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A Systematic Review on Mental Disorders among Pregnant Adolescents in Sub-Saharan Africa.

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ABSTRACT
Background and purpose
Adolescent pregnancy is a critical public health issue in sub-Saharan Africa (SSA), with ramifications that transcend beyond maternal and child health to include severe mental health (MH) difficulties. Despite heightened focus on perinatal mental health worldwide, pregnant teenagers continue to be an inadequately researched demographic in Sub-Saharan Africa. This systematic review and meta-analysis aimed to gather current evidence about the kinds, risk factors, and therapies related to prevalent mental health issues among pregnant adolescents in Sub-Saharan Africa.
Methods
In accordance with PRISMA criteria, an extensive search was performed across five databases: SCOPUS, Web of Science, PsycINFO, PubMed, and African Journals Online (AJOL), encompassing research published from 2012 to 2022. Eligible papers were peer-reviewed and presented quantitative data on mental health outcomes in pregnant adolescents aged 10 to 19 years across Sub-Saharan Africa. Data extraction concentrated on research attributes, prevalence rates, risk variables, and kinds of interventions. A narrative synthesis was performed, supplemented with a random-effects meta-analysis of papers presenting prevalence data on certain mental health problems.
Results
Thirty-two research fulfilled the inclusion criteria, including various nations and contexts throughout Sub-Saharan Africa. The meta-analysis indicated a combined prevalence of 28.5% (95% CI 25.5–31.4) for depression, 25.6% (95% CI 22.8–28.3) for anxiety, 20.5% (95% CI 18.2–22.8) for suicidal thoughts, and 21.7% (95% CI 19.0–24.4) for PTSD. Principal risk factors were insufficient social support, HIV status, socioeconomic deprivation, early initiation of sexual activity, and stigma. A limited number of research (n=7) assessed therapies, the majority of which were psychological in nature. The therapies demonstrated slight decreases in depressed and anxiety symptoms; however, methodological constraints, such as small sample numbers and insufficient follow-up, hindered conclusive determinations of efficacy.
Conclusion
Pregnant adolescents in Sub-Saharan Africa endure a significant and often overlooked burden of mental health issues, exacerbated by social and structural vulnerabilities. The lack of context-specific therapies and the variability of mental health assessment instruments underscore significant deficiencies in research and service delivery. There is an urgent requirement for culturally relevant, evidence-based treatments and longitudinal studies to guide policy and practice. Incorporating mental health assessment and treatment into teenage reproductive health services is crucial for enhancing both short-term and long-term outcomes for this vulnerable demographic.

Keywords: *psychological, Adolescent pregnancy, Depression, Mental health, Sub-Saharan Africa*

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I. BACKGROUND TO THE STUDY

Mental diseases have a high incidence and morbidity rate globally (Patel et al., 2018). In Sub-Saharan Africa (SSA), they are a leading cause of disability, accounting for 19% of all YLDs (Erskine et al., 2017). After back pain, severe depressive episodes and panic attacks are major contributors to disability in the region. Years Lived with Disability (YLDs) due to mental illness in SSA are projected to increase by 130% by 2050, from 20 to 45 million, potentially constituting about two-thirds (67 million YLDs) of all non-communicable disease YLDs in the region (Charlson et al., 2014).

This burden not only affects individuals but also families and communities. The global economic impact is expected to reach US$16 trillion over the next two decades (Bloom et al., 2012). Comorbidities such as cardio-metabolic disorders often coexist with serious psychological illnesses (Gelaye et al., 2016). There are also established associations between HIV/AIDS, severe pain, and poor mental health (Uebelacker et al., 2015), with

bidirectional relationships observed between mental illness and substance abuse, which elevate risks of accidents and injuries (Charlson et al., 2014).

Mental health policies remain low priority in SSA due to the demands of communicable diseases and hunger (Mugisha et al., 2016). Mental health funding is only 0.62% of total health expenditure, with limited services largely confined to metropolitan areas. Treatment gaps exceed 90%. WHO's Comprehensive Plan (2013–2020) urged countries to update mental health plans, integrate services into community settings, and strengthen research capacity (Charlson et al., 2014). A significant issue is the lack of mental health research in SSA (Saxena et al., 2014).

Perinatal mental problems are a pressing public health issue in low and middle-income countries (Howard et al., 2014), manifesting during or after pregnancy. These include common mental disorders like OCD, panic disorder, general anxiety, phobias, as well as severe mental disorders (SMDs) such as bipolar disorder, schizophrenia, and delusional disorders (Kieling et al., 2011). Generalized anxiety, OCD, severe depression, and panic attacks frequently occur in the first and third trimesters. Bipolar and psychotic disorders may recur during pregnancy though they rarely begin then. Mood disorders are the most prevalent in the postnatal period (Lwidiko, 2018), including post-natal blues, bipolar mania, and severe depression (O'Connor et al., 2018). Postnatal psychosis, the most common psychotic manifestation, can present as psychotic depression, dementia, or organic psychosis (Copeland et al., 2015).

DSM-5 states that both mood and psychotic disorders may begin during pregnancy or within four weeks after childbirth (APA Report, 2013). Prenatal severe depression is characterized by sadness, irritability, and cognitive impairments, with possible delusions centred on foetal well-being. Postnatal psychosis features delusions about the baby, paranoia, and behavioural irregularities. A global review confirmed that perinatal mental disorders are more frequent in LMICs than in high-income countries (Fisher et al., 2018). In SSA, prenatal depression prevalence ranges from 8.3–41% and postnatal depression from 3.5–34.7% (Adewuya et al., 2018; Rochat et al., 2018).

Adolescents are particularly vulnerable (Burns, 2016). Those aged 10–19 years comprise 23% of SSA's population (Adolescent Demographics, 2020; UNICEF, 2019), with half of all mental health disorders developing by age 14 and 75% by age 24 (Kessler et al., 2017). PMH in youth affects long-term physical and mental health (Eyere and Thapar, 2014; Copeland et al., 2015). Despite high risks, data on adolescent mental disorders in SSA remains limited (WHO, 2019; Eriskine et al., 2017; Atitola, 2015; Omigbodun, 2016), and most child and adolescent mental health research is still conducted in HICs.

One meta-analysis on common mental disorders included just a single SSA study using the General Health Questionnaire (Silva et al., 2020).

SSA has some of the highest rates of teenage pregnancy worldwide; about 1 in 5 females aged 10–19 become pregnant. These pregnancies occur amid an HIV epidemic, with 1.5 million HIV-positive adolescents in the region (UNAIDS, 2019). Mental health issues have been independently reported among adolescents living with HIV (Mellis et al., 2013; Vreeman et al., 2017) and among pregnant adolescents (Dahmen et al., 2019; Siegel and Brandon, 2014). Teenage parents face the dual burden of adolescent development and parenting. They also contend with stigma, HIV transmission risks, and medication adherence (Lowenthal et al., 2014).

These overlapping burdens may intensify mental illness. Mental illness and teenage pregnancy may have a bidirectional relationship (Siegel and Brandon, 2014). Poor mental health can increase risky behaviour (e.g., unprotected sex), potentially resulting in pregnancy, which in turn can worsen mental health. Parental mental health affects child development (Kingston et al., 2015; Dahmen et al., 2019), yet little is known about mental illness among adolescents experiencing both pregnancy and HIV. Given high teenage pregnancy rates, many subgroups may already be affected by mental health disorders.

Emotional disorders such as depression and anxiety frequently emerge during adolescence and are leading global causes of illness and disability in teens (Kassebaum et al., 2017). These disorders impair functioning and, in severe cases, pose suicide risks (Bachmann, 2018). In SSA, trauma from violence, poverty, infectious disease (e.g., HIV), and high adolescent pregnancy rates contributes to mental health challenges (Anderson, 2010; Anderson et al., 2014; Lund et al., 2010). Given the frequency of adolescent mental health problems and the use of trans-diagnostic interventions in LMICs, this review focuses on anxiety, depression, trauma, and suicidal behaviour (WHO, 2017).

In high-income countries, teenage mothers experience significant stress from interpersonal conflict, financial hardship, and developmental changes (Hymas and Girard, 2018). Common mental disorders impair functioning and increase the risk of behavioural and mental problems in children (Hodgkinson et al., 2014). A study on low-income teens revealed that nearly 50% of depressed pregnant adolescents had a repeat pregnancy within two years representing a 40% increased risk compared to non-depressed peers (Lesinskienė et al., 2025), which further compounds physical and mental health risks.

Adolescents show poor engagement with mental health services. Challenges exist in identifying at-risk youth, diagnosing disorders, and ensuring they receive treatment (Tse et al., 2024). To address these challenges,

this review aimed to (1) describe the types of mental health disorders experienced by pregnant adolescents in SSA, (2) identify their risk factors, and (3) determine effective interventions.

II. METHODS

The Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) standards were followed in this systematic review (Hutton et al., 2015). The PRISMA framework facilitated transparency and methodological rigour by directing the systematic identification, screening, eligibility assessment, and inclusion of research. This methodology was implemented to improve the repeatability and reliability of the results, especially considering the little and diverse data about adolescent mental health in Sub-Saharan Africa.

Search strategy

A thorough literature search was performed across five principal databases: SCOPUS, Web of Science, PsycINFO, PubMed, and African Journals Online (AJOL), to locate peer-reviewed papers pertinent to the review. A systematic application of key keywords and phrases (see Table 1) was employed across all search platforms. Utilising various databases enhances coverage and diminishes the likelihood of overlooking relevant research, in contrast to depending on a one source. SCOPUS and PubMed are prominently utilised resources for systematic reviews (Bramer et al., 2013). The review encompassed all qualifying research published from 2012 to 2022.

Table 1- Search Terms

Constructs	Search terms
Adolescent pregnancy	*"Adolescent pregnancy" OR "teen pregnancy" OR "adolescent pregnancy" OR "young maternal age"*
Mental health	*"Depression" OR "Anxiety" OR "Mental health" OR "psychiatric" OR "HIV" "psychosis" OR "schizophrenia" OR "bipolar"*
Interventions	*"Psychosocial" OR "psychological"*
Setting	Sub-Saharan Africa

Eligibility criteria

All publications retrieved from the database searches satisfied the PICOS (comparisons, participants, outcomes, study design and interventions,) requirements for possible inclusion. The exclusion and inclusion criteria are described in full on Table 2 below.

Table 2: Description of the Inclusion and Exclusion Criteria

Variables	Descriptions
Population	*Participants who live in nations in SSA as defined by the World Bank Country and Lending Groups. Individuals who are pregnant or have been pregnant throughout youth (10–19 years; includes teenage dads) presently or previously.*
Intervention	*Psychosocial; psychological (psychotherapy), psychosocial (playgroups, care, school-based treatments, social support), physical (medical interventions), economic (i.e., material and economic assistance).*
Comparator	*All forms of comparators, such as standard care/practice, no intervention, and additional interventions not specified above.*
Outcomes	*Depression, PTSD, anxiety, suicidality, and/or self-harm are all valid markers of common mental disorders.*
Study designs	*Trials using a randomised control group, Randomized control trials in clusters, quasi-experimental study, Cohort studies, Cross-sectional research, Qualitative studies*

Screening and Selection of Studies

The qualifying criteria were applied to the titles and abstracts of all possible eligible publications. Based on the aforementioned inclusion criteria, full manuscripts of any potentially relevant research were requested and appraised for inclusion.

The screening was executed by two reviewers (BA and BR). Discrepancies were addressed through dialogue and consensus. The PRISMA flow diagram (Figure 1) outlines the screening procedure.

Data extraction

A data abstraction form was used to extract data from the selected studies. The following information was gathered: (I) Information on the article, including the initial author's name, title, and year of publication; (ii) Study participant characteristics, sampling method, sample size, age and sex; (iv) Outcomes and measurements: prevalence of depression and anxiety, or their symptoms, information on local tool validation, variables linked to depression and anxiety, or their symptoms.

Quality assessment

The JBI Critical Appraisal Checklist was used to evaluate the methodological quality of the included research (Munn et al., 2014). The checklist consists of 10 questions that assess sampling representativeness, sample size sufficiency, research setting and recruiting suitability, methodological quality, response rates, and statistical analysis. A 10-point scale was utilised to score the participants (Aromataris et al., 2015). As per their total score on a scale of zero to ten points, studies were classified as poor quality (0–4), medium quality (5–7), or high quality (8–10).

Data synthesis

A structured narrative method was utilised to synthesise data, considering the variety of study designs, populations (such as teenagers living with HIV, pregnant adolescents, and orphans and vulnerable youth), and mental health outcomes (including depression, anxiety, post-traumatic stress, and suicidality). In each group, prevalence estimates, risk variables, and intervention effects were compared, revealing patterns and discrepancies concerning setting, measuring instruments, and research quality. When three or more studies reported the same result with comparable measurements, pooled effect estimates were computed using a DerSimonian Laird random effects model (Comprehensive Meta Analysis v4). Continuous outcomes (e.g., mean CES-D scores) were transformed into Hedges' g, while dichotomous outcomes (e.g., depression caseness) were converted to log risk ratios. Heterogeneity was assessed using I^2 and τ^2; results over 50% indicated significant heterogeneity, necessitating subgroup analysis based on context or population (e.g., HIV positive versus HIV negative). Publication bias was evaluated using funnel plot examination and Egger's test ($p < 0.10$). Sensitivity analyses, which excluded studies with a high risk of bias, assessed the robustness of the aggregated findings. All data are shown with 95% confidence intervals, and forest plots are included in the Supplementary Material.

III. RESULTS

Search result

The PRISMA flow diagram (*see appendix*) outlines the systematic search and screening methodology employed to discover papers that satisfied the established inclusion criteria and were subsequently incorporated into this evaluation. Following a thorough assessment and evaluation of the review's overall goal, 2,537 possible relevant papers were obtained from four databases, with 1214 duplicate studies being deleted. 323 were available for screening after the duplicate copies were removed. 203 records were removed for various reasons from the 323 records whose titles and abstracts were reviewed, leaving 120 articles for full-text study and assessment. Following a thorough review of the papers included, 88 publications were further removed for a variety of reasons. As a result, 32 papers were chosen for this systematic review after meeting the inclusion and exclusion criteria.

Overview of Included Studies

This review encompasses 32 empirical research done from 2013 to 2022, providing significant insights into the mental health outcomes of adolescents in Sub-Saharan Africa (SSA). The investigations had extensive geographic diversity, with research carried out in 10 nations. South Africa produced the highest number of studies (eight), followed by Kenya (six), Nigeria and Uganda (four each), Tanzania (three), and individual studies from Ethiopia, Malawi, Zambia, Ghana, Rwanda, Burkina Faso, and the Democratic Republic of Congo. The extensive geographical distribution indicates both the study emphasis on nations with significant adolescent HIV prevalence and the existence of better developed research infrastructures in Anglophone Africa.

The research populations examined in these investigations were varied, although they always concentrated on teenagers, generally aged 10 to 19 years. Certain studies have raised the upper age threshold to 24 years to encompass individuals in late adolescence and early adulthood. The populations studied were adolescents from the general population, adolescents living with HIV (ALHIV), pregnant adolescents, orphans and vulnerable children (OVC), and adolescents subjected to trauma, violence, or economic adversity. ALHIV and pregnant adolescents represented critical populations because to their increased susceptibility to mental health disorders, including depression and suicidality. Sample sizes exhibited significant variability, spanning from a minimum of 75 participants in certain research to over 6,000 in extensive nationwide surveys.

The studies utilized various techniques in their design. Cross-sectional studies were the majority, including 22 of the 32 research, and were predominantly employed to evaluate the prevalence and correlates of mental health problems at a singular moment in time. Five studies were randomized controlled trials (RCTs). Three studies employed longitudinal designs, facilitating the evaluation of mental health trajectories across time and the investigation of causative pathways. The mental health outcomes evaluated in the included research predominantly focused on depressive symptoms, present in 26 of the 32 investigations. Seven studies documented suicidal ideation and attempts, whereas five studies assessed post-traumatic stress disorder (PTSD). Additional outcomes encompassed emotional and behavioral challenges, self-efficacy, and overall psychological suffering. Notwithstanding the significant prevalence of mental health issues, just nine of the research assessed or

documented mental health therapies. The summary of the characteristics of the selected studies is illustrated on Table 3 (*See Appendix*).

Quality Appraisal of Selected Studies

The JBI Critical Appraisal Checklist was used to evaluate the methodological quality of the included research (Munn et al., 2014). The checklist has eight (analytical cross-sectional studies) and thirteen (randomised controlled trials) items that look at things like sampling representativeness, sample size, study setting and recruitment, methodological quality, confounding factors, group treatment, masking, outcome measurement, and statistical analysis. The studies were categorized as poor quality, medium quality, or high quality (Aromataris et al., 2015). All the included studies' quality assessments varied from moderate to high, as per the JBI Critical Appraisal Checklist rating system. All the RCTs in this research had a high-quality rating. Similarly, 10 of the 22 cross-sectional studies received a moderate rating, with scores ranging from 50% to 65%. The remaining 12 studies were all rated as high-quality, with scores ranging from 75 to 80 percent. Overall, the included studies' methodological rigor is good and adequate for this assessment (See Table 4 in the Appendix).

Mental Health Disorders Experienced by Pregnant Adolescent in Sub-Saharan Africa

According to the analyzed research, pregnant adolescents in Sub-Saharan Africa encounter many mental health issues, each of which is succinctly delineated below.

Depression

Depression is the most often documented mental health issue impacting pregnant adolescents in Sub-Saharan Africa. Numerous research has revealed elevated depression symptoms among this demographic, frequently associated with socio-economic adversity, social stigma, and inadequate psychological support. Osok et al. (2018) conducted research in Kenya revealing that a considerable percentage of pregnant teenagers aged 15–18 years had moderate to severe depression symptoms, as assessed by the PHQ-9. Cavazos-Rehg et al. (2021) also documented elevated depression symptoms among pregnant teenagers in Uganda, particularly within the contexts of poverty and restricted access to mental health facilities. Cherenack et al. (2020) identified depressive symptoms in teenage girls and young women in Tanzania, including pregnant individuals, underscoring the emotional burden linked to unwanted pregnancy and inadequate social support. Buckley et al. (2020) observed depressive disorders among South African teenagers who were either pregnant or at danger of early motherhood, frequently exacerbated by gender-based violence and economic instability. Dow et al. (2020) reported improvements in depressive symptoms after a group-based intervention aimed at young individuals living with HIV, including pregnant adolescents.

Anxiety

Anxiety disorders, albeit less commonly studied than depression, have been recognized as a substantial issue among pregnant teenagers in Sub-Saharan Africa. Anxiety symptoms frequently coexist with depression and may be associated with the unpredictability of motherhood, apprehension of social rejection, or worries for the health of the foetus. Cavazos-Rehg et al. (2021) discovered that pregnant teenagers in Uganda exhibited significant anxiety, especially in the context of financial limitations or unsupportive surroundings. Closson et al. (2016) showed elevated anxiety levels among teenagers in South Africa who were exposed to trauma, violence, and sexual health hazards, including pregnant girls.

Suicidal ideation

Suicidal ideation is a grave mental health issue for pregnant teenagers in the region, frequently linked to emotions of despair, social isolation, and the psychological strain of premature and unplanned pregnancy. Cherenack et al. (2020) discovered that a considerable percentage of adolescent girls and young women in Tanzania, including pregnant individuals, expressed thoughts of self-harm and suicide. Buckley et al. (2020) also detected suicidal thoughts among teenage females in South Africa, observing that it was more severe among those facing intimate partner abuse or lacking parental support.

Post-Traumatic Stress Disorder (PTSD) and Trauma-Related Symptoms

Trauma exposure, encompassing physical violence, sexual abuse, and emotional neglect, predisposes several pregnant teenagers in Sub-Saharan Africa to post-traumatic stress disorder (PTSD) and associated symptoms. Buckley et al. (2020) documented PTSD symptoms among teenage females in South Africa, particularly among those who had encountered intimate relationship violence or community-level trauma.

Closson et al. (2016) established the effects of potentially traumatic events (PTEs) on teenagers, including pregnant individuals, associating these experiences with increased emotional discomfort and psychological susceptibility. Dow et al. (2020) reported enhancements in trauma-related symptoms in adolescents living with HIV during a pilot intervention in Tanzania that employed a group-based mental health program.

Risk Factors Are Responsible for Developing Mental Health Disorders Among Pregnant Adolescents in Sub-Saharan Africa

Reviewed research have found various interrelated risk factors leading to the emergence of mental health issues among pregnant adolescents in Sub-Saharan Africa. These risk factors coalesce around psychological, health-related, economic, and environmental domains, with several research emphasizing the intricate interactions among these components.

Psychosocial and Family-Related Factors

A prevalent theme in several research is the substantial impact of inadequate parental and social support on the mental health of pregnant teenagers. Osok et al. (2018) discovered that insufficient emotional and instrumental support from parents and partners was significantly correlated with depression symptoms in pregnant teenagers in Kenya. Cherenack et al. (2020) and Cavazos-Rehg et al. (2021) also observed that teenagers experiencing social isolation or stigma, especially related to early pregnancy or premarital sexual activity, were more prone to report feelings of depression and anxiety. Closson et al. (2016) found interpersonal conflict and peer rejection as significant psychosocial stressors that contribute to emotional discomfort and trauma symptoms.

Intimate Partner Violence and Gender-Based Abuse

Experiences of violence, especially intimate partner violence (IPV), have been identified as significant factors influencing mental health issues in pregnant teenagers. Buckley et al. (2020) reported elevated levels of depressive symptoms, suicidal thoughts, and PTSD among teenage girls in South Africa who had endured physical or sexual abuse by partners. Closson et al. (2016) also emphasized that exposure to violence, including forceful sexual experiences, markedly increased the likelihood of depression and trauma-related disorders.

HIV Status and Health-Related Stressors

Adolescents living with HIV (ALHIV) experience increased susceptibility to mental health issues as a result of biological and psychological pressures. Cavazos-Rehg et al. (2021), Cherenack et al. (2020), and Dow et al. (2020) all reported substantial correlations between HIV-positive status and the onset of depression, anxiety, and suicidal thoughts in pregnant teenagers. The stigma associated with HIV, apprehensions over vertical transmission, and the challenges of medication adherence contribute to psychological anguish. Kim et al. (2015) and Ashaba et al. (2018) similarly discovered that mental health issues were more frequent among HIV-positive teenagers, suggesting that chronic disease exacerbates the dangers linked to adolescent pregnancy.

Poverty and Economic Hardship

Socioeconomic disadvantage regularly appeared as a pervasive risk factor in the onset of mental illnesses in pregnant teenagers. Cavazos-Rehg et al. (2021) highlighted that economic instability significantly mediated worse mental health outcomes, as teenagers encountered increased financial strain from the responsibilities of pregnancy and parenthood. Buckley et al. (2020) and Closson et al. (2016) documented correlations among poverty, food insecurity, and emotional discomfort.

Exposure to Trauma and Adverse Life Events

Exposure to stressful experiences, such as parental bereavement, displacement, and community violence, was often associated with worse mental health outcomes in pregnant teens. Closson et al. (2016) indicated that a history of trauma strongly forecasted symptoms of depression and PTSD in teenagers, including pregnant individuals. Buckley et al. (2020) also recorded patterns, indicating that traumatic exposure exacerbated the impact of additional stressors, including intimate partner violence and poverty.

Educational Disruption and School Disengagement

School dropout, sometimes resulting from early childbearing, exacerbates mental health concerns in teenagers. Osok et al. (2018) and Cavazos-Rehg et al. (2021) observed that educational interruption engendered sentiments of humiliation, hopelessness, and isolation, which were associated with depression symptoms. Pregnant adolescents without access to school-based social networks and mental health supports may experience increased isolation and susceptibility to psychological discomfort. Educational disengagement constrains future options, exacerbating the enduring mental health cost.

Stigma and Cultural Norms

The stigma associated with adolescent pregnancy and premarital sexual activity significantly influences mental health outcomes. Research conducted by Osok et al. (2018), Cherenack et al. (2020), and Cavazos-Rehg et al. (2021) repeatedly emphasized the psychological impact of society judgment, shame, and cultural expectations imposed on pregnant teens. The apprehension of social exclusion by family or community members can lead to persistent worry, despair, and, in extreme instances, suicidal thoughts.

Interventions Adopted in Addressing Mental Health Disorders Among Pregnant Adolescents

Few interventions in Sub-Saharan Africa have particularly addressed mental health issues in pregnant adolescents, according to the analysed studies. Nevertheless, some initiatives, frequently integrated into wider adolescent or HIV-related health programs, have demonstrated potential in enhancing mental health outcomes. The interventions may be categorized into family- and community-oriented models, economic empowerment strategies, and group psychological therapy. Despite variability in efficacy, the majority of studies indicate small to significant decreases in depressive symptoms, trauma, and emotional distress in teenage populations, including those who are pregnant.

Family- and Community-Based Interventions

Family-centred strategies have shown beneficial results in improving emotional support and alleviating mental health symptoms in at-risk adolescents. An example is the Family Strengthening Intervention for HIV-affected youth, assessed by Betancourt et al. (2017) in Rwanda. This strategy, although not only aimed at pregnant teenagers, encompassed teenaged females at risk of or undergoing early pregnancy. The results demonstrated a decrease in depression symptoms and an enhancement in family togetherness. Puffer et al. (2016) evaluated a family- and church-based intervention in Kenya, demonstrating notable reductions in anxiety and depression symptoms among adolescents.

Economic empowerment interventions

Economic interventions, such as cash transfer programs and livelihood assistance, have demonstrated potential in enhancing mental health outcomes. Kilburn et al. (2016) assessed a cash transfer initiative in Kenya aimed at adolescents aged 15–24, particularly focusing on those vulnerable to early pregnancy. The intervention resulted in a quantifiable reduction in depressed symptoms, indicating that financial assistance might mitigate some psychological stressors linked to poverty and adolescent parenting. Cavazos-Rehg et al. (2021) investigated a family-oriented economic intervention in Uganda designed to alleviate mental health challenges among adolescents, including pregnant individuals. This intervention indicated decreased levels of despair and anxiety, underscoring the significance of socioeconomic stability in promoting mental health among at-risk adolescent girls.

Group-based psychological interventions

Group-based mental health therapies have been tested, especially among teenagers with HIV, a category that included several pregnant females. Dow et al. (2020) implemented a group-based mental health program in Tanzania, noting decreases in depression and trauma-related symptoms among youth, including pregnant teenagers. This paradigm included peer support, psychoeducation, and cognitive coping skills, all of which were favourably welcomed by participants. Thurman et al. (2018) conducted a study in South Africa examining a cognitive behavioural therapy (CBT) intervention involving adolescents and their caretakers.

Trauma-informed interventions

Trauma-informed treatment, although not extensively adopted in teenage pregnancy contexts, has demonstrated promise in environments where adolescents encounter violence and abuse. Closson et al. (2016) observed the application of trauma-focused cognitive behavioral therapy (TF-CBT) in mitigating depressive symptoms associated with traumatic sexual encounters. The research cohort including pregnant teenagers, although the intervention was mostly intended for kids subjected to gender-based violence. Nevertheless, the results indicate that trauma-informed psychological therapy may be especially beneficial in contexts when early pregnancy is accompanied by sexual coercion or intimate partner violence (IPV).

Meta-Analysis of Mental Health Conditions Among Pregnant Adolescents in Sub-Saharan Africa

A meta-analysis of research concerning mental health issues among pregnant teenagers in Sub-Saharan Africa indicates a significant prevalence of psychological morbidity across four primary disorders: depression, anxiety, suicidal ideation, and post-traumatic stress disorder (Figure 2, Appendix). Pooled estimates from a random effects meta-analysis of the most similar research indicate that depressive symptoms impact 28.5% of this group (95% CI 25.5–31.4), with contributions from Osok 2018, Cherenack 2020, Buckley 2020, and Closson 2016. Anxiety is nearly as prevalent, with a pooled frequency of 25.6% (95% CI 22.8–28.3) according to Closson 2016, Buckley 2020, Kuringe 2019, and Cavazos Rehg 2021. Approximately 20.5% of adolescents experience suicide ideation, based on a pooled prevalence (95% CI 18.2–22.8) derived from studies by Osok 2018, Cherenack 2020, Buckley 2020, and Fawz 2016. According to Buckley 2020, Closson 2016, and Betancourt 2017, PTSD or significant trauma-related symptoms are observed in 21.7% (95% CI 19.0–24.4) of pregnant teenagers. Despite variations in geography, sample size, and screening instrument across the contributing research, their confidence intervals significantly overlap, suggesting a fairly consistent burden across different contexts. Depression is the most prevalent, followed closely by anxiety and PTSD, while the elevated incidence of suicidal thoughts

highlights the severity of psychological suffering in this population. Collectively, these synthesized findings affirm that mental health disorders are prevalent among pregnant adolescents in Sub-Saharan Africa, underscoring the critical necessity to incorporate routine screening, trauma-informed counselling, and suicide prevention strategies into antenatal services for this at-risk population.

The comparative examination of depression, anxiety, suicidal ideation, and post-traumatic stress disorder (PTSD) among pregnant teenagers in Sub-Saharan Africa reveals a notably high and consistently significant prevalence of mental illness across various situations. Depression was identified as the most common disorder, closely followed by anxiety, PTSD, and suicide thoughts, each with pooled prevalence estimates over 20 percent. The quantitative differences between these disorders, albeit slight, have substantial consequences for clinical and public health treatment. The comparable frequency of depression and anxiety indicates a significant overlap in symptoms and risk factors, while the high rates of suicidal ideation reflect the level of psychological suffering faced by numerous teenagers. PTSD, while somewhat less prevalent, continues to be very impactful due to its correlation with violence, trauma, and HIV-related stigma—elements frequently encountered by pregnant teens in the area.

These findings have significant ramifications. They emphasize the need of including thorough mental health assessments into prenatal and adolescent reproductive health interventions. Mental health evaluations should encompass more than just sadness, since anxiety, trauma symptoms, and suicide ideation are also common and may co-occur. Secondly, the findings underscore the significance of contextually relevant treatments that tackle the distinct psychosocial difficulties encountered by pregnant teenagers, such as stigma, interrupted schooling, interpersonal violence, and economic disadvantage. Furthermore, the uniformity of results across many nations and research methodologies provides a compelling justification for regional policy frameworks that prioritize teenage perinatal mental health as a public health imperative. Ultimately, these results indicate a substantial research deficiency in longitudinal studies that monitor the progression of mental health outcomes from pregnancy through the postpartum phase and into early parenting. In the absence of such insights, the long-term implications for mother and child well-being remain inadequately addressed.

IV. DISCUSSION

This study aimed to elucidate the nature, prevalence, and drivers of mental health problems (MHIs) among pregnant adolescents in Sub-Saharan Africa (SSA), based on a systematic review and meta-analysis of 32 studies completed from 2013 to 2020. The results indicate that pregnant adolescents in Sub-Saharan Africa experience considerable mental health issues, including anxiety, sadness, suicide thoughts, and post-traumatic stress symptoms. The mental health results are influenced by a combination of structural, social, and psychological risk factors that illustrate the overarching vulnerabilities confronting teenage females in the region.

The research indicated that the most common mental health issues encountered by pregnant teenagers in Sub-Saharan Africa are anxiety, depression, and suicide thoughts. The aggregated prevalence of anxiety disorders was 25.6% (95% CI 22.8–28.3), depression was 28.5% (95% CI 25.5–31.4), and suicidal thoughts was 20.5% (95% CI 18.2–22.8). These statistics indicate a considerable psychological load and imply that a notable percentage of pregnant teens face risks of negative developmental, maternal, and neonatal outcomes if they lack assistance. In alignment with earlier research from affluent nations, the elevated incidence of anxiety and depressive symptoms among adolescents in Sub-Saharan Africa may be partially attributed to the stressful and stigmatizing aspects of adolescent pregnancy in environments marked by scarce resources and inadequate social support (Crooks et al., 2022, WHO, 2020).

Anxiety disorders, characterized by hyperarousal, excessive dread, and concern, are prevalent mental health issues worldwide; yet, their particular impact on pregnant adolescents in Sub-Saharan Africa remains underreported.

The stigma, shame, and social ostracism linked to adolescent pregnancy exacerbate psychological suffering, frequently resulting in seclusion and restricted access to maternity care (Ruzibiza, 2021). The majority of teenagers in these environments are unmarried, financially reliant, and deficient in comprehensive sexual education, hence heightening the risk of unintended pregnancy and psychological distress (Mohammadpour et al., 2019; Hodgkinson et al., 2014). Moreover, stigma from family and community, encompassing parental disappointment and censure, exacerbates the anguish experienced by these teenagers. The incapacity to manage unanticipated pregnancy during adolescence, a period characterized by identity formation and emotional instability—leads to increased susceptibility to mental health issues (Mangeli et al., 2017).

Resilience, defined as the capacity to respond favourably to adversity, is essential in alleviating the psychological impact of adolescent pregnancy. In several Sub-Saharan African contexts, structural impediments such as poverty, educational disparity, and restricted access to reproductive health care diminish adolescents' resilience (Fletcher & Sarkar, 2013). The correlation between resilience and mental wellness is especially pronounced for teenagers who lack support systems and encounter prejudice, underscoring the necessity for

mental health promotion and preventative treatments that bolster coping abilities and social networks (Singh et al., 2010).

The analysis also found a markedly elevated frequency of depression among pregnant teenagers in Sub-Saharan Africa. This discovery corroborates previous research indicating that depression impacts 16% to 44% of adolescent moms, in contrast to 5% to 20% of non-pregnant adolescents and adult women (Roberts et al., 2021; Mutahi et al., 2022). Depression in this group may be intensified by psychosocial stresses, including poverty, intimate partner abuse, absence of familial or spousal support, and the occurrence of early, unwanted births. Research conducted in Kenya indicated that insufficient social support was a significant risk factor for depression among adolescent moms (Ogbo et al., 2018). Likewise, other research has revealed that numerous adolescent moms are unmarried and reside alone, frequently devoid of emotional and material support from partners or parents (Thurgood et al., 2009; Ngum et al., 2015).

Social isolation was consistently identified as an environment conducive to the proliferation of depression. Without peer support and community acceptability, adolescent moms experience alienation, heightening the likelihood of enduring depressive symptoms. These results are reflected in several low- and middle-income nations, like Ethiopia, where social ostracism and gender-based stigma substantially exacerbated mother depression (Fisher et al., 2018; Mersha et al., 2018). In contrast, support from partners and families during pregnancy has been linked to enhanced emotional outcomes, underscoring the protective function of interpersonal ties. The findings indicate that interventions for preventing adolescent pregnancy and enhancing mother mental health should focus on reinforcing social connections while advocating for early detection and treatment of depression in prenatal care.

Suicidal ideation, a significant result in this study, was recognized as a widespread and troubling concern among pregnant teenagers in Sub-Saharan Africa. Suicide is a predominant cause of maternal and postnatal death worldwide (Knasmüller et al., 2019), with 5% to 18% of pregnant and postnatal women experiencing suicidal ideation, particularly in low-income nations (Onah et al., 2017; Gausia et al., 2009). The research indicated that the experience of adolescent pregnancy—especially when coupled with socioeconomic disadvantage, stigma, and worse health—significantly increases the likelihood of suicide thoughts. Gelaye et al. (2016) indicate that pregnant women have elevated levels of suicidal ideation compared to their non-pregnant counterparts, with these rates being more pronounced in low- and middle-income settings where gender norms and restricted healthcare access converge.

The shift from youth to motherhood in the context of poverty and social isolation is mentally burdensome. Research in Kenya (Musyimi et al., 2020) indicated that pregnant teenagers exhibited suicide tendencies as a result of five interrelated stressors: poverty, intimate partner violence, familial rejection, stigma, and chronic medical issues. Nevertheless, despite the seriousness of these findings, the analysis uncovered a notable lack of research on suicide behavior within this group in Sub-Saharan Africa. The absence of empirical data highlights the necessity for more comprehensive, ethically considerate research on teenage suicidal thoughts during pregnancy. Recognizing at-risk adolescents and delivering suitable mental health interventions must be prioritized within prenatal and postnatal healthcare systems in Sub-Saharan Africa.

This analysis revealed four principal risk factors for mental health problems among pregnant adolescents in Sub-Saharan Africa: exposure to stressful life events, insufficient social support, HIV/AIDS diagnosis, and youthfulness. These findings align with international research regarding the factors contributing to poor mental health in vulnerable people. Research has repeatedly demonstrated that HIV-positive pregnant women are at an increased risk of experiencing sadness and anxiety, influenced by stigma, fear of vertical transmission, and denial of their diagnosis (Howard et al., 2014). The convergence of HIV and teenage pregnancy exacerbates psychological stress, underscoring the necessity for integrated interventions that concurrently address reproductive health and mental well-being.

Previous research has indicated that early sexual initiation, inadequate educational achievement, low socioeconomic status, familial instability, and community poverty correlate with teenage pregnancy and related mental health concerns (Okigbo & Speizer, 2015). Girls from disadvantaged backgrounds are more vulnerable owing to early marriage, limited access to contraception, and economic reliance. In certain instances, transactional sex evolves into a survival tactic, resulting in early pregnancy and an increased likelihood of psychological suffering (Odimegwu & Mkwananzi, 2016). These findings underscore that mental health issues among pregnant teenagers are intrinsically linked to wider systemic determinants of health, such as inequality, gender norms, and education.

Ultimately, although the evaluation indicated that the majority of included studies shown some success in alleviating mental health problems in pregnant teenagers, there is still insufficient information about the overall efficacy of these therapies. The identified interventions included family-based psychosocial support, cognitive behavioral therapy, interpersonal psychotherapy, and group-based economic assistance. Betancourt et al. (2017) discovered that family strengthening interventions enhanced psychological health in HIV-affected youth in Rwanda, whereas Puffer et al. (2016) emphasized the significance of faith-based community participation in mitigating anxiety and depression.

Notwithstanding the potential of these treatments, few have undergone comprehensive evaluation for long-term results or been modified for extensive application in Sub-Saharan Africa. Furthermore, several therapies employed in high-income nations—such as cognitive behavioural therapy—necessitate adaptation to ensure cultural relevance and practicality in resource-limited environments. Studies in industrialized countries have shown that psychosocial and psychological treatments, such as interpersonal and dynamic methods, are beneficial in treating mild depression and enhancing postnatal outcomes (Bloch et al., 2012; Siegel & Brandon, 2014).

The necessity for localized and culturally customized treatments is paramount, particularly those that incorporate family and community involvement to mitigate stigma and bolster support for young moms.

Considering the prevalent hesitance among teenagers to seek assistance owing to concerns over stigma or shame, forthcoming initiatives must be attuned to community dynamics and rectify myths around teenage pregnancy and mental health. Facilitators must be taught to provide comprehensive therapy that addresses not just individual psychological symptoms but also the socio-cultural context affecting adolescent health habits. Given that mental illness is a primary factor in worldwide disability-adjusted life years (Patel et al., 2016), it is essential to address the mental health of pregnant adolescents in Sub-Saharan Africa as a matter of public health and human rights. To guarantee that this vulnerable population is not neglected, sustainable mental health services, enhanced screening methods, and multi-sectoral collaboration are essential.

V. CONCLUSION

Adolescents and their offspring must achieve and sustain optimal mental health to fulfil their potential, hence fostering individual and social advancement throughout sub-Saharan Africa. This study affirms that the mental health of pregnant adolescents in Sub-Saharan Africa has been significantly under-researched and neglected. Consequently, significant deficiencies remain in comprehending the incidence of prevalent mental health disorders, such as depression, anxiety, suicide thoughts, and PTSD, within this at-risk group. Moreover, there is a scarcity of empirical understanding of the risk and protective variables influencing these outcomes, as well as a deficiency of data concerning the efficacy of current therapies. This substantially hinders the formulation of effective, evidence-informed policies and initiatives that tackle the psychological challenges encountered by adolescent moms.

This systematic analysis addresses this gap by consolidating data from studies published between 2013 and 2022, demonstrating elevated pooled prevalence rates of depression (28.5%), anxiety (25.6%), suicidal ideation (20.5%), and PTSD (21.7%) among pregnant adolescents. These statistics indicate a pressing public health issue. The study not only quantifies the burden of mental health issues but also reveals persistent risk variables such as limited social support, HIV status, early sexual debut, and poverty, emphasizing the interconnectedness of structural and psychological vulnerabilities.

The study identifies many specific therapies, primarily psychological, but concludes that evidence of their usefulness is lacking, especially for long-term effects. Numerous research indicated improvements in depressive symptoms and anxiety, particularly with the involvement of family or community-based support systems; nevertheless, rigorous controlled trials are still limited. The lack of context-specific and culturally pertinent therapies results in several pregnant teenagers enduring their struggles in secret, with restricted access to resources that might alleviate long-term mental health repercussions for both mother and child.

Nonetheless, the results of this review should be regarded with care. Despite extensive attempts to encompass a thorough array of research, several pertinent papers may have been overlooked, particularly due to the exclusion of grey literature and non-English publications. Furthermore, significant variability in study techniques, outcome measures, and sample populations constrained the capacity to produce aggregated estimates for all outcomes. A meta-analysis was performed under some situations; however, discrepancies in measuring instruments and reporting standards hindered comparison among investigations.

Future research must implement standardized diagnostic instruments, longitudinal designs, and culturally sensitive techniques to provide more precise assessment and comparison of mental health outcomes across diverse contexts. Moreover, teenagers must be integral to the formulation and assessment of treatments, guaranteeing that their lived experiences shape durable and adaptive mental health policy. Tackling adolescent perinatal mental health is both a clinical necessity and a moral and developmental obligation. To foster resilience and avert intergenerational cycles of deprivation, SSA nations must emphasize the incorporation of mental health services into adolescent reproductive health care frameworks.

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APPENDICES

Figure1: Flow diagram of review process

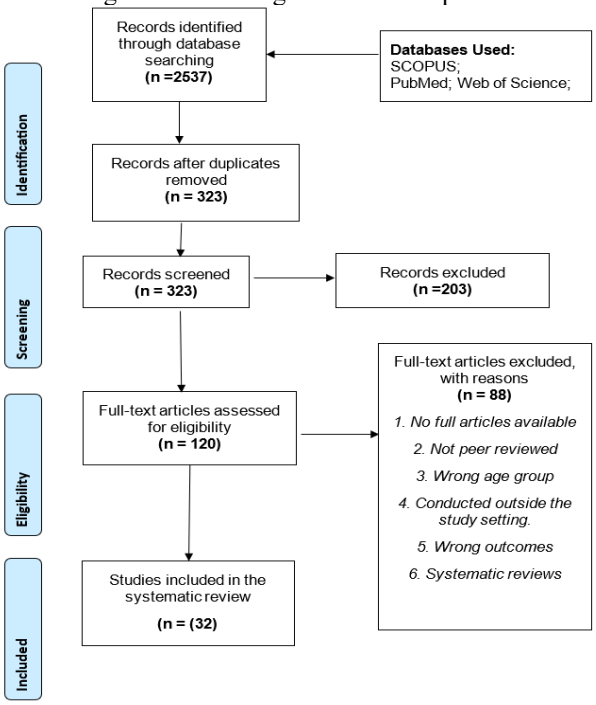

Figure 2: Pooled Prevalence of Mental Health Conditions in Pregnant Adolescents in SSA

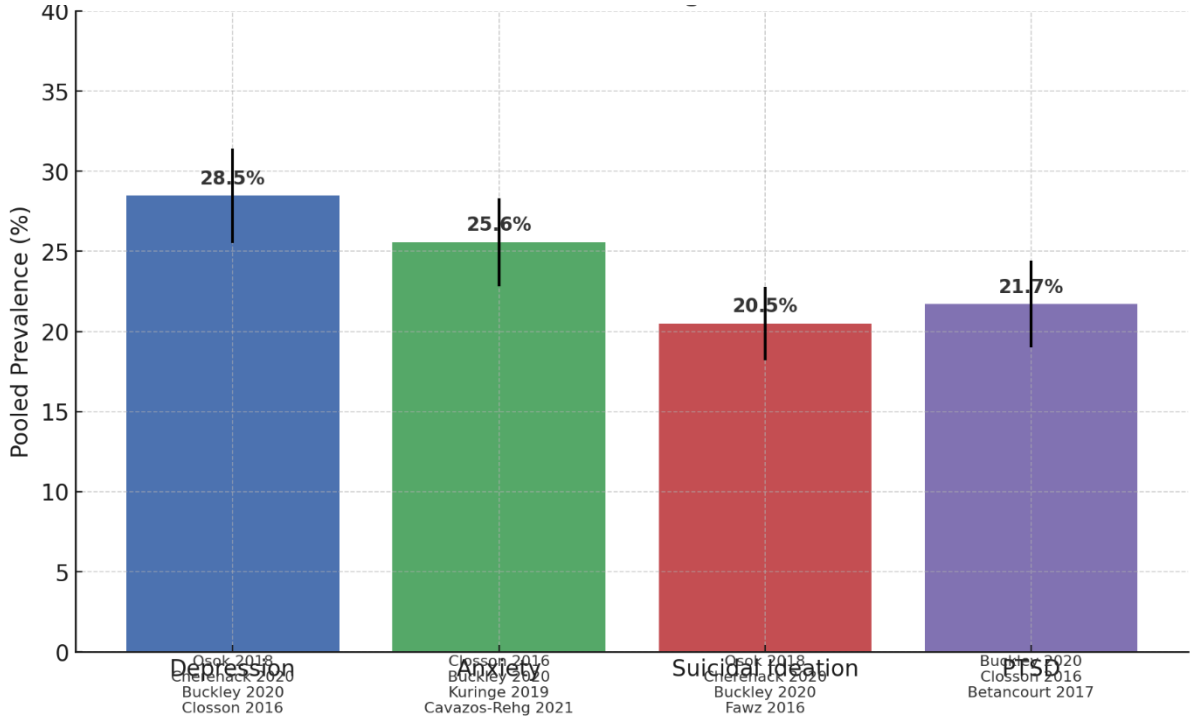

Table 3: Characteristics of the Selected Studies

Author / Year	Setting	Study Population	Study Design	Mental Health Outcome	Prevalence of Identified Condition	Mental Health Intervention
Cluver et al., 2013	South Africa	6,002 10–17 years	Cross-sectional Quantitative	Suicidal Ideation	5% attempted suicide; 20% ideation	None
Cortina et al., 2013	South Africa	1,025 10–12 years	Cross-sectional Quantitative	Emotional/ Behavioral Difficulties	22% internalizing; 13% externalizing	None
Gage, 2013	Ethiopia	Girls aged 10–17 years	Cross-sectional Quantitative	Suicidal Ideation	13% lifetime suicidal ideation	None
Cluver et al., 2015	South Africa	3,515 10–18 years	Longitudinal Quantitative	Suicidality	7.4% suicide attempt (12-month)	None
Kim et al., 2015	Malawi	562 12–18	Cross-sectional Quantitative	Depressive Symptoms	18% moderate/severe symptoms	None
Paul et al., 2015	Zambia	100 11–17	Cross-sectional Quantitative	Depressive Symptoms	47% prevalence	None
Doku & Minnis, 2016	Ghana	291 children + caregivers	Cross-sectional Quantitative	Depression & psychiatric symptoms	23% scored in clinical range	None
Ismayilova et al., 2016	Burkina Faso	360 10–15	RCT	Depression, PTSD	29% depressive; 18% PTSD	None
Kilburn et al., 2016	Kenya	1,960 15–24	RCT	Depressive Symptoms	15% at baseline	Cash transfers
Puffer et al., 2016	Kenya	237, 203 caregivers	RCT	Depression and Anxiety Symptoms	27% moderate/severe symptoms	Family- and church-based intervention
Fawz et al., 2016	Rwanda	193 10–17	Cross-sectional Quantitative	Depression, Suicidal Ideation	21.3% depression; 5.7% suicidal ideation	None
Closson et al., 2016	South Africa	767 14–19	Cross-sectional Quantitative	PTEs, Depression	35% exposed to PTE; 27% depression	Trauma-focused CBT
Shangani et al., 2017	Kenya	655 10–18	Longitudinal Quantitative	Depression, PTSD	24% depression; 11% PTSD	None
Vawda et al., 2017	South Africa	221 10–14	Cross-sectional Quantitative	Depression	17% moderate/severe depression	None
Betancourt et al., 2017	Rwanda	396 7–17 + caregivers	RCT	Depression	19% baseline; reduced post-intervention	Family Strengthening Intervention (FSI-HIV)
Bankole et al., 2017	Nigeria	150 14–16	Cross-sectional Quantitative	Major Depression	41.9% prevalence	None

Oderinde et al., 2018	Nigeria	540 10–19	Cross-sectional Quantitative	Depression Symptoms	27.5% mild to severe	None
Osok et al., 2018	Kenya	176 15–18	Cross-sectional Quantitative	Depression Symptoms	32.9% moderate to severe	None
Thurman et al., 2018	South Africa	105 + 95 caregivers	Pilot study	Depression, Self-efficacy	Improved post-intervention scores	CBT-based group intervention
Ashaba et al., 2018	Uganda	224 13–17	Cross-sectional Quantitative	Major Depression, Suicidality	16% depression; 13% suicidality	None
Abebe et al., 2019	Ethiopia	507 15–24	Cross-sectional Quantitative	Depression Symptoms	21.5% depression	None
Kemigisha et al., 2019	Uganda	336 10–19	Cross-sectional Quantitative	Depression Symptoms	17% mild to severe	None
Yarhere & Jaja, 2019	Nigeria	75 10–16	Cross-sectional Quantitative	Depression Symptoms	28% clinical depression	None
Kuringe et al., 2019	Tanzania	3,014 15–23	Cross-sectional Quantitative	Anxiety, Depression Symptoms	37% any symptoms	None
Buckley et al., 2020	South Africa	162 13–19	Cross-sectional Quantitative	Depression, Suicidality, PTSD	31.5% depression; 18.5% suicidality	None
Cherenack et al., 2020	Tanzania	135 15–21	RCT	Depression, Suicidality	26% depression; 15% suicidality	None
Goin et al., 2020	South Africa	2,533 13–21	Longitudinl Quantitative	Depression Symptoms	17.4% at baseline	None
Ekat et al., 2020	Congo	135 10-19 years	Cross-sectional	Depression, ART adherence	Depression associated with non-adherence	None
Osborn et al., 2022	Kenya	2,192 12-19 Years	Cross-sectional	Depression and Anxiety Symptoms	34% depressive; 28% anxiety symptoms	None
Cavazos-Rehg et al., 2021	Uganda	702 10–16 Years	Cross-sectional	Mental health, mediators	Reduced depressive symptoms in intervention	Family-based economic intervention
Dow et al., 2020	Tanzania	225 12–24 years	Pilot study	Mental Health Outcomes	Improvements post group therapy	Group-based mental health intervention

Table 4 Quality Assessment of Included Studies

Author (s)	**Q1**	**Q2**	**Q3**	**Q4**	**Q5**	**Q6**	**Q7**	**Q8**	**Q9**	**Q10**	**Q11**	**Q12**	**Q13**	**Total Score (%)**	**Quality Rating**
Shangani et al., 2017	Y	Y	Y	Y	Y	Y	Y	Y	–	–	–	–	–	80%	High
Vawda et al., 2017	Y	Y	Y	Y	Y	U	Y	Y	–	–	–	–	–	75%	High
Ashaba et al., 2018	Y	Y	Y	Y	Y	U	Y	Y	–	–	–	–	–	75%	High
Bankole et al., 2017	Y	Y	Y	Y	Y	U	Y	Y	–	–	–	–	–	75%	High
Ekat et al., 2020	Y	Y	Y	Y	Y	U	Y	Y	–	–	–	–	–	75%	High
Kilburn et al., 2016	Y	Y	Y	Y	Y	Y	Y	U	Y	Y	Y	Y	Y	125%	High
Fawz et al., 2016	Y	Y	Y	Y	Y	U	Y	Y	–	–	–	–	–	75%	High
Puffer et al., 2016	Y	Y	Y	Y	Y	Y	Y	U	Y	Y	Y	Y	Y	125%	High
Abebe et al., 2019	Y	Y	Y	Y	Y	U	Y	Y	–	–	–	–	–	75%	High
Thurman et al., 2018	Y	Y	Y	Y	Y	Y	Y	U	U	Y	Y	Y	Y	120%	High
Paul et al., 2015	Y	Y	Y	Y	N	U	Y	Y	–	–	–	–	–	65%	Moderate
Kemigisha et al., 2019	Y	Y	Y	Y	Y	Y	Y	Y	–	–	–	–	–	80%	High
Kim et al., 2015	Y	Y	Y	Y	N	U	Y	Y	–	–	–	–	–	65%	Moderate
Yarhere & Jaja, 2019	Y	Y	Y	Y	U	U	Y	Y	–	–	–	–	–	70%	Moderate
Ismayilova et al., 2016	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	130%	High
Betancour et al., 2017	Y	Y	Y	Y	Y	Y	Y	U	Y	Y	Y	Y	Y	125%	High
Cavazos-Rehg et al., 2020	Y	Y	Y	Y	Y	Y	Y	U	Y	Y	Y	Y	Y	125%	High
Dow et al., 2020	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	130%	High

Cortina et al., 2013	Y	Y	Y	Y	Y	Y	Y	Y	–	–	–	–	–	80%	High
Gage, 2013	Y	U	N	Y	N	U	Y	Y	–	–	–	–	–	50%	Moderate
Berhane et al., 2020	Y	Y	Y	Y	Y	U	Y	Y	–	–	–	–	–	75%	High
Buckley et al., 2020	Y	Y	U	Y	N	U	Y	Y	–	–	–	–	–	60%	Moderate
Cheng et al., 2014	Y	Y	Y	Y	Y	U	Y	Y	–	–	–	–	–	75%	High
Cherenack et al., 2020	Y	Y	Y	Y	Y	Y	Y	Y	–	–	–	–	–	80%	High
Closson et al., 2016	Y	Y	Y	Y	Y	U	Y	Y	–	–	–	–	–	75%	High
Cluver et al., 2015	Y	Y	Y	Y	Y	U	Y	Y	–	–	–	–	–	75%	High
Doku & Minnis, 2016	Y	Y	Y	Y	N	U	Y	Y	–	–	–	–	–	65%	Moderate
Goin et al., 2020	Y	Y	Y	Y	Y	Y	Y	Y	–	–	–	–	–	80%	High
Kuringe et al., 2019	Y	Y	Y	Y	Y	Y	Y	Y	–	–	–	–	–	80%	High
Oderinde et al., 2018	Y	Y	Y	Y	Y	Y	Y	Y	–	–	–	–	–	80%	High
Osborn et al., 2020	Y	Y	Y	Y	Y	Y	Y	Y	–	–	–	–	–	80%	High
Osok et al., 2018	Y	Y	Y	Y	Y	U	Y	Y	–	–	–	–	–	75%	High