



Adolescent perinatal mental health in South Asia and Sub-Saharan Africa: A systematic review of qualitative and quantitative evidence

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ARTICLE INFO

Keywords:

Adolescent
Mental health
Pregnancy
Postpartum
South Asia
Sub-Saharan Africa
LMIC
Perinatal

ABSTRACT

Despite the contribution of mental ill-health to perinatal morbidity and mortality, the experiences of adolescent girls and young women (AGYW) in low- and middle-income countries remain overlooked. This review explores potential intersecting vulnerabilities for perinatal mental health to identify the prevalence, risk factors, interventions, and implications for health services and future research.

We searched mixed-methods English-language studies in four databases (MEDLINE, PsycInfo, Global Health, Embase) published between January 1, 2000 and April 30, 2022 reporting age-disaggregated data on the prevalence, risk factors, and interventions for AGYW's mental health during pregnancy through one year postpartum (quantitative) and/or the mental health experiences of AGYW in the perinatal period (qualitative).

Our search yielded 3205 results, of which 48 met the inclusion criteria. Both regions observe a paucity of robust evidence and intervention evaluations, particularly South Asia. While meta-analysis was infeasible due to study heterogeneity, quantitative studies do identify individual-level risk factors for perinatal depression. Qualitative studies emphasise stigma's impact, among other societal-level social risk factors, on diverse perinatal mental health outcomes of importance to AGYW themselves. Rigorous evaluations of interventions are lacking bar two protocols with forthcoming results.

Evidence gaps persist concerning prevalence of outcomes beyond depression and implications of AGYW's perinatal experiences including pregnancy/perinatal loss and obstetric and postpartum complications. High-quality research, including comparable prevalence and multi-method evidence identifying risk and protective factors and promising interventions is urgently needed to improve adolescent wellbeing in the perinatal period.

A key strength of this review is our assessment of available evidence for both regions. In doing so, we address a critical blind spot of prior reviews that focused either on adult perinatal mental health in low- and middle-income countries, or on AGYW perinatal mental health in high-income settings but neglected the intersection of these potential vulnerabilities for these high-burden, low-resource contexts.

1. Introduction

Perinatal mental health – from pregnancy through one year postpartum – is now recognised as a major contributor to maternal morbidity and mortality (Fisher et al., 2012), and new and recurrent episodes of mental disorder during the perinatal period have garnered growing interest, particularly in high-income countries (Howard and Khalifeh, 2020). Several systematic reviews report a higher prevalence of perinatal mental disorders in low- and middle-income countries (LMICs) than high-income countries (HICs) (Fisher et al., 2012; Shorey et al., 2018; Dennis et al., 2017; Fawcett et al., 2019), and self-harm is now a

leading cause of pregnancy-related death in multiple LMICs (Palfreyman, 2021).

Perinatal mental health in adolescent girls and young women (AGYW) aged 10–24 years is a particularly neglected research area despite recent attention on perinatal mental health more generally and recognition of the importance of adolescent perinatal mental health in HICs. While AGYW may face distinct physical and social risks on account of their developmental stage, they are often subsumed in research on adult women's perinatal mental health outcomes (Vanderkruik et al., 2021; Lucas et al., 2019; Siegel and Brandon, 2014). Importantly, we define adolescents as AGYW aged 10–24 years inclusive, extending the

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<https://doi.org/10.1016/j.socscimed.2022.115413>

Received 1 June 2022; Received in revised form 14 September 2022; Accepted 27 September 2022

Available online 1 October 2022

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United Nations agency definition of adolescence (10–19 years) to more closely correspond to what is now known about physical, cognitive and psychosocial development that continues until the mid-twenties (Sawyer et al., 2018).

In spite of increased scholarship on either perinatal mental health in LMICs or AGYW perinatal mental health (APMH) in HICs, APMH in LMICs is an enduring blind spot (Eboime et al., 2022). This is especially concerning given a growing LMIC adolescent population in which 21 million AGYW aged 15–19 become pregnant; 12 million give birth; and 5.9 million seek induced, largely unsafe abortion each year (WHO, 2020). A further 777,000 under-15s give birth annually across LMICs (WHO, 2020). One systematic review found LMIC adolescents face 2.1–5.4 higher odds of perinatal mental disorders than adult women (Fisher et al., 2012), while a second recent review in Sub-Saharan Africa identified a lack of tailored health system support for pregnant adolescents (Mutahi et al., 2022). Intersecting vulnerabilities in LMICs caused by a greater risk of pregnancy-related morbidity and mortality, chronic comorbidities such as HIV, intimate partner violence (IPV), poverty, food insecurity, exclusion from further education, social isolation from family and peers (Vanderkruik et al., 2021), and transactional sex (Osok et al., 2018a) may leave AGYW especially susceptible to perinatal mental ill-health.

Poor APMH in LMICs is vitally important in its own right and is associated with long-term adverse health outcomes for the mother, including future mental disorders and addictive behaviour (Slomian et al., 2019; WHO, 2009). It may also have multi-generational effects. Perinatal mental disorder is associated with adverse child health outcomes – such as wasting and stunting (Surkan et al., 2011; Dadi et al., 2020), non-exclusive breastfeeding and infant illness (Dadi et al., 2020), and behavioural and (neuro)developmental difficulties (Gelaye et al., 2016). Adverse maternal mental health may also increase risk for daughters to subsequently develop mental disorders when they too enter the perinatal period (Sejourné et al., 2011).

This systematic review aims to respond to current knowledge gaps on APMH in LMICs guided by five research questions:

- What is the prevalence of perinatal mental disorders among AGYW in South Asia and Sub-Saharan Africa?
- What unique and shared risk factors for poor perinatal mental health exist for AGYW compared to older perinatal women?
- What interventions, if any, have been trialled in South Asia and Sub-Saharan Africa to address the mental health and psychosocial needs of AGYW in the perinatal period?
- What are the implications of (a)–(c) for health services for AGYW in the perinatal period?
- What are the persisting evidence gaps for AGYW in the perinatal period regarding mental health in South Asia and Sub-Saharan Africa?

Its scope is concentrated on two LMIC regions: South Asia and Sub-Saharan Africa. Accepting substantial interregional heterogeneity, compared to other LMIC regions, South Asia and Sub-Saharan Africa observe the highest rates of adolescent pregnancy (United Nations Population Fund, 2015), the highest burden of maternal morbidity and mortality (WHO et al., 2019), and the highest rates of perinatal mental disorder (Fisher et al., 2012) and suicide in AGYW (GBD, 2021). The majority of countries in South Asia and Sub-Saharan Africa are also either low or lower-middle income, further justifying the focus of this review on these two lower-resource regions.

2. Methods

2.1. Search strategy and selection criteria

We conducted a mixed-methods systematic review searching four databases following PRISMA guidelines: MEDLINE, PsycInfo, Global

Health and Embase. A free text search strategy was designed for four concepts: (1) adolescent/ce, (2) perinatal, (3) mental health, and (4) South Asia and/or Sub-Saharan Africa, combining them with synonymous search terms. Each free text search (1–4) was combined with associated database-specific MeSH terms. We reviewed search terms, checking against other systematic review search strategies for completeness or missing synonyms (Vanderkruik et al., 2021). An example MEDLINE search is in Appendix Table A1 for replicability. In addition to peer-reviewed literature, we searched grey literature from UNICEF, UNFPA, WHO, World Bank, Guttmacher Institute, MEASURE Evaluation, USAID Momentum Project, and UK Foreign, Commonwealth and Development Office (formerly DFID).

English studies published between January 1, 2000 and April 30, 2022 were included regardless of methodology and research design, providing articles presented either age-disaggregated data for AGYW (quantitative) or data from AGYW participants in the perinatal period (qualitative or intervention studies). Studies were included irrespective of whether sampling of AGYW in the perinatal period was restricted to participants with known mental disorders. Studies including AGYW subgroups were eligible, e.g., 10–19 or 18–24. To support the comparability of evidence, we excluded studies where (1) adult age categories did not disaggregate adolescent sub-group data (quantitative), (2) contributions of pregnant/postpartum adolescents were not differentiated from parenting AGYW (qualitative), and/or (3) it was unclear whether adolescents were within one year postpartum during the study, to differentiate perinatal experiences from those of adolescent motherhood more generally. After implementing the search and removing duplicates, we screened results by title and abstract. UG grouped results as include, exclude, or maybe include, with discrepancies resolved through discussion with AP.

2.2. Data extraction and quality appraisal

For eligible quantitative studies reporting prevalence estimates, AP and UG independently extracted: country, mental health outcome, time period (perinatal (i.e., ante- and postpartum), antepartum only, postpartum only), sample setting (i.e., facility- and/or community-based), included AGYW age range, AGYW sample size and other age groups if applicable, applied mental health screening tool and cut-off scores, and finally, risk factors with 95% confidence intervals (if specific to AGYW). For qualitative studies, both authors independently identified participant and/or author statements themed by this review's research questions including perceived commonness of APMH difficulties and risk factors, implications for health services, and (potential) interventions. Broader statements regarding the relationship between the perinatal experience and APMH were also extracted. For intervention studies or protocols for upcoming interventions, we extracted type of intervention (to be) implemented. The framework and examples of the authors' evidence synthesis for qualitative studies can be found in the Appendix.

We applied Joanna Briggs Institute Qualitative and Prevalence Studies critical appraisal tools (Joanna Briggs Institute, 2020). These two tools separately assess the quality of quantitative and qualitative studies. Both authors appraised studies, reconciling differences through discussion until consensus was reached. Appendix Table A5 presents quality criteria and levels, while Tables A6 and A7 provide full quality assessments for quantitative and qualitative studies respectively. Importantly, we assessed quality for our specific APMH research questions, and our appraisal may not reflect quality for studies' original purpose, e.g., if their focus was for all women of reproductive age.

2.3. Data analysis and synthesis

Qualitative and quantitative studies were reviewed separately using narrative analysis for extracted data (Popay et al., 2006). AP and UG developed descriptions for each theme in qualitative articles, identifying common patterns across studies (see Appendix Table A8 for illustration).

Due to considerable heterogeneity and a lack of standardisation in study design and outcome measurement for quantitative studies, meta-analysis was infeasible in this review and may reflect the nascent status of APMH research. Finally, both authors independently reviewed the qualitative and quantitative evidence relevant to each research question, drawing higher-level conclusions on the state of knowledge for each issue. These conclusions were subsequently discussed to jointly agree on the final interpretation of the evidence.

2.4. Role of the funding source

The study funder had no role in study design, data collection, analysis, interpretation, or writing of the report.

3. Results

Our search identified 3205 records of which 1955 remained once

duplicates were removed. Title and abstract screening retained 113 records (46 in South Asia and 68 in Sub-Saharan Africa). Following full-text review, 48 peer-reviewed research articles published between 2006 and 2022 across 13 countries met our inclusion criteria (see Fig. 1). India and Bangladesh were the most represented countries in South Asia (n = 8 and n = 4 respectively), while Kenya and Nigeria predominated Sub-Saharan African evidence (n = 7 and n = 6 respectively).

3.1. Study characteristics

Thirty-six quantitative studies presented prevalence estimates, depression symptom scores, and risk factors for APMH outcomes (n = 17 South Asia; n = 19 Sub-Saharan Africa). Significant heterogeneity in study design, sampling, and outcome measurement hindered comparability. Most studies were non-representative, convenience-based samples, except six studies including randomised controlled trials (RCTs) or cross-sectional data from representative RCTs (Oladeji et al., 2019,

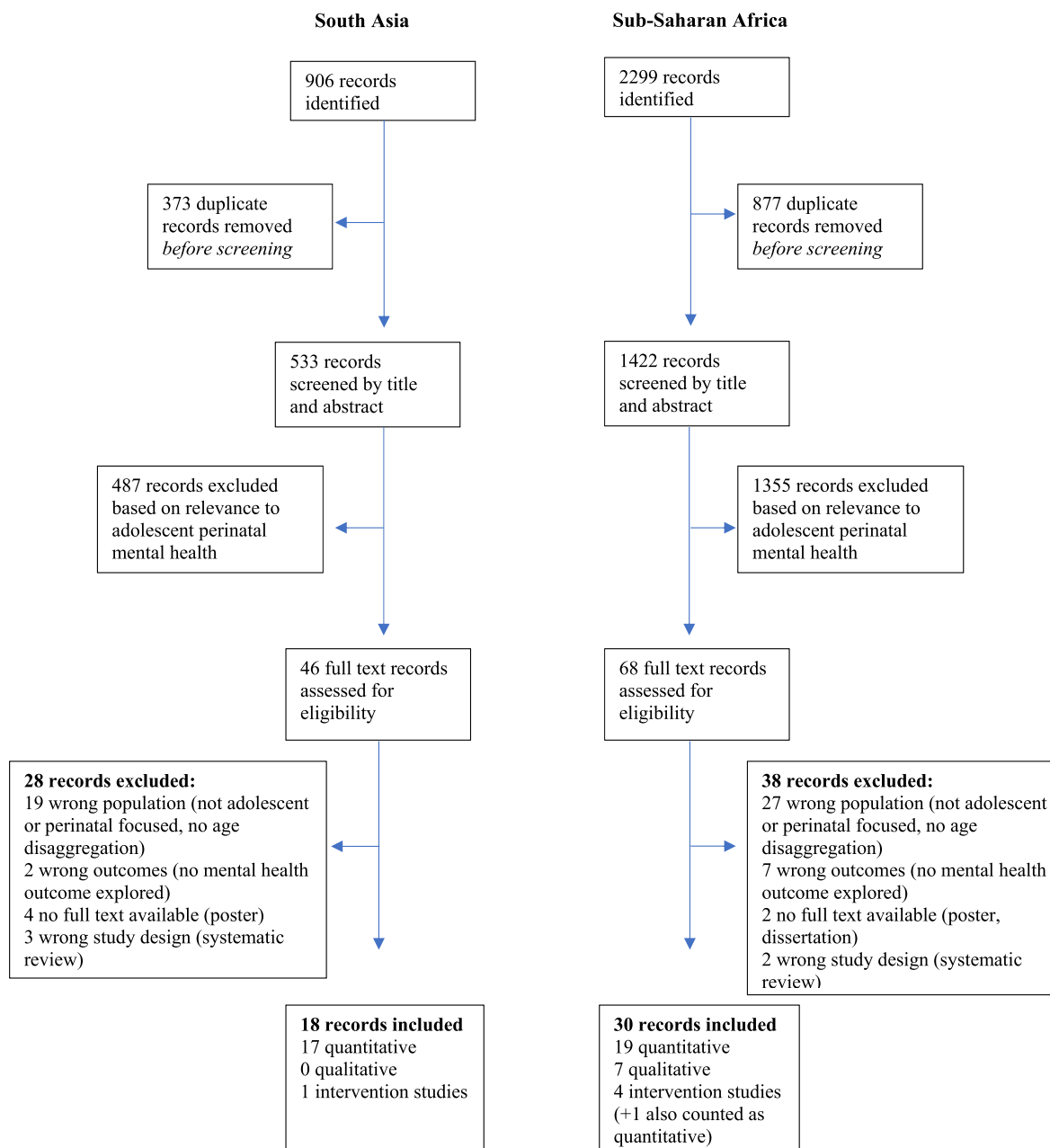


Fig. 1. Study selection.

2022; Prost et al., 2012; Clarke et al., 2014; Surkan et al., 2016, 2018), and four representative prospective cohort studies (Kassa et al., 2021; Weobong et al., 2015; Agampodi et al., 2021; Roux et al., 2019). Ten South Asian studies involved facility-based samples, while seven were community-based. For Sub-Saharan Africa, 13 studies report on facility-based samples, five on community-based, and one on both. None adopted the full age range for AGYW (10–24 years), instead reporting on sub-groups at different stages of physiological and social-emotional development. Selected disorder-specific screening instruments, cut-off scores indicating likely positive symptomology, and timing of perinatal screening (e.g., different trimesters) varied widely, further hampering meaningful analysis (see Table 1). Overall, the magnitude of these differences rendered weighted averages of prevalence nonsensical, and so were not calculated. Finally, our search identified no studies reporting prevalence of the following APMH outcomes: bipolar, schizophrenia, self-harm, suicidal ideation and/or behaviour (SIB), or other anxiety disorders such as obsessive-compulsive disorder. Quantitative studies are summarised in Appendix Table A2.

Seven qualitative studies from just four Sub-Saharan African countries were included (Ghana (Aziato et al., 2016; Gbogbo, 2020), Kenya (Osok et al., 2018a; Musyimi et al., 2020; Kumar et al., 2018), South Africa (Field et al., 2020), Uganda (Kaye, 2008)); none were identified from South Asia (see Appendix Table A3). Qualitative studies used focus group discussions (Aziato et al., 2016), one-on-one interviews (Osok et al., 2018a; Field et al., 2020), or both methods (Gbogbo, 2020; Musyimi et al., 2020; Kumar et al., 2018; Kaye, 2008). Qualitative studies sampled AGYW who experienced the perinatal period under varied conditions, including those with recent symptoms of common

mental disorders (Osok et al., 2018a; Kumar et al., 2018; Field et al., 2020), history of recent terminations (Aziato et al., 2016), and/or those currently attending routine facility-based care (Osok et al., 2018a; Kaye, 2008); five used facility-based samples (Osok et al., 2018a; Aziato et al., 2016; Kumar et al., 2018; Field et al., 2020; Kaye, 2008) and two used community-based (Gbogbo, 2020; Musyimi et al., 2020) (see Table A3). Notably, qualitative studies did not always explore nor report AGYW's experiences in the perinatal period using (just) diagnostic categories and language of mental 'disorder', and instead captured broader and more locally informed mental health outcomes. As such, we recognised APMH difficulties broadly as discussing psychological and/or emotional experiences including negative feelings like stress, fear, and shame. Finally, six intervention studies and protocols were included (Kenya (Kumar et al., 2020), Mozambique (Taylor Salisbury et al., 2021), Nepal (Maharjan et al., 2021), and Nigeria (Oladeji et al., 2019; Gureje et al., 2020; Kola et al., 2021)) (see Appendix Table A4).

Below we summarise evidence on prevalence (a), risk factors (b), and interventions (c), delineating by LMIC region and methodology where appropriate. Implications for health services and future research (research questions (d) and (e)) are reserved for the Discussion.

3.2. Prevalence of poor APMH outcomes (research question (a))

We found limited prevalence estimates for perinatal mental disorders among AGYW in South Asia, and only five high-quality studies. One facility-based study from India estimated depression across the whole perinatal period (Sidhu et al., 2019). Of six studies that estimated antepartum depressive symptoms (Palfreyman, 2021; Surkan et al., 2018; Agampodi et al., 2021; Nasreen et al., 2011; Sheeba et al., 2019; Srinivasan et al., 2015), prevalence of positive screens ranged from 7% (Surkan et al., 2018) (community-based) to 61% (Srinivasan et al., 2015) (facility-based). One facility-based study estimated the prevalence of antepartum anxiety symptoms: social phobia and panic disorder symptoms were 14% and 15% respectively in Pakistan (Tariq et al., 2019). Of seven studies estimating adolescent postpartum depression (Surkan et al., 2016, 2018; Fan et al., 2020; Doke et al., 2021; Neelakanthi et al., 2021; Tasnim et al., 2021; Ghosh and Goswami, 2011), prevalence ranged from 3.5% (Surkan et al., 2018) (facility-based) to 39% (Neelakanthi et al., 2021) (facility-based). Four studies in India and Nepal estimated the prevalence of postpartum distress symptoms (Prost et al., 2012; Clarke et al., 2014; Srinivasan et al., 2015; Khanna et al., 2021), ranging from 10% (Clarke et al., 2014) (community-based) to 21.9% (Khanna et al., 2021) (community-based).

Similarly, high quality, representative studies with population prevalence estimates of perinatal mental disorder among AGYW in Sub-Saharan Africa were scarce, with no studies assessing mental disorders beyond depression. Four studies across Cameroon, Nigeria, and Zimbabwe estimated a high prevalence of perinatal depressive symptoms at any point in the perinatal period (ante- or postpartum or both) (Nicolet et al., 2021; Ayamolowo et al., 2019; Woollett et al., 2021; Babafemi and Adeleke, 2012), from 41.6% (Ayamolowo et al., 2019) (community-based) to 70% (Nicolet et al., 2021) (both community- and facility-based samples). The prevalence of antepartum depression was estimated in eight studies in Sub-Saharan Africa (Oladeji et al., 2019, 2022; Weobong et al., 2015; Kimbui et al., 2018; Osok et al., 2018b; Govender et al., 2020; Bisetegn et al., 2016; Belay and Deressa, 2021), ranging from 10.1% (Weobong et al., 2015) (community-based) to 94% (Belay and Deressa, 2021) (facility-based study of rape survivors with an unwanted pregnancy). Nine studies estimated the prevalence of postpartum depressive symptoms, ranging from 8.8 (Govender et al., 2020) to 85% (Sakari et al., 2021) – both facility-based samples, although the latter study exclusively sampled mothers of preterm neonates (Sakari et al., 2021).

Finally, across both LMIC regions, only one study validated a screening tool specifically with an adolescent population (Kumar et al., 2021). Local validation with adult populations may include older

Table 1
Comparison of screening and diagnostic tools used in quantitative studies.

Mental disorder	Screening tool	No. of studies	Min cut-off	Max cut-off
Depressive symptoms	Edinburgh Postnatal Depression Scale (EPDS)	24	8+	13+
	Beck Depression Inventory (BDI)	2	13+	21+
	Centre for Epidemiologic Studies Depression scale (CES-D)	0	..	..
	Patient Health Questionnaire (PHQ-9)	2	2+ mild 5+ severe	15+
	Self-Reporting Questionnaire (SRQ-25)	1	5+	..
	Modified combination PHQ-9 and CES-D	3	1+	3+
Suicidal ideation and behaviour	Not specified or custom Ask Suicide Screening Questions (ASQ)	3	..	..
	Columbia-Suicide Severity Rating Scale (C-SSRS)	1	..	..
Anxiety symptoms	Edinburgh Postnatal Depression Scale (EPDS)	1	..	..
	Beck Depression Inventory (BDI)	1	21+	..
Distress	Edinburgh Postnatal Depression Scale (EPDS)	1	10+	..
	General Health Questionnaire (GHQ-12)	2	4+	6+
	Kessler-10	1	16+	..
Stress	Daily Hassles	1	..	..
	Feeling of Pregnancy Questionnaire	1	..	..
Anxiety	Diagnostic tools			
	International Classification of Diseases 10th revision (ICD-10)	1	..	..
Depression	Diagnostic and Statistical Manual of Mental Disorders	2	..	..

adolescents (i.e., 18–24), but may not be generalisable to all AGYW, especially adolescent minors, who may differ in their interpretation and comprehension of screening questions.

No qualitative studies explored AGYW's perceptions of how prevalent perinatal mental disorders may be. Qualitative evidence did, however, report the presence of a broader, and less medicalised, range of mental health outcomes underexplored or minimised by quantitative studies. AGYW in qualitative studies often spoke in terms of emotional states and feelings. For example, AGYW reported feelings of alarm, surprise, denial/disbelief, bafflement, disgrace, worry and stress, anxiety, guilt, shame, low mood, and loss of self-esteem upon learning they were pregnant (Osok et al., 2018a; Aziato et al., 2016; Gbogbo, 2020; Musyimi et al., 2020; Kumar et al., 2018; Kaye, 2008). Also reported in the antepartum period were embarrassment and shyness; isolation, loneliness, and perceived neglect; confusion and doubt; stress and pressure; sadness, depression, and despair; disdain; regret; fear and symptoms of trauma; feelings of loss, hopelessness, and worthlessness; and suicidal ideation and behaviour (Osok et al., 2018a; Aziato et al., 2016; Gbogbo, 2020; Musyimi et al., 2020; Kumar et al., 2018; Kaye, 2008). Addiction in pregnancy was raised just once (Osok et al., 2018a), while trouble eating in pregnancy was reported in two studies, both in Kenya (Osok et al., 2018a; Musyimi et al., 2020). AGYW's postpartum experiences included feeling desperate, unprepared, overwhelmed, and isolated by the 'unbearable' difficulties of motherhood; perceived lack of choice/freedom; worry, stress, and low mood; and difficulty bonding with infants (Osok et al., 2018a; Kumar et al., 2018; Kaye, 2008). Three studies recognised limited, positive APMH experiences in a minority of AGYW including pride, joy, happiness, improved self-worth and -esteem, optimism for the future, and feelings of satisfaction and fulfilment from motherhood; however, these were changeable and contingent on social support (Osok et al., 2018a; Gbogbo, 2020; Kaye, 2008).

3.3. Risk factors for poor APMH outcomes (research question (b))

3.3.1. Quantitative evidence

3.3.1.1. Age. In South Asia, six studies estimated the effect of adolescent age as a risk factor for antepartum depression: one found adolescent age increased risk of a positive screen (Agampodi et al., 2021), three found age to have no effect (Palfreyman, 2021; Sheeba et al., 2019; Srinivasan et al., 2015), and two found adolescent age protective relative to women aged 30+ (Surkan et al., 2018) or 35+ (Nasreen et al., 2011). Adolescents appeared at higher risk of antepartum anxiety symptoms than older women in Sri Lanka (Agampodi et al., 2021). For symptomatology of postpartum depression, relative to women of older ages, two studies in India found AGYW at higher risk (Doke et al., 2021; Neelakanthi et al., 2021), two studies in Bangladesh (Tasnim et al., 2021) and India (Ghosh and Goswami, 2011) found age to have no effect, and three studies in Sri Lanka and Bangladesh found adolescents to be at lower risk (Surkan et al., 2016, 2018; Fan et al., 2020). For postpartum distress, three found no effect of age (Clarke et al., 2014; Srinivasan et al., 2015; Khanna et al., 2021), while one found reduced risk for women 15–22 years, relative to women 33+ (Prost et al., 2012). Finally, younger adolescent age may be a risk factor for SIB: pregnant AGYW aged 15–19 years were significantly more likely to disclose SIB than pregnant women 20+ in Sri Lanka (Palfreyman, 2021).

In Sub-Saharan African studies, adolescent age presented a mixed risk profile for antepartum depressive symptoms relative to adult age, with one study reporting greater risk (Oladeji et al., 2019), another reporting no effect (Bisetegn et al., 2016), and a third reporting adolescent age as protective relative to adult women 30+ (Weobong et al., 2015). Among AGYW, one study in Nigeria also found those of younger age (14–17 years) to be at higher risk of antepartum depressive symptoms (Oladeji et al., 2022). There were mixed results for the risk of adolescent age on postpartum depressive symptoms, with increased risk

(Kassa et al., 2021; Nakku et al., 2006), no effect (Roux et al., 2019; Sakari et al., 2021), or reduced risk compared to older women (Kerie et al., 2018).

3.3.1.2. Additional risk factors. Our search identified only one study isolating additional risk factors specifically for APMH in South Asia, highlighting female infant sex and serious postpartum complications as risk factors for postpartum distress in India (Khanna et al., 2021). While 14 additional studies estimated risk factors for all women of reproductive age, with age as a covariate, they did not compute sub-group analyses to estimate the extent to which risk factors differed for adolescents and adult women.

In Sub-Saharan Africa however, seven studies from Cameroon, Kenya, Nigeria, Rwanda, and South Africa estimated adolescent-specific risk factors for perinatal depression only (Oladeji et al., 2022; Nicolet et al., 2021; Ayamolowo et al., 2019; Kimbui et al., 2018; Osok et al., 2018b; Govender et al., 2020; Niyonsenga and Mutabaruka, 2021). Perceived lack of social support for the pregnancy emerged most frequently as a risk factor for depression at any point in the perinatal period (Oladeji et al., 2022; Nicolet et al., 2021; Ayamolowo et al., 2019; Kimbui et al., 2018; Osok et al., 2018b; Govender et al., 2020). This was expressed either directly as perception of social support (Ayamolowo et al., 2019; Govender et al., 2020; Osok et al., 2018b), or indirectly as negative or ambivalent attitudes from the baby's father (Kimbui et al., 2018), or being single or separated (Nicolet et al., 2021; Oladeji et al., 2022). Violence, including from intimate partners, emerged as a second critical risk factor for perinatal depression (Nicolet et al., 2021; Govender et al., 2020), with one study reporting that IPV increased the odds of postpartum depression by over 800% (AOR 9.58, [1.58, 48.8]) (Govender et al., 2020). Experiencing physical violence and verbal abuse – irrespective of the perpetrator – was also a risk factor for ante- and postpartum depression in South Africa (Govender et al., 2020). The extremely high prevalence of diagnosed depression in AGYW rape survivors with an unwanted pregnancy in Ethiopia highlights pregnancy in the context of sexual violence as a significant risk factor for poor APMH (Belay and Deressa, 2021). Unintended pregnancy increased the risk of perinatal (at any time point) (Nicolet et al., 2021) or antepartum (Kimbui et al., 2018) depression in Cameroon and Kenya. Additional adolescent perinatal depression risk factors include (Oladeji et al., 2022) histories of depression or anxiety preceding pregnancy (Nicolet et al., 2021), experience of abortion (Nicolet et al., 2021), being a student (Kimbui et al., 2018), experiencing a stressful life event (Osok et al., 2018b), low income (Kimbui et al., 2018; Niyonsenga and Mutabaruka, 2021), food insecurity (Oladeji et al., 2022), HIV (Osok et al., 2018b), early sexual debut (Kimbui et al., 2018), prior psychoactive substance use (Kimbui et al., 2018), and body weight/shape changes (Niyonsenga and Mutabaruka, 2021). Male partner's employment was protective in Nigeria (Oladeji et al., 2022). Anxiety and higher scores on the Maternal Adjustment and Maternal Attitudes (MAMA) questionnaire – which measures maternal preparedness for parenthood – were identified as risk factors for more severe depressive symptoms in Nigeria (Oladeji et al., 2022; Yako, 2007).

Notably, quantitative studies focus heavily on individual-level risk factors, overlooking sufficiently comprehensive social conditions that may increase the likelihood of poor APMH outcomes.

3.3.2. Qualitative evidence

The seven qualitative studies from Sub-Saharan Africa identified the interpersonal and societal contributors to APMH difficulties omitted by quantitative studies' conceptual and methodological focus on individual-level predictors. Most importantly, despite the diverse backgrounds of AGYW included, participants emphasised self- and social stigma towards pregnant and postpartum adolescents as especially harmful to APMH. Stigma manifested as family-level discrimination, abuse, and/or rejection (Osok et al., 2018a, 2018b; Gbogbo, 2020;

Musyimi et al., 2020); isolation from peers (Musyimi et al., 2020); fear of wider community judgement (Musyimi et al., 2020; Kaye, 2008); mainly due to society's discovery AGYW are sexually active, which was perceived as significantly more stigmatising than HIV and influenced suicidal ideation (Musyimi et al., 2020), and finally, stigmatisation from health workers (Osok et al., 2018a; Aziato et al., 2016). Fear of (obstetric) maltreatment by healthcare workers also emerged as an important reason for adolescents' avoidance of maternal and child health services and/or adolescent mental health services (Kumar et al., 2018; Field et al., 2020) with implications for physical and mental health.

Reactions to pregnancies by family and male partners directly influenced APMH outcomes as well as options for (dis)continuation of pregnancy and broader help-seeking behaviours according to AGYW (Aziato et al., 2016; Gbogbo, 2020). Unwillingness to accept paternity, the abdication of responsibility, and ultimately, abandonment by adolescents' male partners, emerged as common contributors to feelings of shame and depression (Gbogbo, 2020; Kumar et al., 2018; Kaye, 2008). Unplanned and unwanted pregnancy in some cases also resulted in intimate partner violence (Osok et al., 2018a; Musyimi et al., 2020), and pressure or coercion to terminate the pregnancy by partners (Aziato et al., 2016; Musyimi et al., 2020) and family (Aziato et al., 2016). Domestic violence from wider family reportedly included (forcibly) sending perinatal AGYW away to conceal pregnancies (Aziato et al., 2016), neglect, emotional abuse (Musyimi et al., 2020), and threats of violence (Osok et al., 2018a), driving elevated levels of stress, depression, and suicidal thoughts and behaviour (Osok et al., 2018a; Musyimi et al., 2020).

Feelings of failure and despair developed among adolescents struggling with the transition to motherhood, though APMH was mitigated by strong family and/or communal support in some cases (Gbogbo, 2020; Field et al., 2020). In particular, adolescents' realisation that pregnancy would result in termination of schooling and restrict opportunities post pregnancy contributed to feelings of loss and bereavement, depression, regret, shame (Osok et al., 2018a; Aziato et al., 2016; Kumar et al., 2018; Kaye, 2008), and sometimes resentment towards their children (Kaye, 2008). These feelings compounded worries about being able to provide material support for a baby, with poverty and concerns of intergenerational deprivation in material and health resources emerging recurrently as key contributors to APMH (Osok et al., 2018a; Musyimi et al., 2020; Kumar et al., 2018; Field et al., 2020; Kaye, 2008). AGYW who perceived they were viewed as economically and socially burdensome to caregivers reported feeling neglected (Aziato et al., 2016) and sometimes threatened by family (Osok et al., 2018a), resulting in worry, depression (Osok et al., 2018a), and, at the extreme, suicidal thoughts and behaviour (Gbogbo, 2020; Musyimi et al., 2020).

Finally, qualitative studies highlight the double hit to APMH resulting from pregnancy and HIV diagnosis. HIV diagnoses, often confirmed during antenatal appointments (Osok et al., 2018a), and chronic illness(es) from HIV infection (Musyimi et al., 2020), intensified adolescents' fear, stress, and emotional isolation, and in some cases contributed to suicidal ideation in the perinatal period (Musyimi et al., 2020).

3.4. Interventions for improved APMH (research question (c))

We found no already-implemented perinatal mental health interventions explicitly focused on AGYW in South Asia or Sub-Saharan Africa. However, we identified several protocols for rigorous APMH interventions in Mozambique, Nigeria, and Kenya, respectively (Kumar et al., 2020; Taylor Salisbury et al., 2021; Gureje et al., 2020). In Mozambique, a motherhood preparatory course aims to improve pregnant adolescents' agencies, build networks and reduce social isolation, while family-level interpersonal interventions aim to reduce family-driven stigma (Taylor Salisbury et al., 2021). In Nigeria, a "neighbourhood mother" intervention pairs pregnant adolescents with

adult mothers in their community to build parenting skills and reduce both isolation and societal-level stigma (Gureje et al., 2020). In Kenya, a pilot study aims to test the feasibility of group interpersonal therapy (IPT-G) for adolescent perinatal depression (Kumar et al., 2020). Three additional feasibility studies explore mobile phone (i.e., mHealth) approaches: one used mobile phone delivery of mental health information among perinatal adolescents in Nigeria (Kola et al., 2021), and one explored potential use of mobile phone-based passive-sensing data for depression screening and treatment monitoring in Nepal (Maharjan et al., 2021). As all interventions are yet to be implemented and/or evaluated, their relative efficacy remains unclear.

One Nigerian intervention study was not adolescent-focused but did compare the efficacy of a postpartum depression intervention for adolescents vs. adult women (Oladeji et al., 2019). This adjusted-WHO Mental Health Gap (mhGAP) psychosocial treatment intervention included psychoeducation, activity scheduling, and problem-solving. At six months postpartum, however, remission of depressive symptoms was similar across treatment and control arms, suggesting limited efficacy. There was no evidence that age altered the efficacy of the intervention, although adolescents held poorer attitudes to motherhood at six months postpartum (Oladeji et al., 2019).

Qualitative studies offer additional insight into potentially beneficial approaches and recommend adolescent-friendly interventions be delivered through school, family, and community health settings, plus media-based approaches targeting community norm-changing (Musyimi et al., 2020; Kumar et al., 2018). Task-shifting and training health workers in mental health, parenting, and pregnancy prevention may be warranted (Aziato et al., 2016; Kumar et al., 2018), while integrating screening and psychosocial support into maternal and child health services may be acceptable and feasible in LMIC (Musyimi et al., 2020; Kumar et al., 2018; Field et al., 2020). Field et al. (2020) explored AGYW's experiences of an integrated multi-session counselling intervention in South African maternity care to reduce perinatal depression. While some adolescents expressed fear of judgement before commencing counselling, all subsequently reported feelings of validation, interpersonal support, improved ability to speak with parents, and to process and cope with problems (Field et al., 2020). Teachers encouraging perinatal AGYW to attend counselling was perceived beneficial, indicating the potential of mobilising (in)formal social and economic support from varied community actors (Musyimi et al., 2020; Kumar et al., 2018). As higher rates of recurrent pregnancy within two years are observed among AGYW with perinatal depression compared to those without (Field et al., 2020), access to sexual and reproductive health services including contraception may be beneficial (Aziato et al., 2016; Field et al., 2020). Finally, for adolescents managing co-morbidities like HIV in the perinatal period, interventions addressing chronic health management may support improved APMH outcomes (Musyimi et al., 2020).

4. Discussion

To our knowledge, this is the first systematic review to focus on adolescent perinatal mental health in South Asia and Sub-Saharan Africa, expanding upon a timely Sub-Saharan African review on pregnant AGYW's mental health with a more limited scope (Mutahi et al., 2022). Our synthesis addresses a critical blind spot where prior systematic reviews have focused on either perinatal mental health in LMICs or APMH in high-income settings, while neglecting the intersection of potentially negatively synergistic vulnerabilities of adolescent pregnancy in the world's highest-burden, lowest-resource settings.

This review indicates most quantitative evidence on the prevalence of APMH in South Asia and Sub-Saharan Africa is poor or medium quality, while recognising AGYW were not most studies' original focus. Very few studies applied an appropriate methodology to yield reliable prevalence estimates for this sub-group, with most relying on convenience sampling, and potentially unrepresentative samples through facility-based recruitment. Moreover, differences in study design,

operational definitions of adolescents/ce, the perinatal period, and mental health screening tools with varied thresholds for probable positive symptomology, hinder comparability and prohibit meaningful calculation of weighted prevalence estimates. Only one study validated standard tools specifically for adolescent comprehension rather than presuming validity across all reproductive-age participants (Kumar et al., 2021).

Only eight studies in Sub-Saharan Africa, and one study in South Asia, identified perinatal mental health risk factors for AGYW. While limited, these studies suggest individual-level predictors of adolescent perinatal mental disorders are broadly consistent with those identified for adolescent and older women combined, with having an unplanned pregnancy, violence, and being single or separated, recurring as significant predictors. An important exception, however, is the emergence of stigma, which qualitative evidence consistently underscored as a vital contributor to APMH difficulties. Stigma may be uniquely experienced by AGYW, whose sexual activity breaks gendered social norms that differ from those of partnered and/or adult women (Miller et al., 2021).

Very few qualitative studies explicitly focused on AGYW's experience of mental ill-health during the perinatal period. While important, we excluded a vast body of qualitative research blurring the perinatal and parenting windows, which makes it difficult to disentangle the impacts of the perinatal period itself. The mental health experiences and needs of pregnant/postpartum adolescents may be closely related, but distinct, from adolescent mothers beyond one year postpartum. Studies that included mothers of older children reflecting on their experience of pregnancy, birth, and the postpartum as adolescents were also excluded, as it is unclear how a person's recall of the perinatal period may be shaped by more immediate needs and experiences of parenthood.

4.1. Implications for health services and interventions to improve APMH

We build upon Mutahi et al.'s (2022) use of a sociological framework on the risk factors for poor APMH outcomes to draw implications for health service provision in clinical and community settings. Services must be designed to tackle disadvantage operating across multiple societal levels – the individual, micro-, exo-, and macro-systems – that jointly and concurrently increase AGYW's vulnerability to poor mental health in the perinatal period.

First, at the individual-level, exposure to unintended pregnancy, HIV infection, violence, and poor mental health outcomes are interconnected and intersect with prevailing gender norms within countries. The interconnection of these vulnerabilities reaffirms calls for adolescent mental health services to be integrated into gender-sensitive adolescent sexual and reproductive health services (Duby et al., 2021; Roberts et al., 2021). Existing ante- and postpartum and HIV services may provide an acceptable and feasible platform to routinely screen and refer for APMH difficulties, including common mental disorders, SIB, and other psychosocial vulnerabilities (Palfreyman, 2021; Roberts et al., 2021). However, screening is only appropriate where referral pathways and support services for perinatal mental health in AGYW exist. The capacity of health workers to diagnose and treat common mental disorders among AGYW in the perinatal period at the primary care level must be improved (Kutcher et al., 2019).

Next, the primacy of stigma suggests a need for community-level (i.e., micro-system) interventions that extend beyond individual-level risk factors and target gender and social norms and attitudes to improve APMH, as seen in other issues like increasing voluntary HIV testing

(Treves-Kagan et al., 2017) and addressing IPV (Halim et al., 2019) in similar contexts. Also at the micro-level, the importance of family- and peer-based stigma as contributors to AGYW isolation and depression in the perinatal period in qualitative studies indicates that school-based health and life skills interventions which promote mental health literacy and improve knowledge of sexual and reproductive health and rights, safe sex practices, and available social supports among adolescents may hold value. School-based health programmes have previously shown promise in both regions for delivering cost-effective interventions on related challenges like HIV prevention, testing and treatment, particularly for socially disadvantaged AGYW who may otherwise not access services (Sarr et al., 2017), though evidence of what works specifically for mental health promotion through schools in LMICs is lacking (Bradshaw et al., 2021). High school dropout rates for pregnant and parenting AGYW, and the gendered and discriminatory policies that legitimate their exclusion from school, however, reaffirm that interventions must be multi-pronged, and target state-level education policies and practice that disadvantage AGYW in pregnancy and early motherhood.

Finally, the seven medium-high quality qualitative studies included in this review underscore the dominance of societal stigma as a barrier to care utilisation at the exo- and macro-system levels. In many contexts, maternal and child health, sexual and reproductive health, and mental health services are not adolescent-friendly (Mutahi et al., 2022), with health workers' stigmatisation of pregnant adolescents impeding service use at the primary care level (Aziato et al., 2016; Duby et al., 2021). Reinforced by multi-country evidence that AGYW experience obstetric mistreatment more than older women, supporting health providers to deliver respectful care emerges as a priority to improve service utilisation and APMH outcomes (Kola et al., 2021; Bohren et al., 2019). This requires intervention at the exo- and macro-system levels, to reduce stigma towards pregnant and parenting adolescents and mental health difficulties at the community level, as well as inform health worker training to improve attitudes and behaviour in the provision of care for AGYW in the perinatal period. Lessons on promising interventions may be drawn from reviews of efforts to deliver adolescent friendly sexual and reproductive health services across Sub-Saharan Africa and South Asia: multi-faceted, complementary strategies are needed to (1) generate demand for services amongst AGYW; (2) reduce stigma and improve community acceptability of services for AGYW; (3) modify facilities to improve AGYW's utilisation (e.g. extend out-of-school hours, maintain privacy); and (4) provide health workers with knowledge, attitudes, and practices training in providing adolescent-friendly services (Denno et al., 2015).

4.2. Persisting knowledge gaps and implications for future research

Our review identified remarkable evidence gaps that call for urgent and multi-method research. First, and influential for all subsequent gaps, more research is required to understand local conceptualisations of mental health and its challenges affecting AGYW in the perinatal period in both regions. A key contribution of the included qualitative evidence is its insistence on broadening our notions of what constitutes mental (ill-)health, moving beyond the clinical and categorical to explore myriad other idioms of psychological distress and social suffering salient to AGYW in the perinatal period (Osok et al., 2018a). For AGYW who experience pregnancy in the context of violence and other traumas, the recognised disconnect between mental health research priorities of

scholars and clinicians with those of survivors means critical psychosocial experiences of survivors in the perinatal window go un- or under-explored (Lancet Psychiatry, 2022). Future quantitative research may especially benefit from first assessing local framings and explanations of mental health and trauma and pursuing measurement in context-affirming ways including what matters most to adolescents themselves in this critical life stage.

Second, and partially driven by current dominant framings of mental health as synonymous with mental disorder, the included evidence focuses overwhelmingly on perinatal depression as the mental disorder of interest, with only a few studies on anxiety (Agampodi et al., 2021; Tariq et al., 2019; Sakari et al., 2021), self-harm and SIB (Palfreyman, 2021; Gbogbo, 2020; Musyimi et al., 2020), and nothing on other anxiety disorders, posttraumatic stress, and psychosis. Taken together, these two initial gaps call for further high-quality, comparable research on APMH in LMICs, necessitating greater consistency in reporting and further validation of new and existing screening tools for a more comprehensive range of mental health outcomes. Iterating on transdiagnostic approaches already developed and trialled for use by non-mental health specialists in low-resource settings, may prove useful to identify underlying contributors to an array of APMH outcomes, and better recognise complex, often co-presenting forms of distress (Jewkes, 2022).

Third, the research on AGYW perinatal mental health is dominated by a few countries in each region, with efforts required to identify the burden, risk and protective factors, and ingredients for mental health enabling environments in thus far un- or under-studied countries, particularly in South Asia.

Fourth, more evidence is required to understand the effects of risk factors for adverse APMH outcomes previously identified among adult women. Risks to the mental health of adult women in the perinatal period from infant mortality or pregnancy loss (Weobong et al., 2015; Bisetegn et al., 2016; Kerie et al., 2018; Mehra et al., 2018), obstetric outcome or pregnancy complications including caesarean section (Doke et al., 2021; Ghosh and Goswami, 2011; Bisetegn et al., 2016), poor current health of the mother (Nakku et al., 2006; Imam et al., 2021) or baby (Nakku et al., 2006), and fear of childbirth (“tokophobia”) (Johnson et al., 2019) remain understudied and must be expanded for AGYW too. Similarly, despite recent preliminary research pooling AGYW in the perinatal period and mothers more than one year postpartum together (Mutahi et al., 2022; Olorunsaiye et al., 2021; Oluseye et al., 2021), further research is required to understand the mental health needs of AGYW experiencing forced pregnancy, birth, and possibly motherhood where safe, legal abortion services are inaccessible. Research is also required to identify unique challenges and opportunities to support girls’ perinatal mental health in the context of girl-child marriage (Burgess et al., 2022) and preferences for birthing male infants (Khanna et al., 2021), both of which remain stubbornly high in South Asia and Sub-Saharan Africa.

Finally, as observed for older women in pregnancy and the postpartum period, interventions to support mental health following

adolescent pregnancy and birth have not received nearly the same policy prioritisation as those targeting physical complications (Eboime et al., 2022). The lack of evidence on intervention efficacy for APMH means the results of several upcoming, large-scale intervention studies are critical, as is the need to address the shortcomings of key global intervention guidelines that do not yet address the intersecting vulnerabilities of perinatal mental ill-health in adolescence (Kumar et al., 2020).

4.3. Strengths and limitations

A major strength of this review is its comprehensive and rigorous search strategy across a large body of mixed-methods evidence from the highest-burden, lowest resource LMIC regions. Robust quality assessment and, where practicable, synthesis of mixed-paradigm data add value. Exclusion of qualitative research from previous reviews overlooks its value particularly on societal-level contributors to poor APMH, most notably the stigmatisation of pregnant and postpartum adolescents.

Limiting to English-language full manuscripts excluded Lusophone, Francophone, and local language South Asian studies, which may also have facilitated publication bias. The exclusion of phobias (e.g., tokophobia) from our search strategy may have overlooked their contribution to poor APMH. Qualitative research identified that researchers and adolescent participants in South Asia and Sub-Saharan Africa use non-clinical language to describe APMH. Our search terms, informed by medicalised linguistic norms around mental disorders, especially for prevalence studies, may have excluded some quantitative evidence capturing broader expressions of (di)stress and suffering.

The heterogeneity of quantitative studies meant we were unable to conduct meta-analysis including calculating weighted prevalence estimates. Underreporting of APMH difficulties in both regions may be more likely than settings where mental distress and/or adolescent pregnancy are less stigmatised, misrepresenting the scale and nature of the issue. Finally, the varied definition for adolescents/ce across studies rendered it difficult to develop an understanding of APMH for AGYW spanning 10–24 years.

Declaration of competing interest

None.

Data availability

No data was used for the research described in the article.

Acknowledgements

We would like to thank the Naughton/Clift-Matthews Global Health Fund (University College London) for their contribution towards this work.

Appendix A

Table A1

Example MEDLINE database search for records from South Asia.

Term number	Searches
1	Free text MeSH
2	Free text MeSH
3	Free text MeSH
4	Free text MeSH
5	
6	
Final search	

(“adolescent” or “adolescen*” or “teen” or “teen*” or “young adul*” or “pubescen*” or “juvenile” or “youth” or “underage” or “girl”).ti,ab.

Adolescent Medicine/or Psychology, Adolescent/or Adolescent/or Adolescent Health/or Adolescent Psychiatry

(“perinatal” or “peri-natal” or “postpartum” or “post-partum” or “antepartum” or “ante-partum” or “pregnancy” or “maternal” or “puerperium” or “prenatal” or “postnatal” or “post-natal”).ti,ab.

Perinatal Care/or Postnatal Care/or Postpartum Period (Mental Health/Pregnancy Complications)

(“mental health” or “mental illness” or “mental disorder” or “emotional well-being” or “emotional wellbeing” or “psychological state” or “psychological wellbeing” or “psychological well-being” or “psychosis” or “anxiety” or “depression” or “post traumatic stress disorder” or “post-traumatic stress disorder” or “obsessive compulsive disorder” or “obsessive-compulsive disorder” or “OCD” or “PTSD” or “body dysmorphic disorder” or “suicid*” or “suicide” or “bipolar” or “self harm” or “self-harm” or “self-injury” or “self injury” or “deliberate self-harm” or “suicidal ideation” or “schizo*” or “schizophrenia” or “suicide prevention” or “stillbirth” or “still birth” or “abortion” or “miscarriage”).ti,ab.

Mental Disorders/or Mental Health/

(“South Asia” or “Southern Asia” or “India” or “Bangladesh” or “Sri Lanka” or “Ceylon” or “Nepal” or “Afghanistan” or “Bhutan” or “Maldives” or “Pakistan”).ti,ab

Or

(“Africa South of the Sahara” or sub-Saharan Africa or subSaharan Africa or “Central Africa” or “Eastern Africa” or “Southern Africa” or “Western Africa” or “Angola” or (Cameroon or Kamerun or Cameroun) or (Cape Verde or Cabo Verde) or (Comoros or Glorioso Islands or Mayotte) or (Congo not ((Democratic Republic adj3 Congo) or congo red or crimean-congo) or (Cote d’Ivoire or Cote dIvoire or Ivory Coast) or (eSwatini or Swaziland) or (Ghana or Gold Coast) or (Kenya or East Africa Protectorate) or (Lesotho or Basutoland) or “Mauritania” or Nigeria or (Sao Tome adj2 Principe) or Senegal or (Sudan not South Sudan) or (Zambia or Northern Rhodesia) or (Zimbabwe or Southern Rhodesia) or (Botswana or Bechuanaland or Kalahari) or (Equatorial Guinea or Spanish Guinea) or (Gabon or Gabonese Republic)

or (Mauritius or Agalega Islands) or (Namibia or German South West Africa) or (South Africa or Cape Colony or British Bechuanaland or Boer Republics or Zululand or Transvaal or Natalia Republic or Orange Free State) or (Benin or Dahomey) or (Burkina Faso or Burkina Fasso or Upper Volta) or (Burundi or Ruanda-Urundi) or (Central African Republic or Ubangi-Shari) or Chad or (((Democratic Republic or DR) adj2 Congo) or Congo-Kinshasa or Belgian Congo or Zaire or Congo Free State) or Eritrea or (Ethiopia or Abyssinia) or Gambia or (Guinea not (New Guinea or Guinea Pig* or Guinea Fowl or Guinea-Bissau or Portuguese Guinea or Equatorial Guinea) or Liberia or (Madagascar or Malagasy Republic) or (Malawi or Nyasaland) or Mali or (Mozambique or Mocambique or Portuguese East Africa) or (Niger not (Aspergillus or Peptococcus or Schizothorax or Cruciferae or Gobius or Lasius or Agelastes or Melanosuchus or radish or Parastromateus or Orius or Apergillus or Parastromateus or Stomoxys)) or (Rwanda or Ruanda) or (Sierra Leone or Salone) or (Somalia or Somaliland) or South Sudan or (Tanzania or Tanganyika or Zanzibar) or Togo or Togolese Republic or Togoland) or Uganda or Seychelles).ti,ab.

India/or Bangladesh/or Sri Lanka/or Nepal/or Afghanistan/or Pakistan/or Bhutan/or Maldives

Or

Angola/or Cameroon/or Cape Verde/or Comoros/or Congo/or Cote d’Ivoire/or Eswatini/or Ghana/or Kenya/or Lesotho/or Mauritania/or Nigeria/or Senegal/or Sudan/or Zambia/or Zimbabwe/or Botswana/or Equatorial Guinea/or Gabon/or Mauritius/or Namibia/or South Africa/or Benin/or Burkina Faso/or Burundi/or Central African Republic/or Chad/or “Democratic Republic of the Congo”/or Eritrea/or Ethiopia/or Gambia/or Guinea/or Guinea-Bissau/or Liberia/or Madagascar/or Malawi/or Mali/or Mozambique/or Niger/or Rwanda/or Sierra Leone/or Somalia/or South Sudan/or Tanzania/or Togo/or Uganda/or Seychelles

Publication year from 2000-current (final search ran on April 30, 2022)

English language

1 and 2 and 3 and 4 and 5 and 6

Table A2

Summary of quantitative studies reporting prevalence estimates for adolescent perinatal mental health.

Study	Country	Eligible adolescent age range	Study design	Sample setting	Sample size adolescents (n)	Sample size comparison group(s) (n)	Trimester	Assessment tool and cut-off	Prevalence estimate	Risk factors
Perinatal depressive symptoms at any point (ante- and postpartum)										
Sidhu et al. (2019)	India	18–21 years	Cross-sectional study; sampling strategy unclear	Facility	51	151	..	EPDS Cut-off not clear	Prevalence (%): Age 18–20 = 9 (17.0) Age 21–28 = 8 (7.5) Age >28 = 11(25.5) p = 0.011	N/A: risk factors not disaggregated for adolescent subgroup
Antepartum depressive symptoms										
Agampodi et al. (2021)	Sri Lanka	15–19 years	Prospective, representative cohort of pregnant women in one district (Rajarata Pregnancy Cohort)	Community	221	782	First	EPDS depression factor score (no cut-off applied)	Mean EPDS factor score depression (SD): Age 15–19 = -0.024 (0.82) Age ≥20 = -0.064 (0.67) p = 0.46 Mean EPDS factor score anhedonia (SD): Age 15–19 = 0.081 (0.91) Age ≥20 = 0.024 (0.93) p = 0.46	N/A: risk factors for APMH not explored
Nasreen et al. (2011)	Bangladesh	15–19 years	Cross-sectional data originating from a representative prospective cohort study of randomly selected women	Community	157	563	Third	EPDS≥10	Prevalence (%): Age <20 years = 22 (14.0) Age 20–34 years = 90 (17.9) Age ≥35 = 20 (33.3) Adjusted OR: Age 15–19 = reference Age 20–34 = 1.48 (0.71-3.06) Age ≥35 = 3 (1.12-8.01)	N/A: risk factors not disaggregated for adolescent subgroup
Palfreyman (2021)	Sri Lanka	15–19 years	Cross-sectional, representative study of women presenting at antenatal clinic	Facility	65	935	All trimesters	EPDS≥9 C-SSRS (cut-off scores not applicable)	Adjusted OR for depression: Age 15–19 = reference Age 20–25 = 0.96 (0.47, 1.95) Age 26–34 = 1.15 (0.58, 2.27) Age 35–49 = 1.04 (0.48, 2.29) Pregnant adolescents (15–19) significantly more likely to report suicidal ideation and/or behaviour in pregnancy compared to older pregnant women (adjusted OR not reported) p < 0.001	N/A: risk factors not disaggregated for adolescent subgroup
Sheeba et al. (2019)	India	≤20 years	Cross-sectional, convenience sample of women attending antenatal clinic	Facility	76	204	Mostly second trimester (14–28 weeks)	EPDS≥13	Prevalence (%): Age ≤20 = 29 (38.2) Age >20 = 71 (34.8) Crude OR: Age ≤20 = 1.16 (0.67, 2.0) Age >20 = reference	N/A: risk factors not disaggregated for adolescent subgroup
Srinivasan et al. (2015)	India	20–24 years	Cross-sectional, facility-based convenience sample	Facility	49	51	All trimesters, majority third	EPDS≥10	Prevalence (%): Age 20–24 = 30 (61.2) Age 25–29 = 32 (71.1) Age ≥30 = 3 (50.0) p = 0.53	N/A: risk factors not disaggregated for adolescent subgroup
	Bangladesh	<19 years		Community	5742	7675	First			

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Table A2 (continued)

Study	Country	Eligible adolescent age range	Study design	Sample setting	Sample size adolescents (n)	Sample size comparison group(s) (n)	Trimester	Assessment tool and cut-off	Prevalence estimate	Risk factors
Surkan et al. (2018)			Data from a cluster randomised, double-masked, placebo-controlled trial					Adapted PHQ-9 and CES-D + questions about suicide attempts and suicidal attempts, cut-off ≥ 3	Prevalence (%): Age ≤ 19 = 430 (7.5) Age 20–29 = 536 (8.5) Age ≥ 30 = 235 (17.5) Adjusted RR: Age ≤ 19 = reference Age 20–29 = 0.94 (0.8, 1.11) Age ≥ 30 = 1.38 (1.12, 1.70)	N/A: risk factors not disaggregated for adolescent subgroup
Antepartum anxiety symptoms										
Agampodi et al. (2021)	Sri Lanka	15–19 years	Prospective, representative, cohort of pregnant women in one district (Rajarata Pregnancy Cohort)	Community	221	782	First	EPDS anxiety factor score compared (no cut-off applied)	Mean EPDS factor score (SD): Age 15–19 = 0.12 (0.95) Adult = -0.043 (0.80) p = 0.009	N/A: risk factors for APMH not explored
Tariq et al. (2019)	Pakistan	13–19 years	Cross-sectional, facility-based convenience sample of adolescents presenting at antenatal clinic	Facility	150	..	Unclear	Diagnostic criteria according to ICD-10	Prevalence (%): Social phobia = 21 (14.0) Panic disorder = 23 (15.3)	N/A: risk factors for APMH not explored
Postpartum depressive symptoms										
Doke et al. (2021)	India	<25 years	Cross-sectional, convenience sample of women who had had a caesarean section or vaginal delivery	Facility	1735	1073	..	EPDS ≥ 10	Prevalence (%): Age 25 = 62 (3.5) Age ≥ 25 = 25 (2.3) Adjusted OR: Age <25 = 2 (1.16, 3.43) Age ≥ 25 = reference	N/A: risk factors not disaggregated for adolescent subgroup
Fan et al. (2020)	Sri Lanka	15–19 years	Cross-sectional study of mothers who delivered in Medical Offices of Health; sampling strategy unclear	Facility	43	783	..	EPDS ≥ 10	Adjusted OR: Age 15–19 = reference Age 20–34 = 2.58 (0.59, 11.24) Age ≥ 35 = 7.73 (1.69, 35.37)	N/A: risk factors not disaggregated for adolescent subgroup
Ghosh and Goswami (2011)	India	<20 and 20–24 years	Cross-sectional study of women shortly after delivery; Sampling strategy unclear	Facility	3077	2923	..	EPDS > 13	Prevalence (%): Age <20 = 311 (25.5) Age 20–24 = 467 (25.2) Age 25–29 = 397 (24.8) Age 30–34 = 274 (24.9) Age ≥ 35 = 56 (25.2) p > 0.05	N/A: risk factors not disaggregated for adolescent subgroup
Neelakanthi et al. (2021)	India	≤ 24 years	Cross-sectional, facility-based, convenience sample	Facility	61	54	..	EPDS ≥ 10	Prevalence (%): Age ≤ 24 = 24 (39.0) Age > 24 = 12 (22.0) p = 0.001	N/A: risk factors not disaggregated for adolescent subgroup
Surkan et al. (2018)	Bangladesh	<19 years	Data from a cluster randomised, double-masked, placebo-controlled trial	Community	5742	7675	..	Adapted PHQ-9 and CES-D plus questions about suicide attempts and suicidal attempts, cut-off ≥ 3	Prevalence (%): Age ≤ 19 = 1340 (11.6) Age 20–29 = 1926 (14.7) Age ≥ 30 = 699 (24.8) Adjusted RR: Age ≤ 19 = reference Age 20–29 = 1.09* (1.02, 1.2) Age ≥ 30 = 1.44* (1.29, 1.61)	N/A: risk factors not disaggregated for adolescent subgroup
Surkan et al. (2016)	Bangladesh	≤ 19 years	Secondary analysis of data from a cluster randomised, double-masked, placebo-controlled trial JiViTA	Community	21,294	20,031	..	Questions modified from PHQ-9 and CES-D. Five item scale of depressive symptoms	Prevalence of 1 or 2 symptoms (%): Age ≤ 19 = 7709 (36.2) Age 20–29 = 6306 (38.0) Age ≥ 30 = 1369 (39.7)	N/A: risk factors not disaggregated for adolescent subgroup

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Table A2 (continued)

Study	Country	Eligible adolescent age range	Study design	Sample setting	Sample size adolescents (n)	Sample size comparison group(s) (n)	Trimester	Assessment tool and cut-off	Prevalence estimate	Risk factors
									Prevalence of 3–5 symptoms (%): Age ≤19 = 2521 (11.8) Age 20–29 = 2457 (14.8) Age ≥30 = 711 (20.6) Adjusted OR 1–2 symptoms: Age ≤19 = reference Age 20–29 = 1.06 (1.0, 1.12) Age ≥30 = 1.25 (1.14, 1.37) Adjusted OR 3–5 symptoms: Age ≤19 = reference Age 20–29 = 1.16 (1.07, 1.26) Age ≥30 = 1.69 (1.48, 1.88)	
Tasnim et al. (2021)	Bangladesh	15–24 years	Cross-sectional study of women attending vaccination clinic at 6 months postpartum with two-stage systematic cluster sampling	Facility	211	246	..	EPDS≥10	Prevalence (%): Age 15–24 = 67 (30.2) Age 25–34 = 90 (36.6) Age ≥35 = 12(30.0) p = 0.474 Age <18 = 80 (41.0) Age ≥18 = 89 (29.5) p = 0.008	N/A: risk factors not disaggregated for adolescent subgroup
Postpartum distress symptoms										
Clarke et al. (2014)	Nepal	<20 years and 20–24 years	Cross-sectional, data from control clusters in a cluster-randomised controlled trial	Community	5272	3804	..	GHQ-12 ≥ 6	Prevalence (%): Age <20 = 181 (10.0) Age 20–24 = 333 (9.6) Age 25–29 = 244 (9.4) Age 30–34 = 90 (10.9) Age ≥35 = 886 (9.8)	N/A: risk factors not disaggregated for adolescent subgroup
Khanna et al. (2021)	India	15–24 years	Cross-sectional data; multistage random sampling	Community	229	..	..	GHQ-12 ≥ 4	Prevalence (%): 50 (21.9)	Adjusted OR: Female sex of infant: 2.43 (1.12, 5.27) Serious postpartum complications: 3.46 (1.59, 7.56)
Prost et al. (2012)	India	15–22 years	Cross-sectional data from control clusters in a cluster-randomised controlled trial	Community	1955	3846	..	Kessler-10 > 15	Prevalence (%): Age 15–22 = 227 (11.6) Age 23–27 = 219 (1.9) Age 28–32 = 141 (11.1) Age 33–39 = 72 (12.5) Adjusted OR: Age 15–22 = reference Age 23–27 = 1.12 (0.92, 1.39) Age 28–32 = 1.04 (0.83, 1.32) Age 33–39 = 1.44 (1.03, 2.07)	N/A: risk factors not disaggregated for adolescent subgroup
Srinivasan et al. (2015)	India	20–24 years	Cross-sectional, convenience sample	Facility	49	51	All trimesters, majority third	EPDS≥10	Prevalence (%): Age 20–24 = 9 (18.4) Age 25–29 = 4 (8.89) Age ≥30 = 1 (16.7) p = 0.53	N/A: risk factors not disaggregated for adolescent subgroup
SUB-SAHARAN AFRICA										
Perinatal depressive symptoms at any point (ante- and postpartum)										
	Nigeria	13–20 years		Community	120			

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Table A2 (continued)

Study	Country	Eligible adolescent age range	Study design	Sample setting	Sample size adolescents (n)	Sample size comparison group(s) (n)	Trimester	Assessment tool and cut-off	Prevalence estimate	Risk factors
Ayamolowo et al. (2019)			Cross-sectional, multistage sample, sampling strategy unclear					BDI 1-10: normal 11-16 = mild mood disturbance 17-20 = borderline clinical depression 21-30 = moderate depression 31-40: severe ≥41 = extreme depression	Prevalence (%): Mild mood disturbance: 17 (14.2) Borderline clinical: 14 (11.7) Moderate depression: 24 (19.9) Severely depressed: 12 (10.0)	Negative correlation between level of depression and level of perceived low social support, p = 0.001
Babafemi and Adeleke (2012)	Nigeria	13–19 years	Cross-sectional study with two-stage cluster simple random sampling	Community	300 (150 pregnant, 150 breastfeeding)	..	..	Measurement unclear	Prevalence (%): 177 (59.0)	N/A: risk factors for APMH not explored
Nicolet et al. (2021)	Cameroon	≤20 years	Cross-sectional convenience sample, recruited through door-to-door, health facilities and associations/groups	Facility and community	1307	..	..	EPDS≥12	Prevalence (%): 900 (70.0)	Adjusted OR: Unintended or unplanned pregnancy: 1.33 (1.14, 1.56) Being separated or single: 1.34 (1.12, 1.60) Experiencing depression and anxiety before childbirth: 1.50 (1.02, 2.27) Abortion experience: 2.60 (1.03, 7.14) Domestic violence: 1.76 (1.12, 2.83)
Woollett et al. (2021)	Zimbabwe	14–24 years	Cross-sectional, facility-based study of women recruited at 'waiting mothers' shelters	Facility	442	..	..	Modified custom tool to measure psychosocial well-being, including feelings of sadness	Prevalence (%): Often very sad: 48 (10.9) Always very sad: 22 (4.98) Often felt they had nothing to be proud of: 73 (16.5) Always felt they have nothing to be proud of: 33 (7.47) Never felt that their future would be good: 36 (8.14) Felt alone: 156 (35.3)	N/A: risk factors for APMH not explored
Antepartum depressive symptoms										
Belay and Deressa (2021)	Ethiopia	10–19 years	Cross-sectional, convenience sample of adolescents attending clinic for evaluation of rape	Facility	118	56	All trimesters	DSM-5 diagnostic criteria	Prevalence (%): 113 (96.0) of adolescent rape victims with unwanted pregnancy	N/A: risk factors for APMH not explored
Bisetegn et al. (2016)	Ethiopia	20–24 years	Cross-sectional, study of pregnant women selected through cluster sampling of sub-districts	Community	145	382	All trimesters	EPDS≥12	Prevalence (%): Age 20–24 = 13 (10.6) Age 25–29 = 22 (10.9) Age 30–34 = 11 (9.6) Age ≥35 = 16 (25.0)	N/A: risk factors not disaggregated for adolescent subgroup

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Table A2 (continued)

Study	Country	Eligible adolescent age range	Study design	Sample setting	Sample size adolescents (n)	Sample size comparison group(s) (n)	Trimester	Assessment tool and cut-off	Prevalence estimate	Risk factors
Govender et al. (2020)	South Africa	13–19 years	Cross-sectional convenience sample	Facility	132	..	Second (24 weeks +) and third	EPDS \geq 13	Adjusted OR: Age 20–24 = 0.56 (0.17, 1.82) Age 25–29 = 0.64 (0.22, 1.8) Age 30–34 = 0.45 (0.14, 1.4) Age \geq 35 = reference Prevalence (%): 21 (15.9)	Adjusted OR: Physical violence: 6.47 (1.36, 30.53) Verbal abuse: 4.8 (1.5, 15.16) Received a lot of support from their partners: 0.07 (0.01, 0.45) Adjusted OR: Being a student: 5.12 (1.19, 22.0) Low family income: 0.22 (0.09, 0.56) Unplanned pregnancy: 3.41 (1.19, 9.80) Negative and ambivalent attitudes of the unborn baby's father: 8.72 (2.88, 26.37) 4.26 (1.35, 13.45) Early age at sexual debut: 0.70 (0.55, 0.89, p = 0.003) Ever used any psychoactive substances: 3.21 (1.31, 7.88) Adjusted OR: <u>Risk factors for depression:</u> 1 or more days gone hungry in the previous week: 2.82 (1.96, 4.05) Married or cohabitating: 0.49 (0.37, 0.65) Partner is employed: 0.57 (0.34, 0.96) β coefficient estimates: <u>Risk factors for depression severity:</u> Symptoms of anxiety: 0.161, p = 0.01 Poor maternal attitudes: 0.167, p = 0.03 N/A: risk factors not disaggregated for adolescent subgroup
Kimbui et al. (2018)	Kenya	16–18 years	Cross-sectional convenience sample	Facility	212	..	Unclear	EPDS \geq 8 BDI \geq 13	Prevalence (%): Positive on EPDS = 128 (60.0) Severe depression on BDI: 110 (51.9)	
Oladeji et al. (2022)	Nigeria	14–20 years	Cross-sectional data from a cluster-randomised controlled trial	Facility	1359	..	Mostly second	EPDS \geq 12 and DSM-4 diagnostic criteria	Prevalence (%): 246 (18.1) Adjusted OR: Age 14–17 = reference Age 18–20 = 0.58 (0.4, 0.82)	
Oladeji et al. (2019)	Nigeria	\leq 19 years	Data from a randomised controlled trial for perinatal depression in primary maternal care (Expanding Care for Perinatal Women with Depression EXPONATE trial)	Facility	772	8590	Mostly second	EPDS \geq 12	Prevalence (%): Age \leq 19 = 137 (17.7) Age \geq 20 = 593 (6.9) p < 0.001 Mean EPDS score (SD): Age \leq 19 = 14.9 (2.6) Age \geq 20 = 14.4 (2.7) p = 0.08	

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Table A2 (continued)

Study	Country	Eligible adolescent age range	Study design	Sample setting	Sample size adolescents (n)	Sample size comparison group(s) (n)	Trimester	Assessment tool and cut-off	Prevalence estimate	Risk factors
Osok et al. (2018a, 2018b)	Kenya	15–18 years	Cross-sectional, convenience sample	Facility	176	..	Second and third	EPDS>13 PHQ-9≥15	Prevalence (%): 58 (32.9)	β coefficient estimates: Younger adolescent age: 2.46, p = 0.038 Experience a stressful life event: 3.27, p = 0.001 HIV: 3.8, p = 0.004 Receiving social support (protective): -2.76, p = 0.008 N/A: risk factors not disaggregated for adolescent subgroup
Weobong et al. (2015)	Ghana	15–19 years	Data from population-based cohort study of pregnant women	Community	2360	18,560	All	PHQ≥5 = major depressive symptoms PHQ≥2–4 = minor depressive symptoms	Prevalence (%): Age 15–19 = 239 (10.1) Age 20–29 = 1011 (9.1) Age ≥30 = 812 (10.9) Adjusted RR: Age 15–19 = 1.01 (0.87, 1.16) Age 20–29 = reference Age ≥30 = 1.21 (1.11, 1.33)	
Postpartum depressive symptoms										
Govender et al. (2020)	South Africa	13–19 years	Cross-sectional convenience sample	Facility	194	..	..	EPDS≥13	Prevalence (%): 17 (8.8)	Adjusted OR: Physical violence: 7.32 (1.66, 29.44) Verbal abuse: 4.3 (1.03, 15.79) Intimate partner violence: 9.58 (1.58, 48.82) N/A: risk factors for APMH not explored
Kassa et al. (2021)	Ethiopia	15–19 years	Prospective cohort, randomly selected representative health centres	Facility	442	836	..	EPDS≥13	Prevalence (%): Age 15-19 = 165 (37.4) Age ≥20 = 168 (20.1) p = 0.0001 Adjusted OR: Age 15–19 = 2.29 (1.42, 3.70) Age ≥20 = reference	N/A: risk factors for APMH not explored
Kerie et al. (2018)	Ethiopia	15–24 years	Cross-sectional, study selected with simple random sampling	Facility	183	225	..	EPDS≥10	Prevalence (%): Age 15–24 = 61 (33.0) Age 25–34 = 44 (25.3) Age ≥35 = 33 (64.7) Adjusted OR: Age 15–24 = 0.420 (0.18, 0.98) Age ≥35 = reference	N/A: risk factors not disaggregated for adolescent subgroup
Roux et al. (2019)	South Africa	≤18 years	Prospective, cohort study with a representative sample	Facility	76	441	..	EPDS≥13	Prevalence (%): Age ≤18 = 8 (10.5) Age >19 = 75(17.0) p > 0.05	N/A: risk factors for APMH not explored
Nakku et al. (2006)	Uganda	10–19 years	Cross-sectional convenience sample	Facility	101	419	..	SRQ-25 > 5 MINI	Prevalence (%): Age 10–19 = 15 (14.9) Age ≥20 = 23 (5.49) Adjusted OR: Age 10–19 = 3 (1.42,6.3) Age ≥20 = reference p = 0.001	N/A: risk factors not disaggregated for adolescent subgroup
	Rwanda	15–19 years		Community	120	EPDS≥13		

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Table A2 (continued)

Study	Country	Eligible adolescent age range	Study design	Sample setting	Sample size adolescents (n)	Sample size comparison group(s) (n)	Trimester	Assessment tool and cut-off	Prevalence estimate	Risk factors
Niyonsenga and Mutabaruka (2021)			Cross-sectional convenience sample recruited from DREAM programme participants						Prevalence (%): 58 (48.3)	β coefficient estimates: Parental distress: 0.297, $p = 0.001$ Weight/shape disturbances: 0.217, $p = 0.017$ Economic income: -0.210, $p = 0.022$ Parental-child dysfunctional interaction: 0.20, $p = 0.03$ N/A: risk factors not disaggregated for adolescent subgroup
Sakari et al. (2021)	Kenya	15–24 years	Cross-sectional, study of mothers with preterm neonates, selected with simple random sampling	Facility	72	190	..	EPDS \geq 13	Prevalence (%): Age 15–24 = 61 (84.7) Age 25–29 = 54 (78.3) Age 30–34 = 45 (65.2) Age 35–45 = 11 (21.1) $p = 0.658$	N/A: risk factors not disaggregated for adolescent subgroup
Postpartum anxiety										
Sakari et al. (2021)	Kenya	15–24 years	Cross-sectional, study of mothers with preterm neonates, selected with simple random sampling	Facility	72	190	..	BDI \geq 22	Prevalence (%): Age 15–24 = 65 (90.3) Age 25–29 = 58 (84.1) Age 30–34 = 31 (44.9) Age 35–45 = 11 (22.2) $p = 0.049$	N/A: risk factors not disaggregated for adolescent subgroup
Postpartum stress										
Yako (2007)	Lesotho	15–19 years	Cross-sectional, convenience sample	Facility	128	64	..	Daily Hassles Feeling of Pregnancy Questionnaire (FOPQ)	..	Factor score: Marital status: Mean difference – never pregnant adolescents and unmarried adolescent mothers = -21.95 ($p < 0.001$); married adolescents -17.92 ($p \leq 0.001$)

Table A3
Summary table for qualitative studies.

Study	Country	Eligible adolescent age range	Sample setting	Sample	Perinatal adolescent sample size (n)	Perinatal period assessed	Study/intervention design
Sub-Saharan Africa							
Aziato et al. (2016)	Ghana	10–19 years	Facility	Adolescents who had experienced a recent pregnancy termination	92	Postpartum (post pregnancy termination)	Vignette-based focus group discussions
Field et al. (2020)	South Africa	15–19 years	Facility	Adolescents who had received one or more counselling sessions during the past year and had concluded their counselling	12	Ante- and postpartum	In-depth interviews
Gbogbo (2020)	Ghana	15–19 years	Community	N/A	46	Antepartum	In-depth interviews and focus group discussions
Kaye (2008)	Uganda	14–19 years	Facility	Adolescents who attended ANC clinic	52	Ante- and postpartum	In-depth interviews and focus group discussions
Kumar et al. (2018)	Kenya	10–24 years	Facility	Adolescents who screened positive for depression symptomology	8 pregnant adolescents 22 postpartum adolescents	Ante- and postpartum	In-depth interviews and focus group discussions; Grounded theory
Musyimi et al. (2020)	Kenya	13–19 years	Community	N/A	21	Ante- and postpartum	Key informant interviews and focus group discussions
Osok et al. (2018a, 2018b)	Kenya	15–19 years	Facility	Adolescents who attended ANC clinic and screened positive for depression symptomology	12	Antepartum	Engagement interviews; Grounded theory

N.B. Although we solely present the included perinatal AGYW sample, we acknowledge some study samples may have also included participant groups like health providers, caregivers (mothers/husbands), and adolescent boys and young men.

Table A4
Summary table for intervention studies.

Study	Country	Eligible adolescent age range	Perinatal adolescent sample size (n)	Perinatal period assessed	Study/intervention design
INTERVENTION STUDIES, FEASIBILITY STUDIES, OR PROTOCOLS					
South Asia					
Maharjan et al. (2021)	Nepal	15–24 years	38 ^a	Postpartum	Feasibility study: Passive sensing on mobile devices to improve monitoring, diagnosis, and treatment of APMH
Sub-Saharan Africa					
Gureje et al. (2020)	Nigeria	<20 years	170	Ante- and postpartum	Protocol for intervention study: Randomised controlled trial of behavioural and psychosocial intervention in primary maternal care
Kola et al. (2021)	Nigeria	16–19 years	260	Ante- and postpartum	Feasibility study: cross-sectional survey of mobile phone access for mobile-based preventive interventions
Kumar et al. (2020)	Kenya	13–18 years	90	Antepartum	Protocol for intervention study: Adaptation of mhGAP and group interpersonal therapy
Oladeji et al. (2019)	Nigeria	≤19 years	772	Ante- and postpartum	Intervention study: Randomised controlled trial of psychosocial intervention in primary maternal care
Taylor Salisbury et al. (2021)	Mozambique	16–24 years	23	Ante- and postpartum	Feasibility/intervention design study: Pregnancy and parenting course and family sessions

^a Some women in this sample are age 25 and it is unclear how many; at least 33/38 participants fall within our adolescent catchment (10–24 years).

Table A5
Study quality assessment criteria, adapted from Joanna Briggs Institute.

Criteria	
Study design	
Quantitative studies providing prevalence estimates	(i) sample frame, (ii) sampling strategy, (iii) sample size, (iv) study subject and setting, (v) coverage bias, (vi) method for condition identification, (vii) reliability of condition measurement, (viii) statistical analysis, and (viiii) response rate
Qualitative studies	Congruity between methodology and (i) philosophy, (ii) research objectives, (iii) methods, (iv) representation and analysis, (v) interpretation; (vi) cultural/theoretical positionality statement, (vii) reflexivity statement, (viii) adequately represented voices, (viiii) clear ethics, and (x) grounded conclusions Scoring 0 if 'not met', 1 if 'unclear' or 'partially met', and 2 if 'met', with a maximum possible score of 18 and 20 for prevalence and qualitative studies respectively
Overall ratings (quantitative & qualitative)^a	
High quality	Score ≥ 16
Medium quality	Score between 12 and 15
Low quality	Score ≤ 11

^a Maximum score for quantitative appraisal = 18; maximum score for qualitative appraisal = 20. We applied the same thresholds to categorise the quality of quantitative and qualitative studies.

Table A6
Quality assessment of quantitative studies reporting prevalence estimates for adolescent perinatal mental health.

Study	Criteria									Total score	Quality
	Appropriate sample frame for target population? ^a	Study participants sampled appropriately? ^b	Adequate sample size? ^c	Study subjects and setting described in detail?	Data analysis done with sufficient coverage of sample? ^d	Valid methods used to ID condition or outcome of interest? ^e	Were the outcomes or condition measured in a standardised, reliable way?	Was appropriate statistical analysis used?	Adequate response rate or low rate managed appropriately? ^f		
South Asia											
Agampodi et al (2021)	2	0	0	2	2	1	1	0	2	10	Low
Clarke et al (2014)	2	2	2	2	1	1	1	2	2	15	Medium
Doke et al (2021)	0	0	2	2	1	1	1	2	0	9	Low
Fan et al (2020)	2	1	0	2	1	1	1	2	1	11	Low
Gosh et al (2011)	1	1	2	0	1	1	1	2	1	10	Low
Khanna et al (2021)	2	1	0	2	1	2	2	2	1	13	Medium
Nasreen et al (2011)	2	2	0	2	2	2	2	2	2	16	High
Neelakanthi (2021)	2	0	0	2	1	1	1	2	1	9	Low
Palfreyman (2021)	2	2	0	2	2	2	2	2	2	16	High
Prost et al (2012)	2	2	2	2	2	1	2	2	2	17	High
Sheeba et al (2019)	0	0	0	2	2	1	1	2	2	10	Low
Sidhu et al (2019)	1	0	0	1	2	1	2	2	2	11	Low
Srinivasan (2015)	0	0	0	2	2	1	1	2	2	10	Low
Surkan et al (2018)	2	2	2	2	2	1	2	2	2	17	High
Surkan et al (2016)	2	2	2	2	2	1	1	2	2	16	High
Tariq et al (2019)	0	0	0	0	1	0	1	0	1	3	Low
Tasnim et al (2021)	2	1	0	2	1	2	1	2	1	12	Medium
Sub-Saharan Africa											
Ayamolowo et al (2019)	1	0	2	1	2	2	0	2	2	12	Medium
Babafemi (2012)	1	0	2	2	1	0	1	2	2	11	Low
Belay et al (2021)	0	0	0	2	1	1	1	2	2	9	Low
Bisetegn et al (2016)	2	1	0	2	2	1	2	2	2	14	Medium

Govender et al (2020)	2	0	0	2	1	1	1	2	1	10	Low
Kassa et al (2021)	0	1	2	2	1	1	1	2	0	10	Low
Kerie et al (2018)	0	2	0	2	2	1	1	2	2	12	Medium
Kimbuyi et al (2018)	0	0	0	2	2	1	1	2	2	10	Low
Le Roux et al (2019)	2	2	0	2	2	2	2	2	2	16	High
Nakku et al (2006)	2	0	0	2	1	1	1	2	2	11	Low
Nicolet et al (2021)	2	0	2	2	2	1	1	2	2	14	Medium
Niyonsenga et al (2020)	0	0	0	2	1	1	1	2	2	9	Low
Oladedji et al (2022)	0	1	2	2	1	1	2	2	2	13	Medium
Oladedji et al (2019)	0	1	2	2	1	1	2	2	0	11	Low
Osok et al (2018)	0	0	0	2	1	1	2	2	2	10	Low
Sakari et al (2021)	0	2	0	2	2	2	1	2	2	13	Medium
Weobong et al (2015)	2	2	2	2	2	1	1	2	2	16	High
Woollett et al	1	0	2	2	1	0	1	2	1	10	Low
Yako (2007)	1	0	0	2	1	0	1	0	1	6	Low

* Sample frame was graded as 2 if population based. If a facility-based sampling frame was used, i.e., list of mothers attending antenatal care or from those delivering in the facility, this was only deemed an appropriate sample frame (graded 2) if 75% or more of the population in question utilised the services in question (e.g., 75% or more women attended antenatal care if the sampling frame was an antenatal care register).

† Sampling method was graded as 2 if random sampling was used. However, if two-stage cluster random sampling was used, the study was only awarded two points if their analysis had accounted for clustering design and awarded one point if it was not clear. Convenience samples were awarded 0 points.

‡ We assessed sample size adequacy as greater than 245 adolescent participants for perinatal depression, assuming 20% prevalence, and greater than 195 participants for perinatal anxiety, assuming 15% prevalence.

§ Where non-response rate less than 5% (column 9 – adequate response rate), even if the characteristics of the refusals are not shown and no discussion of bias was included, we awarded two points for adequate coverage as coverage bias unlikely to be a major problem.

¶ Studies were awarded two points if they used a standard tool validated in the country in question and applied a cut-off that had also been validated in that population. Studies received one point if they used a standard tool but local validation was unclear, or if they applied a custom tool (unvalidated) but with good justification.

|| Studies were awarded two points if the non-response rate was <10%. Studies were awarded one point if non-response exceeded 10% but it was handled and discussed appropriately.

Table A7
Quality assessment of qualitative studies on APMH.

Study	Criteria					Other criteria					Total Score	Quality
	Congruity between research methodology and					Cultural/theoretical positionality statement	Reflexivity statement	Adequately represented voices	Clear ethics	Grounded conclusions		
Philosophy	Research objectives	Methods	Representation & analysis	Interpretation								
Sub-Saharan Africa												
Aziato et al (2016)	0	2	2	2	2	1	0	1	2	2	14	Medium
Field et al (2020)	0	2	2	1	2	2	1	2	2	2	16	High
Gbogbo (2020)	2	2	2	1	2	1	0	1	2	2	15	Medium
Kaye (2008)	2	2	2	2	2	0	0	2	2	1	15	Medium
Kumar et al (2018)	1	2	2	2	2	0	0	1	2	2	14	Medium
Musyimi et al (2020)	0	2	2	1	2	1	0	2	2	2	14	Medium
Osok et al (2018)	2	2	2	2	2	2	2	2	2	2	18	High

Table A8
Example descriptions by thematic area for qualitative narrative analysis.

Participant or author statements on:						
Study	Country	Perceived prevalence or commonness of APMH difficulties	Perceived risk factors	Implications for (sexual and reproductive) health services	(Potential) interventions	Noted relationship between perinatal period and APMH outcomes
Aziato et al. (2016)	Ghana	Not explored	Not explored	Knowledge, attitudes and practices of health providers require further exploration and mediation to reduce maltreatment and improve quality of care responses when encountering unplanned pregnancy in AGYW	1. Training health workers to support AGYW to choose responses in event of unplanned pregnancy, including access to safe abortion and 'modern' contraceptives to prevent pregnancies 2. Increased access to safe and effective contraceptive methods to avoid unplanned pregnancy	Adolescent pregnancy perceived to cause shyness, alarm, surprise, sadness, discomfort, confusion, unhappiness, and loss (of education, youth and future aspirations), bafflement, feelings of disgrace, worry, shame in AGYW Reactions of family, partner and health services act upon the adolescent and affect her experience and options (for (dis)continuation of pregnancy) and include stigma, denial, abandonment, forced abortion, obstetric and domestic violence, and 'hiding' practices like sending AGYW away until birth Pregnancy led to isolation, loneliness, stress (over interpersonal and material conditions) driving anxiety, distress and depression, loss (of education), pressure (to secure livelihood), denial/disbelief at being pregnant, despair, sadness, disdain, and trauma at abandonment by male partners; subjection to derision and shame for adolescent pregnancy; doubt over quality of and ability to access healthcare due to stigma from providers Postpartum feeling unprepared, worried, stressed, low mood due to above plus additional life/bodily changes
Kumar et al. (2018)	Kenya	Not explored	1. Self and social stigma 2. Lack of emotional support from partner/boyfriend and parents, including abandonment and ostracisation leading to single motherhood 3. New life adjustment stress 4. Lack of access to material and health resources ante- and postpartum driving AGYW's continued unmet needs 5. Poor healthcare access (especially maternal and child health clinic access) and mistreatment/poor quality of care 6. Insufficient money/financial support 7. Domestic violence 8. Perpetuation of intergenerational poverty and marginalisation 9. Engagement in survival sex work	1. Current maternal and child health models perceived not fit-for-purpose for adolescents 2. Perceived lack of support and institutional investment in caring for adolescents and their babies 3. Lack of training and capacity for health providers on adolescent development, and how to intervene in mental, physical, and social needs of adolescents 4. Poor communication flows across health stakeholders 5. 'Psychosocial support' used in language, but not sufficiently understood by health workers to know what it means for service provision/care in action	1. Task shifting with lay community health workers 2. Integration of interventions in maternal and child health services 3. Strengthen social workers and their integration in primary care 4. Health worker training in mental health, parenting, delaying early pregnancy 5. Other social, behavioural, economic interventions	
Musyimi et al. (2020)	Kenya	Not explored	1. Chronic illness (HIV/AIDS) 2. Intimate partner violence including lack of sexual and reproductive health autonomy 3. Family rejection 4. Social isolation by community 5. Poverty and lack of psycho-socio-economic support 6. Unplanned pregnancy 7. Male substance abuse 8. Lack of access to health services and poor healthcare transition to adult services	1. Decentralised youth-friendly mental health services to ensure rural coverage 2. Monitoring for suicide risk needed in pregnancy 3. Monitoring for substance abuse in male partner needed 4. Preference for primary care health support	1. Interventions with evaluations of effectiveness on community-level norm change in sub-Saharan Africa to mediate violence and gender inequality 2. Parent-adolescent communication interventions 3. Integrated mental health care 4. Monitoring for suicidal behaviour risk in pregnancy in healthcare setting 5. Economic empowerment for adolescent mothers 6. Improved management of chronic illness for adolescent mothers 7. Family and community-level interventions addressing substance abuse in men	HIV diagnosis during antenatal appointments in pregnant adolescents contributed to depression and developing suicidal ideation Intimate partner violence included coercion to abort pregnancies and male substance abuse fuelled quarrels perceived to expose perinatal adolescents to 'suicidal behaviour risk'. Unplanned pregnancy, substance abuse and mistrust between adolescent and male partner caused violence, which 'elevated stress levels... depression and suicidal thoughts' Family criticism ('torture and stress their girls')/ disconnection perceived to cause miscarriage, abortion,

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Table A8 (continued)

Participant or author statements on:						
Study	Country	Perceived prevalence or commonness of APMH difficulties	Perceived risk factors	Implications for (sexual and reproductive) health services	(Potential) interventions	Noted relationship between perinatal period and APMH outcomes
						poor health in adolescent mothers (e.g., not eating) leading to adverse birth outcomes (e.g., premature birth and low birth weight), and driving feelings of neglect and 'lack of peace of mind', guilt, hopelessness, social isolation, and vocalisations of suicidal thoughts/plans. Peer and community mockery led to isolation, shame, worthlessness, and rejection resulting in suicidal ideation. Reliance on caregivers/family members causes 'stress to the point of giving up'. Being perceived as burdens by others could drive neglect, causing depression and suicidal behaviour in perinatal AGYW.

N.B. Descriptions are not extracted verbatim quotations from study text; this stage of narrative analysis reflects some synthesis and abstraction by us and is not an example of coding which preceded this stage.

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