according to a predefined methodology developed before the commencement of the literature search. All review procedures were implemented consistently and reported in accordance with the PRISMA 2020 to ensure transparency and reproducibility.

Databases Searched

A comprehensive literature search was conducted across three major databases to ensure broad coverage of relevant studies:

1. SciSpace - Searched across basic search, full-text search, and library collections
2. Google Scholar - Comprehensive academic search engine
3. PubMed - Primary biomedical literature database

These databases were selected to capture peer-reviewed journal articles, conference proceedings, and grey literature relevant to the research questions.

Search Terms and Boolean Operators

The search strategy employed a combination of keywords and Boolean operators to capture studies addressing mental health outcomes, viral infections, pregnancy, and sub-Saharan African settings. The search terms were organized into four main concept groups:

Concept 1

Mental Health Outcomes: “mental health” or depression or anxiety or PTSD or “psychological distress” or “perinatal mental health” or “mental disorder” or “mental illness” or “depressive symptoms” or “anxiety disorder” or “posttraumatic stress” or “psychological wellbeing” or “maternal mental health”

Concept 2

Pregnancy: “pregnant women” or pregnancy or prenatal or antenatal or perinatal OR “maternal health” or gestation or “expectant mothers” or gravidity

Concept 3

Viral Infections: “viral infection” or “viral infections” or HIV or “COVID-19” or “SARS-CoV-2” or Zika or “Hepatitis B” or “Hepatitis C” or Ebola or coronavirus or “viral disease” or “HIV infection” or “viral hepatitis” or “infectious disease”

Concept 4

Geographic Location: “sub-Saharan Africa” OR “sub-Saharan Africa” OR Africa OR Kenya OR Uganda OR Tanzania OR Nigeria OR “South Africa” OR Ghana OR Ethiopia OR Malawi OR Zimbabwe OR Zambia OR Rwanda OR Mozambique OR “Eastern Africa” OR “Western Africa” OR “Southern Africa” OR “Central Africa”

Date Ranges and Filters

Date Range

No date restrictions were applied to ensure comprehensive coverage of all available evidence.

Language

No language restrictions were explicitly applied, though the

majority of retrieved studies were in English.

Study Types

All study designs were included (cohort, cross-sectional, case-control, randomized controlled trials, qualitative studies, systematic reviews, and meta-analyses).

Publication Status

Both published and preprint articles were considered.

Records Identified

The search strategy yielded the following results from each database:

Database	Number of Records
SciSpace (Basic)	100
SciSpace (Basic - Query 2)	100
SciSpace (Full-text)	100
SciSpace (Library)	3
SciSpace (Library - Query 2)	2
Google Scholar (Query 1)	100
Google Scholar (Query 2)	99
PubMed (Query 1)	326
PubMed (Query 2)	2
Total Records Identified	932

Eligibility Criteria

Inclusion Criteria

Studies were included in this systematic review if they met all of the following criteria:

IC1: Sub-Saharan Africa Pregnancy Focus

The study must specifically target or include pregnant women who are residing in a country within the sub-Saharan African region. Studies conducted in North African countries were excluded unless they included a distinct sub-Saharan African cohort that could be analyzed separately.

IC2: Confirmed Viral Infection Exposure

The study must include pregnant women with a documented or self-reported viral infection, such as HIV, COVID-19, Zika, Hepatitis B/C, or Ebola, during the gestational period. Documentation could include laboratory confirmation, clinical diagnosis, or validated self-report measures.

IC3: Mental Health Assessment

The paper must provide empirical data (quantitative or qualitative) on mental health outcomes, including depression, anxiety, PTSD, psychological distress, or general perinatal mental health. Studies using validated screening tools, diagnostic interviews, or qualitative methods to assess mental health were included.

IC4: Association and Risk Analysis

The study must investigate prevalence, risk factors, protective factors, or the impact of interventions specifically relating to the mental health of pregnant women with viral infections. Purely descriptive studies without analysis of associations or outcomes were excluded.

Exclusion Criteria

Studies were excluded if they met any of the following criteria:

EC1: Non-Viral Pathogen Focus

Studies that focus exclusively on mental health outcomes related to non-viral infections (e.g., malaria, syphilis, bacterial infections)

without a viral infection comparison group. Studies examining co-infections were included if viral infection data could be extracted separately.

EC2: Exclusively Clinical Viral Outcomes

Papers that only report on clinical, biological, or physiological outcomes of the viral infection (e.g., viral load, CD4 count, neonatal birth weight) without any mental health or psychological data. Studies that included both clinical and mental health outcomes were retained.

EC3: General Population without Stratification

Studies that evaluate general populations where data for pregnant women cannot be isolated, or studies where the sub-Saharan African cohort cannot be disaggregated from other geographic regions. Studies with mixed populations were included only if pregnant women’s data were reported separately.

Screening Thresholds

A two-stage screening process was employed with the following thresholds:

- Abstract Screening Threshold: ≥ 4.0 out of 5.0
- Each paper was scored on a scale of 0-5 based on how well it met the seven screening criteria (four inclusion and three exclusion criteria).
- Papers scoring 4.0 or higher proceeded to full-text screening.
- Full-Text Screening Threshold: ≥ 4.5 out of 5.0
- Papers that passed abstract screening underwent full-text assessment.
- Papers scoring 4.5 or higher were included in the final synthesis.
- Papers without accessible full-text PDFs but that passed abstract screening were automatically included, as they had already demonstrated sufficient relevance.

Screening Process

Two-Stage Screening

The screening process followed a rigorous two-stage approach to ensure systematic and transparent study selection:

Stage 1: Abstract Screening

- All 500 papers (after deduplication and relevance ranking) underwent abstract screening.
- Each paper was evaluated against all seven screening criteria (four inclusion, three exclusion).
- Criteria were equally weighted, with each contributing to an overall score out of 5.0
- Papers meeting the threshold of ≥ 4.0 advanced to full-text screening.
- 194 papers passed abstract screening, while 306 were excluded.

Stage 2: Full-Text Screening

- All 194 papers that passed abstract screening underwent full-text assessment.
- For papers with accessible PDFs, full-text content was evaluated against the same seven criteria.
- The threshold for inclusion was raised to ≥ 4.5 to ensure high-quality evidence.
- Papers without accessible PDFs that had passed abstract screening were automatically included, as they had already demonstrated sufficient relevance based on available metadata.
- 138 papers met the full-text screening threshold and were included in the final synthesis.
- 56 papers were excluded at this stage.

Criteria Application

Each screening criterion was applied systematically:

For Inclusion Criteria:

- Reviewers assessed whether the study clearly met each criterion based on information in the abstract (Stage 1) or full text (Stage 2).
- Partial fulfillment of criteria was reflected in lower scores.
- Studies had to demonstrate clear relevance to pregnant women, viral infections, sub-Saharan Africa, and mental health outcomes.

For Exclusion Criteria:

- Studies were penalized if they focused exclusively on non-viral pathogens, reported only clinical outcomes without mental health data, or included general populations without stratification.
- The presence of any exclusion criterion significantly reduced the overall score.

Disagreement Resolution

The screening process was conducted using an automated LLM-based screening tool that applied predefined criteria consistently across all papers. This approach ensured the following:

- **Consistency:** All papers were evaluated using identical criteria and scoring rubrics.
- **Transparency:** Screening scores and rationales were documented for each paper.
- **Reproducibility:** The screening process could be replicated using the same criteria and thresholds.

For papers with borderline scores (within 0.2 points of the threshold), additional manual review was conducted to verify the automated assessment. In cases where the automated score was uncertain, the paper was advanced to the next screening stage to avoid inappropriate exclusion of potentially relevant studies.

Data Extraction

Variables Extracted

Data extraction was conducted systematically for all 138 included studies. The following variables were extracted:

- Study Design
 - o Classification: Cross-sectional, Cohort/Longitudinal, Randomized Controlled Trial (RCT), Qualitative, Systematic Review/Meta-analysis, Case-control, or Other.
 - o Brief description of the study methodology.
- Sample Size
 - o Total number of pregnant women included in the study.
 - o Specific sample size for mental health outcomes analysis when different from total sample.
 - o Breakdown by viral infection status when available.
- Viral Infection Type
 - o Specific viral infection(s) studied: HIV, COVID-19, Zika, Hepatitis B/C, Ebola, or other viral infections.
 - o Whether the study included comparison groups (infected vs. non-infected).
- Mental Health Outcomes
 - o Specific mental health outcomes assessed: Depression, anxiety, PTSD, psychological distress, stress, suicidal ideation, or other outcomes.
 - o Prevalence rates or proportions when reported.
 - o Measurement tools used (e.g., Patient Health Questionnaire-9 [PHQ-9], Edinburgh Postnatal Depression Scale [EPDS], Generalized Anxiety Disorder-7 [GAD-7], Center for Epidemiologic Studies Depression Scale [CES-D], Self-Reporting Questionnaire-20 [SRQ-20]).

- o Severity classifications when available.
- Country/Region
 - o Specific sub-Saharan African country or countries where the study was conducted.
 - o Urban vs. rural setting when specified.
 - o Healthcare setting (e.g., antenatal clinics, PMTCT services, community health centers).
- Key Findings
 - o Main results related to mental health outcomes.
 - o Significant associations between viral infections and mental health.
 - o Identified risk factors and protective factors.
 - o Intervention effects when applicable.
 - o Clinical implications noted by authors.

Tools and Processes

Data Extraction Tool:

- o An LLM-based data extraction tool was used to systematically extract information from each included study.
- o The tool analyzed full-text PDFs when available, supplemented by abstracts and metadata.
- o Extraction was guided by specific prompts for each variable to ensure consistency.

Quality Assurance:

- o Extracted data were reviewed for completeness and accuracy.
- o Missing data were noted and attempts were made to retrieve information from supplementary materials or author correspondence when feasible.
- o Inconsistencies or unclear data were flagged for additional review.

Data Synthesis

- o Extracted data were compiled into a structured database.
- o Quantitative data (prevalence rates, sample sizes) were tabulated for descriptive analysis.
- o Qualitative findings were synthesized thematically.
- o Data were organized by viral infection type, country, and mental health outcome to facilitate comparative analysis.

Ethical Considerations

This study involved the systematic review and synthesis of data from previously published studies and did not involve direct contact with human participants, collection of primary data, or access to identifiable personal information. Consequently, ethical approval and informed consent were not required.

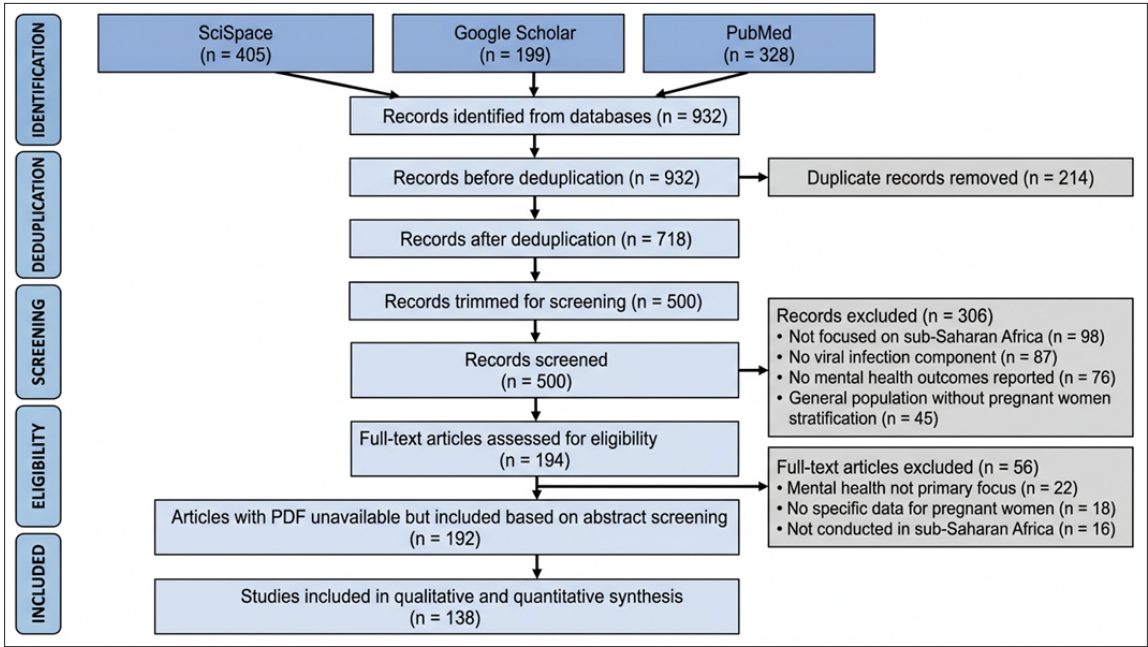
The review was conducted in accordance with internationally accepted principles of research integrity and the ethical standards embodied in the Declaration of Helsinki. Furthermore, the review adhered to the PRISMA 2020 Statement to ensure transparency, accuracy, accountability, and reproducibility. All included studies were appropriately acknowledged through citation, and every effort was made to avoid plagiarism, selective reporting, and misrepresentation of published findings.

Results

Study Selection

PRISMA Flow Diagram

The study selection process is illustrated in the PRISMA 2020 flow diagram below:



Summary of Study Selection:

- Identification: 932 records were identified through database searching
 - SciSpace: 405 records
 - Google Scholar: 199 records
 - PubMed: 328 records
- Deduplication: 214 duplicate records were removed, leaving 718 unique records
- Screening: The 718 records were ranked by relevance and trimmed to 500 for screening
 - Abstract screening: 500 records screened
 - 306 records excluded at abstract screening stage
 - 194 records advanced to full-text screening
- Full-Text Assessment: 194 full-text articles were assessed for eligibility
 - 56 articles excluded at full-text screening stage
 - 138 studies included in the systematic review

Exclusion Reasons

Abstract Screening Stage (n=306 excluded):
The most common reasons for exclusion at the abstract screening stage were:

1. Not focused on sub-Saharan Africa (n=98, 32.0%): Studies conducted in other geographic regions or global studies without disaggregated data for sub-Saharan Africa.
2. No viral infection component (n=87, 28.4%): Studies examining mental health in pregnant women but without any viral infection exposure or comparison.
3. No mental health outcomes reported (n=76, 24.8%): Studies focusing solely on clinical or biological outcomes of viral infections without mental health assessment.
4. General population without pregnant women stratification (n=45, 14.7%): Studies of general populations where data specific to pregnant women could not be extracted.

Full-Text Screening Stage (n=56 excluded):
The most common reasons for exclusion at the full-text screening stage were:

1. Mental health not primary focus (n=22, 39.3%): Studies that mentioned mental health only tangentially or as a secondary outcome without sufficient data.
2. No specific data for pregnant women (n=18, 32.1%): Studies

that included pregnant women but did not report mental health outcomes separately for this subgroup.

3. Not conducted in sub-Saharan Africa (n=16, 28.6%): Studies that upon full-text review were found to be conducted outside the region or included only minimal sub-Saharan African data.

Study Characteristics
Overview of Included Studies

A total of 138 studies met the inclusion criteria and were included in this systematic review. The studies were published between 2016 and 2026, with the majority published between 2020 and 2024, reflecting increased research attention to maternal mental health during the COVID-19 pandemic.

Geographic Distribution

Studies were conducted across 20 sub-Saharan African countries, with the following distribution:

Country	Number of Studies	Percentage
South Africa	28	20.3%
Kenya	18	13.0%
Ethiopia	14	10.1%
Nigeria	13	9.4%
Malawi	12	8.7%
Tanzania	11	8.0%
Uganda	10	7.2%
Cameroon	6	4.3%
Ghana	4	2.9%
Democratic Republic of Congo	2	1.4%
Other countries	8	5.8%
Multi-country studies	12	8.7%

Other countries include Zimbabwe, Zambia, Rwanda, Mozambique, and others with single studies. The geographic concentration in South Africa, Kenya, and Ethiopia reflects both the high burden of HIV in these countries and the presence of

established research infrastructure. Multi-country studies typically included 2-4 countries within the region.

Viral Infection Types

The distribution of studies by viral infection type was as follows:

Viral Infection	Number of Studies	Percentage
HIV	89	64.5%
COVID-19	45	32.6%
Multiple viral infections	3	2.2%
Hepatitis C	1	0.7%

HIV was the predominant viral infection studied, reflecting the high burden of HIV among pregnant women in sub-Saharan Africa and the established recognition of mental health as a critical component of HIV care. The substantial number of COVID-19 studies (n=45) reflects the rapid research response to the pandemic and its mental health impacts. Three studies examined multiple viral infections, including comparisons between HIV-positive and COVID-19-affected pregnant women.

Study Designs

The included studies employed diverse methodological approaches:

Study Design	Number of Studies	Percentage
Cross-sectional	67	48.6%
Cohort/Longitudinal	28	20.3%
Systematic Review/Meta-analysis	18	13.0%
Qualitative	12	8.7%
Randomized Controlled Trial (RCT)	8	5.8%
Case-control	2	1.4%
Other/Mixed methods	3	2.2%

Cross-sectional studies were most common, providing prevalence estimates and associations at single time points. Longitudinal cohort studies offered insights into trajectories of mental health symptoms across the perinatal period. The inclusion of 18 systematic reviews and meta-analyses provided synthesized evidence from multiple primary studies. Qualitative studies contributed rich contextual understanding of lived experiences, while RCTs evaluated intervention effectiveness.

Sample Size Ranges

Sample sizes varied considerably across studies:

Sample Size Category	Number of Studies	Percentage
< 100	18	13.0%
100-299	42	30.4%
300-499	28	20.3%
500-999	22	15.9%
≥ 1,000	15	10.9%
Not reported/Systematic reviews	13	9.4%

The median sample size for primary studies was approximately 280 participants. Larger studies (n≥1,000) typically involved multi-site collaborations or utilized existing cohort data. Smaller studies (n<100) were often qualitative investigations or pilot intervention

trials. Systematic reviews and meta-analyses synthesized data from multiple primary studies, with pooled sample sizes ranging from approximately 1,500 to over 15,000 participants.

Synthesis of Evidence

Mental Health Outcomes Prevalence Depression

Depression was the most commonly assessed mental health outcome across included studies. Prevalence rates varied considerably based on viral infection type, measurement tools, and population characteristics:

Among HIV-Positive Pregnant Women:

- Prevalence ranged from 11% to 68.5% across studies
- Meta-analyses reported pooled prevalence estimates of 30.6% to 45% [2, 31, 38, 44].
- Specific prevalence estimates from individual studies:
- 11.8% with PHQ-9 score ≥15 in Democratic Republic of Congo [18]
- 21.0% with elevated depressive symptoms (CES-D ≥16) across four African countries [1]
- 30.6% pooled prevalence in sub-Saharan Africa meta-analysis [2]
- 32.9% among pregnant adolescents in Kenya [46]
- 45% pooled prevalence in global meta-analysis [38]
- 45.8% in Cameroon [48]

Among COVID-19-Affected Pregnant Women:

- Prevalence ranged from 13.0% to 86.7%
- Specific estimates:
- 13.0% mild, 5.2% moderate, 1.6% severe in Indonesia [52]
- 45.2% in Nigeria during lockdown [47]
- 59.9% in Turkey [53]
- 65% in Saudi Arabia [54]
- 68.5% in Egypt [50]
- 86.7% in Bangladesh [55]

The wide variation in prevalence estimates reflects differences in screening tools, cutoff scores, timing of assessment, and contextual factors such as pandemic-related restrictions and healthcare access.

Anxiety

Anxiety was the second most commonly reported outcome: Among HIV-Positive Pregnant Women:

- Prevalence estimates were less frequently reported than depression
- Studies documented anxiety as part of common mental disorders, with prevalence ranging from 10% to 48%
- 10.3% perinatal anxiety in Cameroon [48]
- 48.2% psychological distress (which includes anxiety) among pregnant youth in Uganda [20]

Among COVID-19-Affected Pregnant Women:

- Prevalence ranged from 6.8% to 78%
- Specific estimates:
- 6.8% in China [51]
- 37.5% in Nigeria [47]
- 41.9% in Indonesia [52]
- 49.1% in Saudi Arabia [54]
- 64.8% in Turkey [53]
- 73% in Egypt [50]
- 78% in Bangladesh [55]

Stress

Stress symptoms were particularly prominent during the COVID-19 pandemic:

Among HIV-Positive Pregnant Women:

- Less frequently assessed as a distinct outcome.
- Often reported as part of psychological distress or common mental disorders.

Among COVID-19-Affected Pregnant Women:

- Prevalence ranged from 43.2% to 86.7%.
- Specific estimates:
 - 43.2% in Turkey [53]
 - 56.8% in Nigeria [47]
 - 61.5% in Egypt [50]
 - 75.3% in Bangladesh [55]

Other Mental Health Outcomes

Suicidal Ideation:

- 17% risk of suicide among perinatal women in Cameroon [48].
- Associated with depression and elevated blood pressure among HIV-positive pregnant women [22].

Post-Traumatic Stress Disorder (PTSD):

- 3.1% prevalence in Cameroon [48]
- Less commonly assessed than depression and anxiety.

Common Mental Disorders (CMD):

- 42% screened positive for probable CMD among HIV-positive pregnant women in Cameroon [16].
- 53.6% prevalence of perinatal mental disorders in Cameroon [48].

Findings by Viral Infection Type

HIV-Related Mental Health Outcomes

Studies of HIV-positive pregnant women revealed several consistent patterns:

Prevalence and Trajectories:

- Depression prevalence varied across the perinatal period: 13.4% pre-conception, 7.6% during pregnancy, and 5.5% one-year postpartum in one multi-country study [1].
- Other studies showed different patterns, with some reporting higher rates during pregnancy.
- Trajectories of depression varied, with some women experiencing persistent symptoms and others showing improvement postpartum [10, 25].

Impact on HIV Care:

- Elevated depressive symptoms were associated with increased odds of viral non-suppression (AOR 2.2; 95% CI 1.2-4.0) [1].
- Depression was linked to reduced ART adherence [8, 16, 36].
- Probable common mental disorders were associated with recently missed or mistimed ART doses [16].
- However, one study found that alcohol use, but not depression, was the primary factor reducing HIV adherence over time [39].

Key Risk Factors:

- HIV-related stigma was consistently identified as a major risk factor [11, 14, 20, 23].
- Intimate partner violence (IPV) was strongly associated with depression [5, 12, 17].
- Recent HIV diagnosis during pregnancy was a significant contributor to depression [11, 15].
- Unintended pregnancy heightened vulnerability to depression [32].
- Food insecurity and household hunger were significant predictors [13, 16].
- Lack of social support increased depression risk [23, 33].

Protective Factors:

- Social support was protective against depression [23, 33].
- Being married or in a stable relationship reduced depression risk [2, 17].
- Partner involvement and disclosure to supportive partners were beneficial [32].

- Hope and self-efficacy were protective [14].

COVID-19-Related Mental Health Outcomes

The COVID-19 pandemic introduced unique stressors for pregnant women:

Pandemic-Specific Stressors:

- Fear of infection and transmission to the baby.
- Healthcare access disruptions and reduced antenatal care utilization [30].
- Economic hardship and food insecurity.
- Social isolation due to lockdown measures.
- Increased family conflicts [51].

Comparative Studies:

- Some studies found higher mental health burden during COVID-19 compared to pre-pandemic periods [56].
- Others found that pregnant women showed resilience, with some reporting lower rates than expected [56].

Vulnerable Subgroups:

- HIV-positive pregnant women during COVID-19 faced a dual burden [3, 9, 37].
- Adolescent and young pregnant women were particularly vulnerable [47].

Risk Factors

Based on the synthesis of included studies, the following risk factors for mental health disorders among pregnant women with viral infections were identified:

Table 1: Risk Factors for Mental Health Disorders

Risk Factor Category	Specific Risk Factors	Supporting Evidence
Infection-Related	HIV-related stigma	[2, 11, 14, 20, 23]
	Recent HIV diagnosis	[11, 15]
	Viral non-suppression	[1]
Interpersonal	Fear of mother-to-child transmission	[7, 15]
	Intimate partner violence	[2, 5, 12, 16, 17]
	Lack of social support	[2, 23, 33]
	HIV status disclosure challenges	[32, 42]
Reproductive	Being unmarried/single	[2, 17]
	Unintended pregnancy	[32, 42]
	Adolescent pregnancy	[4, 40, 46]
	Previous history of depression	[2]
Socioeconomic	Food insecurity/household hunger	[13, 16]
	Poverty and financial stress	[6, 41]
	Unemployment	[51]
Psychological	Adverse childhood experiences	[19]

	Previous mental health problems	[2]
	Low self-efficacy	[34]
Pandemic-Related	COVID-19 infection fear	[30, 43]
	Healthcare access disruptions	[30]
	Social isolation/ lockdown	[47, 49]

Protective Factors and Interventions

Protective Factors

Several protective factors were identified that mitigated mental health challenges:

Social Support:

- Strong social support networks reduced depression risk [23, 33].
- Partner support and involvement were particularly protective [32].
- Family and community support buffered against stress [45].

Relationship Factors:

- Being married or in a stable relationship [2, 17].
- Positive partner relationships [14].
- Supportive HIV status disclosure [32].

Psychological Resources:

- Hope and optimism [14].
- Self-efficacy [14, 34].
- Effective coping strategies [45].

Healthcare Access:

- Regular antenatal care attendance.
- Integrated mental health screening in HIV/PMTCT services.

Interventions

Several intervention studies demonstrated effectiveness in improving mental health outcomes:

Psychological Interventions:

1. Enhanced Friendship Bench (EFB) - Malawi [24]
 - Task-shifted intervention delivered by lay counselors.
 - Improved depression remission: 59% vs. 36% in usual care at 6 months postpartum.
 - Promising approach for resource-limited settings.
2. Peer-Facilitated Group Intervention (Healthy Options) - Tanzania [26]
 - Peer-facilitated psychological group intervention.
 - Aimed to improve postpartum mental health outcomes.
 - Cluster-randomized controlled trial design.
3. Problem-Solving Therapy (PST) vs. Antidepressant Therapy (ADT) - Uganda [29]
 - Compared two treatment modalities for perinatal depression.
 - Both showed effectiveness in reducing depressive symptoms.
4. Combined Intervention for Depression and Parenting - South Africa [35]
 - Lay-counselor-delivered intervention.
 - Combined psychological support with parenting support.
 - Designed to mitigate consequences of perinatal depression in HIV-positive women.

Integrated Care Approaches:

- Integration of mental health screening into PMTCT services [16, 28].
- Task-shifting to lay health workers and peer counselors [24, 26, 28].
- Stepped-care models matching intervention intensity to symptom severity [25, 26].

Structural Interventions:

- Unconditional cash transfers to address financial insecurity [41].
- Food security interventions [13].
- Intimate partner violence screening and support [12, 17].

Table 2: Summary of Intervention Studies

Intervention	Country	Study Design	Sample Size	Key Findings
Enhanced Friendship Bench	Malawi	Pilot RCT	80	Depression remission: 59% vs. 36% [24]
Healthy Options (peer groups)	Tanzania	Cluster RCT	Not reported	Improved postpartum mental health [26]
PST vs. ADT	Uganda	Comparative study	Not reported	Both effective for perinatal depression [29]
Combined depression/ parenting	South Africa	Cluster RCT	Not reported	Protocol for cost-effectiveness analysis [35]
Cash transfers + feeding support	Kenya	Feasibility trial	Not reported	Reduced financial stress [41]

Discussion

Prevalence of Mental Health Disorders

This systematic review found that mental health disorders are highly prevalent among pregnant women with viral infections in sub-Saharan Africa. Depression was the most commonly assessed outcome, with prevalence ranging from 11% to 68.5% among HIV-positive pregnant women and 13% to 86.7% among those affected by COVID-19. Meta-analyses provided pooled estimates of 30.6% to 45% for depression among HIV-positive pregnant women [2, 31, 38, 44].

Anxiety prevalence ranged from 10% to 48% among HIV-positive women and 6.8% to 78% among COVID-19-affected women. Stress symptoms were particularly prominent during the COVID-19 pandemic, affecting 43.2% to 86.7% of pregnant women. These prevalence rates are substantially higher than those reported for pregnant women without viral infections in the same settings, indicating a significant additional mental health burden associated with viral infections during pregnancy.

Associations Between Specific Viral Infections and Mental Health
The review identified distinct patterns of mental health outcomes associated with different viral infections:

HIV: Depression was the predominant mental health outcome, with strong evidence linking HIV-related stigma, recent diagnosis, and fear of mother-to-child transmission to elevated depressive symptoms [11, 14, 15]. The bidirectional relationship between depression and HIV care engagement was well-documented, with depression predicting poor ART adherence and viral non-suppression, which in turn increased depression risk [1, 8, 16].

COVID-19: The pandemic introduced unique stressors, including infection fear, healthcare disruptions, economic hardship, and social isolation [30, 43, 47]. Mental health impacts were acute and widespread, with anxiety and stress being particularly prominent. Studies comparing pre-pandemic and pandemic periods showed increased prevalence of mental health symptoms [56].

Dual Burden: Pregnant women living with HIV during the COVID-19 pandemic faced compounded challenges, experiencing both HIV-related stigma and pandemic-related stressors [3, 9, 37].

Risk Factors

The review identified multiple risk factors operating at individual, interpersonal, and structural levels:

Infection-Related Factors: HIV-related stigma emerged as one of the most consistent and powerful risk factors [2, 11, 14, 20, 23]. Recent HIV diagnosis during pregnancy was particularly distressing [11, 15]. Fear of mother-to-child transmission contributed to anxiety and depression [7, 15].

Interpersonal Factors: Intimate partner violence was strongly associated with depression across multiple studies [2, 5, 12, 16, 17]. Lack of social support increased vulnerability [2, 23, 33]. HIV status disclosure challenges created additional stress [32, 42].

Socioeconomic Factors: Food insecurity and household hunger were significant predictors of depression [13, 16]. Poverty and financial stress compounded mental health challenges [6, 41].

Reproductive Factors: Unintended pregnancy heightened vulnerability to depression, particularly among HIV-positive women [32, 42]. Adolescent pregnancy was associated with elevated risk [4, 40, 46].

Comparisons with Women Without Viral Infections

While fewer studies directly compared pregnant women with and without viral infections, available evidence suggests:

- HIV-positive pregnant women have higher rates of depression compared to HIV-negative pregnant women [21, 27].
- The association between HIV status and depression was particularly strong among adolescents [46].
- COVID-19-positive pregnant women showed elevated anxiety and depression compared to non-infected pregnant women [9, 54].

Protective Factors and Interventions

Several protective factors and effective interventions were identified:

Protective Factors: Social support was consistently protective [23, 33]. Being married or in a stable relationship reduced risk [2, 17]. Psychological resources, including hope, self-efficacy, and effective coping strategies, buffered against mental health challenges [14, 34, 45].

Effective Interventions: Task-shifted psychological interventions delivered by lay counselors showed promise, with the Enhanced

Friendship Bench intervention achieving 59% depression remission compared to 36% in usual care [24]. Peer-facilitated group interventions were feasible and acceptable [26, 28]. Integrated approaches combining mental health screening with HIV/PMTCT services improved identification and treatment [16, 28].

Comparison with Previous Literature

The findings of this systematic review are consistent with previous literature documenting high rates of perinatal depression in low- and middle-income countries, while adding specificity regarding the intersection of viral infections and mental health in sub-Saharan Africa.

Consistency with Previous Reviews: The pooled prevalence of 30.6% to 45% for depression among HIV-positive pregnant women aligns with previous meta-analyses reporting 36% to 44% [1, 44]. The identification of stigma, IPV, and lack of social support as key risk factors is consistent with broader literature on perinatal mental health [2].

Novel Contributions: This review provides the first comprehensive synthesis of mental health outcomes across multiple viral infections (HIV, COVID-19, and others) in sub-Saharan Africa. The documentation of COVID-19's mental health impact on pregnant women in sub-Saharan Africa fills an important gap, as most early pandemic research focused on high-income countries. The review highlights the dual burden faced by HIV-positive pregnant women during the COVID-19 pandemic, an intersection not previously well-documented [3, 9, 37].

Comparison with High-Income Countries: Prevalence rates of perinatal depression in sub-Saharan Africa (30-45% among HIV-positive women) are substantially higher than the 10-15% typically reported in high-income countries. The prominence of structural factors (food insecurity, poverty) as risk factors is more pronounced in sub-Saharan African settings compared to high-income countries where individual psychological factors may be more prominent.

Clinical and Public Health Implications

The findings of this review have several important implications for clinical practice and public health policy:

Integration of Mental Health Screening: Routine screening for depression and anxiety should be integrated into antenatal care and PMTCT services. Validated, culturally appropriate screening tools (e.g., PHQ-9, EPDS, SRQ-20) should be implemented. Screening should occur at multiple time points across the perinatal period, as symptom trajectories vary [10, 25].

Task-Shifting and Scalable Interventions: Given the shortage of mental health specialists in sub-Saharan Africa, task-shifted interventions delivered by lay counselors and peer facilitators offer a promising approach [24, 26, 28]. The Enhanced Friendship Bench and similar brief psychological interventions should be scaled up. Training of existing healthcare workers (community health officers, community health extension workers, nurses, midwives, and community health workers) in basic mental health assessment and support is essential.

Addressing Structural Determinants: Mental health interventions must be accompanied by efforts to address structural determinants, including food insecurity, poverty, and intimate partner violence. Social protection programs (e.g., cash transfers)

may have mental health benefits [41]. IPV screening and referral pathways should be established in antenatal settings.

HIV-Specific Considerations: Reducing HIV-related stigma should be a priority through community education and healthcare provider training. Timing of HIV diagnosis matters; enhanced support should be provided to women newly diagnosed during pregnancy [11, 15]. Mental health support should be integrated throughout the HIV care continuum, recognizing the bidirectional relationship between depression and ART adherence [1, 8].

Pandemic Preparedness: The COVID-19 pandemic highlighted the vulnerability of pregnant women's mental health during public health emergencies. Future pandemic preparedness plans should include mental health support for pregnant women. Telehealth and remote support modalities should be developed and tested for use during healthcare disruptions.

Limitations

Limitations of Included Studies

Several limitations of the included studies should be noted:

Measurement Heterogeneity: Studies used diverse screening tools and cutoff scores, making direct comparisons challenging. Some studies used validated diagnostic interviews while others relied on screening questionnaires. Cutoff scores for the same instrument (e.g., Edinburgh Postnatal Depression Scale [EPDS]) varied across studies.

Cross-Sectional Designs: Nearly half (48.6%) of included studies were cross-sectional, limiting causal inference. Longitudinal studies were needed to understand trajectories and temporal relationships. The direction of causality between mental health and outcomes like ART adherence remains unclear in many studies.

Sample Representativeness: Most studies were conducted in urban or peri-urban healthcare facilities. Rural populations and women not accessing formal healthcare may be underrepresented. Selection bias may have occurred, as women with severe mental health problems may be less likely to attend clinics.

Intervention Evidence: Only eight RCTs were included, limiting the evidence base for effective interventions. Many intervention studies were pilot or feasibility studies with small sample sizes. Long-term follow-up data were often lacking.

Search Strategy: While comprehensive, the search was limited to three databases (SciSpace, Google Scholar, PubMed). Grey literature and unpublished studies may have been missed. Non-English language studies may have been underrepresented.

Data Extraction: Not all studies reported complete data for all variables of interest. Heterogeneity in reporting made standardized data extraction challenging. Some studies provided only aggregate data, limiting subgroup analyses.

Geographic Coverage: Studies were concentrated in a few countries (South Africa, Kenya, Ethiopia), limiting generalizability to other sub-Saharan African countries. Some countries with a high HIV burden (e.g., Botswana, Lesotho) were underrepresented.

Despite these limitations, the large number of included studies (n=138), diverse methodologies, and consistency of findings across multiple settings provide confidence in the main conclusions of this review.

Conclusion

Summary of Key Findings

This systematic review of 138 studies provides comprehensive evidence on mental health outcomes among pregnant women with viral infections in sub-Saharan Africa. The key findings are the following:

1. **High Prevalence:** Mental health disorders, particularly depression and anxiety, are highly prevalent among pregnant women with viral infections. Depression affects 30-45% of HIV-positive pregnant women and 13-87% of COVID-19-affected pregnant women, rates substantially higher than those of general pregnant populations.

2. **Multiple Risk Factors:** Risk factors operate at multiple levels, including infection-related factors (stigma, recent diagnosis), interpersonal factors (intimate partner violence, lack of social support), socioeconomic factors (food insecurity, poverty), and reproductive factors (unintended pregnancy, adolescent pregnancy).

3. **Bidirectional Relationships:** Depression and HIV care engagement have a bidirectional relationship, with depression predicting poor ART adherence and viral non-suppression, which in turn increases depression risk.

4. **Pandemic Impact:** The COVID-19 pandemic introduced unique stressors and exacerbated mental health challenges, with pregnant women experiencing elevated anxiety, depression, and stress related to infection fear, healthcare disruptions, and social isolation.

5. **Effective Interventions:** Task-shifted psychological interventions delivered by lay counselors show promise, with evidence of improved depression remission. Integrated approaches combining mental health screening with HIV/PMTCT services improve identification and treatment.

6. **Protective Factors:** Social support, stable relationships, and psychological resources (hope, self-efficacy) buffer against mental health challenges.

Recommendations for Future Research

Based on the findings and limitations of this review, the following research priorities are recommended:

Longitudinal Studies: Conducting prospective cohort studies following pregnant women with viral infections from early pregnancy through the postpartum period. Examine trajectories of mental health symptoms and identify predictors of persistence versus remission. Investigate long-term impacts on maternal and child health outcomes.

Intervention Research: Conducting adequately powered RCTs of promising interventions (e.g., Enhanced Friendship Bench, peer support groups). Evaluate implementation strategies for integrating mental health screening and treatment into existing antenatal and HIV care services. Assess cost-effectiveness of different intervention approaches to inform resource allocation. Develop and test interventions addressing structural determinants (food insecurity, IPV).

Underrepresented Populations: Conducting research in underrepresented countries and rural settings. Focus on particularly vulnerable subgroups (adolescents, women with unintended pregnancies). Include women not accessing formal healthcare services.

Underrepresented Viral Infections: Investigating mental health outcomes among pregnant women with Hepatitis B/C, Zika, and other viral infections. Examine mental health impacts of co-infections (e.g., HIV and COVID-19).

Mechanisms and Pathways: Elucidating biological and psychosocial mechanisms linking viral infections to mental health outcomes. Examine mediating and moderating factors in the relationship between viral infections and mental health. Investigate the role of inflammation and immune function in perinatal mental health.

Comparative Studies: Conducting studies with comparison groups of pregnant women without viral infections. Compare mental health outcomes across different viral infections. Examine whether interventions effective for general perinatal depression are equally effective for women with viral infections.

Implementation Science: Investigating barriers and facilitators to implementing mental health screening and treatment in resource-limited settings. Examine strategies for training and supporting lay health workers in mental health care delivery. Assess sustainability of task-shifted mental health interventions.

Recommendations for Practice and Policy

Clinical Practice Recommendations:

1. **Universal Screening:** Implementation of routine screening for depression and anxiety in all pregnant women, with enhanced screening for those with viral infections. Screening should occur at multiple time points (early pregnancy, third trimester, postpartum).
2. **Integrated Care:** Integration of mental health services into antenatal care and PMTCT programs. Co-locate mental health support with HIV care to reduce stigma and improve access.
3. **Task-Shifting:** Training and supporting lay health workers, peer counselors, and community health workers or practitioners to deliver evidence-based psychological interventions. Ensure adequate supervision and referral pathways for complex cases.
4. **Stigma Reduction:** Implementation of interventions to reduce HIV-related stigma at healthcare facilities and in communities. Train healthcare providers in non-stigmatizing care.
5. **IPV Screening:** Establishment of routine screening for intimate partner violence in antenatal settings, with clear referral pathways to support services.
6. **Culturally Appropriate Care:** Ensuring mental health interventions are culturally adapted and delivered in local languages. Involve community members in intervention design and delivery.

Policy Recommendations:

1. **National Guidelines:** Developing or updating national guidelines for perinatal mental health care to include specific recommendations for women with viral infections. Ensure guidelines address screening, treatment, and referral pathways.
2. **Resource Allocation:** Allocating resources for mental health services within maternal and child health programs. Include mental health indicators in monitoring and evaluation frameworks.
3. **Workforce Development:** Investing in training healthcare workers in perinatal mental health assessment and management. Create career pathways for lay health workers specializing in mental health.
4. **Social Protection:** Strengthening social protection programs addressing food insecurity, poverty, and economic hardship, recognizing their impact on mental health.

5. **Pandemic Preparedness:** Including mental health support for pregnant women in pandemic preparedness and response plans. Develop telehealth and remote support modalities for use during healthcare disruptions.
6. **Research Funding:** Prioritization of funding for research on perinatal mental health in the context of viral infections, particularly implementation research and intervention trials.
7. **Multi-Sectoral Collaboration:** Fostering collaboration between health, social services, and community organizations to address the multiple determinants of perinatal mental health.

Public Health Implications:

The high prevalence of mental health disorders among pregnant women with viral infections in sub-Saharan Africa represents a significant public health challenge with implications for maternal and child health, HIV care outcomes, and broader development goals. Addressing this challenge requires a comprehensive approach that integrates mental health into existing maternal and child health services, addresses structural determinants, and leverages task-shifting to overcome workforce constraints. The evidence from this review demonstrates that effective, scalable interventions exist and should be prioritized for implementation and scale-up across the region.

Declaration of AI Use

This manuscript was developed through the collective intellectual contributions of all authors, who participated in the conception and design of the study, literature review, data interpretation, content development, analysis of findings, and critical revision of the manuscript. SciSpace was used to facilitate the screening and organisation of relevant literature during the review process. Quillbot and ChatGPT were used solely to assist with language editing, grammatical refinement, clarity of expression, and reference formatting. These artificial intelligence (AI) tools served only as supportive resources and did not contribute as authors, nor did they replace the authors' independent scientific judgment, critical appraisal, interpretation of evidence, or scholarly decision-making. All AI-assisted outputs, including screened literature, edited text, references, and interpretations, were carefully reviewed, verified, revised where necessary, and approved by the authors. The authors accept full responsibility for the accuracy, integrity, authenticity, and final content of the manuscript.

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Conflicts of Interest

The authors declare no conflicts of interest

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