

Mental health outcomes beyond the post-partum period among adolescent mothers: a systematic review and meta-analysis

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ABSTRACT

Background: Adolescence is the most crucial part of life. The vulnerability of adolescent mothers is even more pronounced and can affect various health aspects. While they suffer from social and emotional stresses shortly after giving birth, the long-term effect after the post-partum period of adolescent pregnancy on the mental outcomes holds prime importance. Thus, this systematic review aims to ascertain the association between adolescent pregnancy on mental health outcomes.

Methods: The search strategy was run in June 2023 on databases including PubMed, CINAHL, Scopus, Psych Info, and Embase. Quality assessment of the studies was done using the National Institute of Health (NIH)'s National Heart, Lung and Blood Institute (NHLBI) tool for observational studies. For studies that measured similar outcomes, a meta-analysis was conducted.

Findings: The search strategy yielded 21 results from all databases and cross-referencing. Of these, all except for one (case-control) were cross-sectional and cohort studies. The pooled analysis found a significant association between adolescent pregnancy and depression (RR 1.34; 95% CI 1.05, 1.72, 6 studies, heterogeneity: $\text{Chi}^2 P = 0.01$; $I^2 = 60\%$); however, no association was found in anxiety (RR 1.05; 95% CI 0.26, 4.14, 2 studies; heterogeneity: $\text{Chi}^2 P = 0.0003$; $I^2 = 93\%$) and suicidal ideation (RR 3.21; 95% CI 0.17, 59.33; 3 studies; heterogeneity: $\text{Chi}^2 P < 0.00001$; $I^2 = 98\%$).

Implication: These findings suggest that the mental health needs of adolescent mothers must be addressed and innovative and


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effective interventions that support and address the mental health needs of adolescent mothers are needed to improve their mental health.

Introduction

The current shift in the disease paradigm has brought mental health issues to the prime focus globally. While its consideration is integral to every population, adolescent pregnancy and its impact on overall mental health are the most pressing issues (Sedgh et al., 2015). In 2017, 12 million females aged 15–19 gave birth in developing countries (World Health Organization, 2019). Central Africa has an adolescent fertility rate of 129.5 per 1000 (Ganchimeg et al., 2014) compared to Australia, a developed country with a fertility rate of 9.2 per 1000 in the same year (Ganchimeg et al., 2014). Although significantly lower than in marginalized communities, high rates of adolescent pregnancies are prevalent, especially in larger populated countries, including the United States, indicating 57 pregnancies per 1000 15–19-year-olds (Sedgh et al., 2015).

Teenage pregnancy typically focuses on pregnancy between the ages of 15 and 19 due to lesser data collection and discrepancies on teenage pregnancies before the age of 15 (Xavier et al., 2018). Adolescent pregnancies are highly risky, with maternal and foetal welfare at risk knowing to impose adverse pregnancy complications (WHO; Khatoon et al., 2021). These include higher rates of preeclampsia, systemic infections, urinary infections, puerperal endometritis, preterm delivery, very low birth weight, and perinatal mortality (Azevedo et al., 2015). Further complications arise, past the birth of the child, showing conclusive evidence of the correlation between behaviour and health problems in the children of adolescent mothers (Lee et al., 2021).

Adolescent pregnancy is strongly associated with marginalization and stigmatization. The impacts of adolescent pregnancy are widely known to create socioeconomic and educational disadvantages, ultimately creating a more significant problem with intergenerational issues as an outcome (Mann et al., 2020). Adolescent mothers have reported struggling immensely due to stigmatization and stereotyping within society, such as higher rates of unemployment and low levels of education (Govender et al., 2020). Pregnancy and postpartum mental health outcomes have been evaluated as a strong area in research fields, indicating that depression in postpartum is significantly higher in adolescent mothers compared to older age groups (Govender et al., 2020; Vanderkruik et al., 2021). The resulting factors are likely to lead to increased mental health implications.

Another proposed view, regarding the possible association with poor mental health outcomes in adolescent mothers, is the stress process theory which provides a perspective on alternate confounding factors. Falci et al. suggest that the possible build-up of chronic strain among adolescent mothers may be the underlying reason for poor mental health outcomes due to low educational achievement, underemployment, and poor social circumstances, as supported by other literature (Falci et al., 2010). Mental health issues, particularly after a crucial phase of life, i.e. adolescent motherhood, hold great public health importance. Young mothers living with mental illness after birth are also at an increased risk of suicidal ideations and attempts, relationship dysfunction within families, and somatic illnesses (Bulloch et al., 2009; Van der Kooy et al., 2007). Conversely, this also

affects the health outcomes of their children, who are at risk of developmental deficits and delinquent behaviours (Hammerton et al., 2015; Letourneau et al., 2013; Van der Kooy et al., 2015).

It has previously been poorly researched and defined how adolescent pregnancy impacts mental health on a more long-term scale. The most previously relevant published study on adolescent pregnancy and mental health beyond the post-partum period represented inconclusive evidence and association due to the entanglement of factors shown within the research (Xavier et al., 2018). Thus, this systematic review aims to synthesize more recent literature predicting adolescent pregnancy-related mental health outcomes compared to older mothers.

Materials and methods

Information sources and search strategy

This systematic review was guided by the Preferred Items for Systematic Reviews and Meta-analyses guidelines (Page et al., 2021). The study was exempted from the ethical review approval. Before the commencement of the review, it had been registered online on PROSPERO (CRD42022333535). The review has been conducted as per the registration, without any modifications. The databases searched included PubMed, SCOPUS, Embase, CINAHL, and PsycINFO. The search strategy was made with the help of the librarian (refer to annexure 1). Ancestry searching was also done to identify hand-searched articles which might have been omitted from the databases. It involved reviewing the reference lists of identified articles and relevant systematic reviews to ensure a thorough exploration of the available evidence and uncover additional studies that may not have been captured through traditional database searches, enhancing the inclusivity and comprehensiveness of this review (Higgins et al., 2023).

A research strategy for each search engine was formatted specifically to each engine to include a range of relevant literature and keep a record of the number of articles and the date searched. The key starting search terms to build the search strategy were ‘teenage pregnancy’ and ‘mental disorder’. Three reviewers (ZSL, NE, and IT) searched various search engines from the commencement of the research study, with the last consultation of databases such as PubMed, CINAHL, Scopus, Psych Info, and Embase on 14 June 2023.

Eligibility criteria

Key eligibility criteria were determined for the collection of research studies. Determining factors to include a study indicated that focused on the mental wellbeing of adolescent mothers below the age of 20. We included studies that compared mental health outcomes, among mothers who were pregnant in adolescence, with mothers who were pregnant in adulthood. Due to adolescent pregnancies being less reported in very young people (<13 years), studies comparing different adolescent age groups and not with non-adolescent groups were excluded. Similarly, studies that included adolescents and young women (10–25) and compared with older mothers (>25 years) were excluded as outcomes were not separately reported for adolescents. Studies were excluded if they reported the mental health of fathers or offspring.

Given sufficient published research indicating mental health outcomes of adolescent pregnancy during the postpartum period, studies of mental health outcomes were only recorded if indicated beyond the post-partum period of one year or more after the birth of the child. Specific mental health conditions for inclusion were, namely post-traumatic stress disorder, depression, anxiety, substance abuse, and suicide. Other factors leading to the exclusion of research were those obtaining data looking at irrelevant comparison groups, such as adolescents who had given birth but did not show custody of the child and adolescents whose pregnancy was terminated. Studies were only included if they were published or available in English. Due to the implication of the study focusing on a global scale, there was no need to have any geographical exclusion criteria as all global data were warranted. In addition, there were no restrictions for the year of publication or study design except for other systematic reviews, case reports, and case series, which were excluded.

Data collection process

Once eligibility was determined and the literature was extracted from the search engines, the exportation of the relevant literature began with the importation into Covidence as the primary screening and data extraction tool. (Covidence, 2022) A team of four reviewers (KAR, NE, IT, and ZL) screened the studies for possible inclusion in the systematic review. The team members performed the screening independently, where every article was to be screened by up to two reviewers from the team. Any disagreements at the title, abstract, and full-text screening were resolved by an expert from the team (ZSL). The studies, which were agreed upon by the team for their possible inclusion, then entered the final stage of data extraction, quality assessment, and data synthesis (meta-analysis). The data were extracted in duplicates by three independent reviewers (KAR, NE, and IT).

Information extracted from the studies included the name of the primary author and year of publication, study design, setting (country), and participant characteristics, including population, age, and sample size. In addition to this, mental health outcomes, which were measured along with the name of the tools, were extracted along with their numbers. Lastly, timelines were also noted (how many months after post-partum).

Risk of bias assessment

The basis of the study design for each study has been the determining factor in evaluating the risk of bias for the methodological assessment. The National Institute of Health (NIH) and National Heart, Lung, and Blood Institute (NHLBI) quality assessment tool for observational cohort and cross-sectional studies was used for observational studies (National Heart Lung and Blood Institute, 2013). If the study did not have 'no' in any of the components, the quality was marked as high. Similarly, if the study had 'no' in 1–2 components, the quality was marked as moderate, and if the study had 'no' on >2 components, the quality was marked as low.

These methodological assessors determine and eliminate this bias by analysing the cofounders and co-interventions of the study and how they were addressed. Signalling questions are asked and answered to determine bias. As a result, it can be determined whether bias is low, somewhat biased, or high bias (Sterne et al., 2019). Three authors

(KAR, IT, and NE) evaluated each article to evaluate the risk of bias further; any discrepancies were resolved by an expert from the team (ZSL).

Synthesis of results

A quantitative synthesis using meta-analysis was performed using Review Manager version 5.4 (Collaboration TC) by two research team members (KAR and ZSL). Dichotomous outcomes were pooled using a summary risk ratio (RR) along with a 95% confidence interval, and continuous outcomes were pooled using mean difference (MD) along with a 95% confidence interval. A random-effect model was used to account for statistical heterogeneity for all these measures. The statistical heterogeneity was assessed using I^2 and its significance. The heterogeneity was also visually inspected on the forest plots (Hansen et al., 2022). A sub-group analysis was performed for outcomes, such as depression and anxiety, based on different tools used by the included studies. Due to sparse and heterogeneous mental health outcomes reported, pooled estimates were only generated for depression, anxiety, and alcohol/drug/substance misuse. All other outcomes are reported narratively in the results. In addition, the authors of two studies (Gavin et al., 2011; Stiffman et al., 1987) were contacted for data clarification. Due to the tight timeline of the current review, we decided that authors who did not reply or get back to us after 30 August 2022 would not be included to ensure the progress of the current review. Only one author clarified the outcomes, and therefore, the results from that study were pooled (Stiffman et al., 1987); however, we decided not to pool the outcomes from the other study (Gavin et al., 2011).

Results

Study selection

A total of 3875 records were obtained from initial hits and seven papers were obtained from cross-referencing. After removing duplicates, 2807 studies entered title and abstract screening, and 54 studies reached the full-text screening stage after removing 2754 irrelevant studies. At full-text, 32 studies were excluded with their reasons for exclusion (Figure 1), 21 studies were finally included in this review, and only nine were meta-analysed.

A PRISMA flow diagram explains the process of the inclusion of the studies in the systematic review.

Study characteristics

Table 1 presents the study characteristics in detail. Of the 21 studies, 12 were conducted in the United States of America (U.S.A.) (Buckingham-Howes et al., 2017; Deal & Holt, 1998; Gavin et al., 2011; Horwitz et al., 1996; Kalil & Kunz, 2002; Patel & Sen, 2012; Schmidt et al., 2006; Stiffman et al., 1987; Taylor, 2009; Vicary & Corneal, 2001; Walker & Holtfreter, 2016; Whitworth, 2017). The remaining studies were from New Zealand (Boden et al., 2008; Jaffee, 2002), Australia (Aitken et al., 2016), France (Iacobelli et al., 2014), Bangladesh (Li et al., 2021), South Africa (Mokwena et al., 2016), United

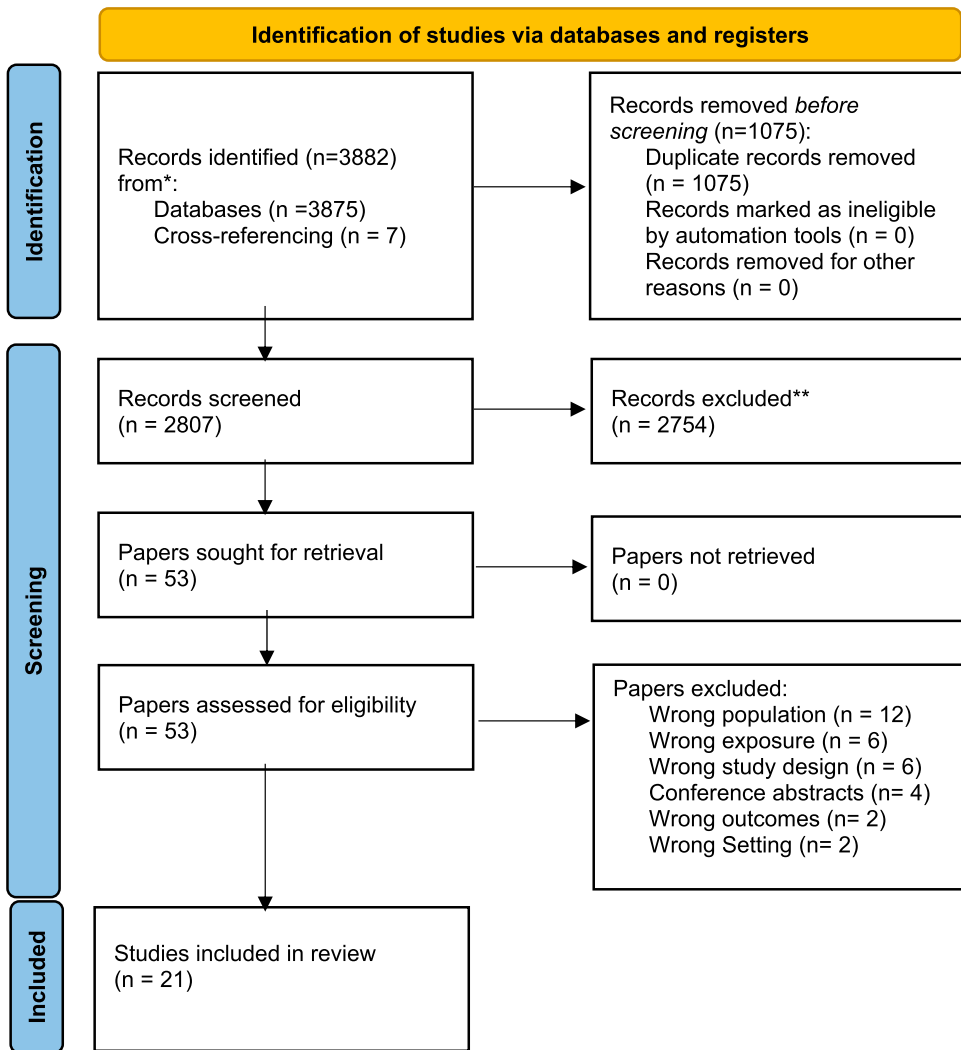


Figure 1. PRISMA flow diagram.

Kingdom (UK) (Maughan & Lindelow, 1997), and Thailand (Piyasil, 1998). There was one multi-centric study conducted in the U.S.A. and the UK (Henretta et al., 2008). Except for one study which was case-control (Iacobelli et al., 2014), all remaining were either cross-sectional (Deal & Holt, 1998; Li et al., 2021; Mokwena et al., 2016; Piyasil, 1998; Stiffman et al., 1987) or cohort (Aitken et al., 2016; Boden et al., 2008; Buckingham-Howes et al., 2017; Gavin et al., 2011; Henretta et al., 2008; Horwitz et al., 1996; Jaffee, 2002; Kalil & Kunz, 2002; Maughan & Lindelow, 1997; Patel & Sen, 2012; Schmidt et al., 2006; Vicary & Corneal, 2001; Walker & Holtfreter, 2016; Whitworth, 2017). Outcome measures were assessed at varied time duration after post-partum. These included, between 1 and 5 years (Boden et al., 2008), 17 months (Deal & Holt, 1998), 18 months (Iacobelli et al., 2014), up to 48 months (Schmidt et al., 2006), at least 12 months (Aitken et al., 2016; Horwitz et al., 1996; Li et al., 2021; Whitworth, 2017),

Table 1. Characteristics of the included studies.

Study ID	Study design	Country	Participants	Exposure	Mental health outcomes	postpartum (months)
Aitken et al. (2016)	Cohort study	Australia	<i>Household, Income and Labour Dynamics in Australia Survey</i> 4216 women observed over the 13 years categorised within three cohorts for first childbirth: 25–40 years, 20–24 years and younger than 20 years.	Pregnancy. Live births	Mental Component Summary	At least 12 months
Boden et al. (2008)	Longitudinal/ cohort study	New Zealand	<i>Christchurch Health and Development Study</i> Children from Christchurch studied from birth to age 25 – included pregnant, non-pregnant and those mothering. Sample size for adolescent pregnancy whereby participants had full data available on pregnancy and motherhood history, and mental health outcomes from ages 21–25 years represented a cohort of 515 females.	Live birth only – adoptions were not included	Depression (CIDI Scale), anxiety (CIDI Scale), suicidal ideation, suicide attempt, substance dependence	Between 1 and 5 years
Gavin et al. (2011)	longitudinal study	U.S.A.	A 17-year longitudinal study of adolescent mothers Pregnant adolescents aged 17 and younger, unmarried, planning on carrying pregnancy to full term – cohort of 173	Adolescent pregnancy: livebirths and after delivery – does not specify whether any participants had stillbirths etc.	Depressive symptoms (BSI scale), smoking, alcohol/marijuana use	Factors identified over 17 years of period.
Henretta et al. (2008)	Cohort study	The UK and the U.S.A.	U.S. Health and Retirement Study birth cohort of 1931–1941 4430 American <21 years compared to 21–25, and 25+ years <i>British 1946 Birth Cohort study</i> 1062 English <21 years compared to 21–25, and 25+ years	Pregnancy	Depression (CES-D scale)	The US Study – at the age of 51 and 61 years The UK study – at the age of 53 years
Maughan (1997)	Two cohort studies	UK	British birth cohort studies (the 1946 and 1958 cohorts) 338 Teenagers in 1946 347 Teenagers in 1958 Mothers <20 years compared to older	Pregnancy (small groups of multiple births and illegitimately born children were excluded from the study)	Antisocial behaviour (the Rutter B2 scale), emotional problems (the Rutter B2 scale), other psychiatric disorder/morbidity	At the age of 36 years
	Cohort	U.S.A.			Depression (the DIS Scale)	At least one year

(Continued)

Table 1. Continued.

Study ID	Study design	Country	Participants	Exposure	Mental health outcomes	postpartum (months)
Horwitz et al. (1996)			Young Mother's Programme between September 1967 and June 1969. Unmarried pregnant women – 154 African American women 13–18 years. Follow-up done at 32–38 years.	Pregnancy Live birth and first birth only		
Jaffee (2002)	Cohort study	New Zealand	Dunedin Multidisciplinary Health and Development Study 482 females were assessed at age 26. First birth before age 20; compared to those who first gave birth between ages 20 and 26 and those who had not given birth by age 26	Young adult pregnancy.	Anxiety (the DIS Scale), depression (DIS Scale)	At the age of 26 years
Patel and Sen (2012)	Cohort/ Longitudinal study	U.S.A.	National Longitudinal Survey of Youth 1979 Adolescents 18 or younger from the NLSY79 who had a live birth – 1,310	Pregnancy and live birth	Mental Component Summary, alcohol and marijuana use	Not stated
Taylor (2009)	Longitudinal study	U.S.A.	Wisconsin Longitudinal Study 464 females, 84 males – American adolescents pregnant before the age of 20 – followed from age 18–53 were compared to adult 939 males, 1224 females	Pregnancy	Self-acceptance, depression (the CES-D scale), purpose in life	16–19 years postpartum for the first assessment, 18–35 for the second assessment
Vicary (2001)	Longitudinal Study	U.S.A.	Rural Adolescent Development Study (RAD) – 1995 and Evaluation of Rural Outcomes of Sexuality (EROS) – 1997 Sample size into three categories: Teen mothers that had given birth before/at 18–26 Mothers who had their first child between age of 19–22 and 49 Mothers who had their first child at 23 or later – 23	Pregnancy and first childbirth (live birth)	Self-image, loneliness, depression (the DI Scale), home stress and satisfaction (the HSSI scale), conflict, managing disagreements (MDS)	Up to 12 years postpartum
Schmidt (2006)	Prospective cohort study	U.S.A./ Colombia	623 adolescent mothers, 18 years or younger, varying in race/ ethnicity who delivered their first child at the University of Texas Medical Branch	Adolescent pregnancy	Depression (the BDI scale)	3, 12, 24 and 48 months postpartum
Walker (2016)	Cohort/ Longitudinal study	U.S.A.	Wave 2 of National Longitudinal Survey of Adolescent Health (Add Health) Adolescents in grades 7–12 in	Pregnancy and live + no live birth.	Self-control, Self-esteem, depression (CES-D scale)	Not stated

Whitworth (2017)	Longitudinal	U.S.A.	U.S.A. 11–21 years. Adolescent mothers 17 years or younger (67) and adult mothers 18 or older (62) and non-mothers (6499) Wave 1 and Wave 4 of the National Longitudinal Study of Adolescent Health (ADD Health) Pregnant U.S.A. adolescents and adults from years 1995 and 2008-16-19-year olds (592) and 20–32-year olds (2306) at their first birth	Pregnancy and live births only	Depression (CES-D scale)	At least 9 months' postpartum
Kalil (2002)	Longitudinal survey	U.S.A.	990 teenage childbearing women (married and unmarried), adult child bearers (married and unmarried) and married and unmarried non-child bearers.	Pregnancy	Depression (the CES-D scale)	initial survey was conducted at age 14 to 21 in 1979, and analyses on 609 women who had become mothers by 1992
Buckingham-Howes *abstract only (2017)	Cohort/ Longitudinal study	U.S.A.	118 low-income African American adolescent mothers (age not specified – presumed 12–17)	Adolescent pregnancy	Depression (no scale mentioned)	Over 2 years and up to 7 years
Iacobelli et al. (2014)	Case Control	France	Mothers who were less than 18 years old compared to mothers who were 18–29 years old at delivery. 476 mother-infant pairs.	Pregnancy and live birth.	Depression (no scale reported), other psychiatric illness, suicidal attempt, self-intoxication	18 months postpartum
Deal (1998)	Cross-sectional study	U.S.A.	National Center for Health Statistics' 1988 National Maternal and Infant Health Survey 447 women (15–17 years), 479 women (18–19 years), 870 women (25–34 years)	Pregnancy and live births only	Depression (the CES-D scale)	Average of 17 months postpartum
Li et al. (2021)	Cross-sectional	Bangladesh	From 5 rural and 5 urban hospitals women with their first pregnancy at age 17 or younger will no severe medical conditions. 940 valid participants.	Pregnancy	Suicide attempts	12 months
Mokwena (2016)	Cross-sectional	South Africa	Rural South African women – 56 teenage mothers and 56 non-mothers aged 14–19.	Pregnancy and birth	Anxiety (GHQ Scale), depression (GHQ Scale), somatic symptoms (GHQ Scale), antisocial behaviour (the GHQ Scale), coping strategies (CSS)	Not specified but postpartum 1 year

(Continued)

Table 1. Continued.

Study ID	Study design	Country	Participants	Exposure	Mental health outcomes	postpartum (months)
Stiffman (1987)	Cross-sectional study	U.S.A.	Nationwide programme initiated in 1980 by the Robert Wood Johnson Foundation 1590, 13–18-year-olds adolescents who have become pregnant, those who are sexually active but never have been pregnant, and those who are sexually inactive were compared.	Pregnancy	Anxiety (no scale reported), depression (DIS Scale), conduct disorder (DICA), suicidal ideation, substance dependence	Not stated – no measure of postpartum mental health
Piyasil *abstract only (1998)	Cross-sectional/ comparative	Thailand	Thailand teenage mothers from non-private Rajvithi Hospital aged < or = 18 years of age compared to 20–35-year-old mothers. Sample size not stated.	Pregnancy and livebirths.	Anxiety and depression – measurement not stated	Not sure if these results have a follow-up during the past 1 year postpartum

Abbreviations: BDI: Beck Depression Inventory; BSI: Brief Symptom Inventory; CES-D: Centre for Epidemiological studies Depression Scale; CIDI: Composite International Diagnostic Interview; CSS: Coping Strategy Scale; DI: Depression Inventory; DICA: Diagnostic Interview for Children and Adolescents; DIS: Diagnostic Interview Schedule; GHQ: General Health Questionnaire; HSSI: Home Stress and Satisfaction Indexes; MCS: mental component summary; NR: Not Reported; MDS: Managing Disagreements Scale; SIQYA: Self-image Questionnaire for Young Adults; UCLA-LS: UCLA Loneliness Scale.

over 2 years and up to 7 years (Buckingham-Howes et al., 2017), up to 12 years (Vicary & Corneal, 2001), over 17 years (Gavin et al., 2011). The remaining studies did not specify the age of assessment (Henretta et al., 2008; Jaffee, 2002; Kalil & Kunz, 2002; Maughan & Lindelow, 1997; Taylor, 2009) or no specified time but mentioned post-partum 1 year (Mokwena et al., 2016; Patel & Sen, 2012; Piyasil, 1998; Stiffman et al., 1987; Walker & Holtfreter, 2016).

Varied outcomes were reported by different studies (Table 2). The mental health outcomes reported were self-acceptance (Taylor, 2009), self-control (Walker & Holtfreter, 2016), self-esteem (Walker & Holtfreter, 2016), self-image (Vicary & Corneal, 2001), mental component summary (Aitken et al., 2016; Patel & Sen, 2012), loneliness (Vicary & Corneal, 2001), anxiety (Boden et al., 2008; Iacobelli et al., 2014; Mokwena et al., 2016; Piyasil, 1998; Stiffman et al., 1987), depression (Boden et al., 2008; Buckingham-Howes et al., 2017; Deal & Holt, 1998; Gavin et al., 2011; Henretta et al., 2008; Horwitz et al., 1996; Iacobelli et al., 2014; Jaffee, 2002; Kalil & Kunz, 2002; Mokwena et al., 2016; Piyasil, 1998; Schmidt et al., 2006; Stiffman et al., 1987; Taylor, 2009; Vicary & Corneal, 2001; Walker & Holtfreter, 2016; Whitworth, 2017), somatic symptoms (Mokwena et al., 2016), antisocial behaviours (Maughan & Lindelow, 1997; Mokwena et al., 2016), conduct disorders (Stiffman et al., 1987), emotional problems (Maughan & Lindelow, 1997), coping (Mokwena et al., 2016), other psychiatric disorder/comorbidity (Iacobelli et al., 2014; Maughan & Lindelow, 1997), home stress and satisfaction (Vicary & Corneal, 2001), conflicts (Vicary & Corneal, 2001), disagreement management (Vicary & Corneal, 2001), purpose in life (Taylor, 2009), suicidal ideations (Boden et al., 2008; Stiffman et al., 1987), suicidal attempts (Boden et al., 2008; Stiffman et al., 1987), suicide attempt (Boden et al., 2008; Iacobelli et al., 2014; Li et al., 2021), substance dependence (Boden et al., 2008; Stiffman et al., 1987), smoking (Gavin et al., 2011), alcohol or marijuana use (Gavin et al., 2011; Patel & Sen, 2012), and self-intoxication (Iacobelli et al., 2014).

Risk of bias with studies

Twenty studies were conducted either on cross-sectional or cohort studies. Of these, 11 studies were of high quality (Aitken et al., 2016; Boden et al., 2008; Gavin et al., 2011; Henretta et al., 2008; Horwitz et al., 1996; Jaffee, 2002; Kalil & Kunz, 2002; Maughan & Lindelow, 1997; Patel & Sen, 2012; Vanderkruik et al., 2001; Walker & Holtfreter, 2017), three were of moderate quality (Deal & Holt, 1998; Taylor, 2009; Walker & Holtfreter, 2016), four were of low quality (Li et al., 2021; Mokwena et al., 2016; Schmidt et al., 2006; Stiffman et al., 1987), and two studies were not assessed because they were abstract only (Buckingham-Howes et al., 2017; Piyasil, 1998). In addition, there was only one case-control study which was of low quality (Iacobelli et al., 2014) (Table 3).

Depression and anxiety

Of the 21 studies, 17 reported on depression (Boden et al., 2008; Buckingham-Howes et al., 2017; Deal & Holt, 1998; Gavin et al., 2011; Henretta et al., 2008; Horwitz et al., 1996; Iacobelli et al., 2014; Jaffee, 2002; Kalil & Kunz, 2002; Mokwena et al., 2016; Piyasil, 1998; Schmidt et al., 2006; Stiffman et al., 1987; Vanderkruik et al., 2001;

Table 2. Outcomes Reported in the Included Studies.

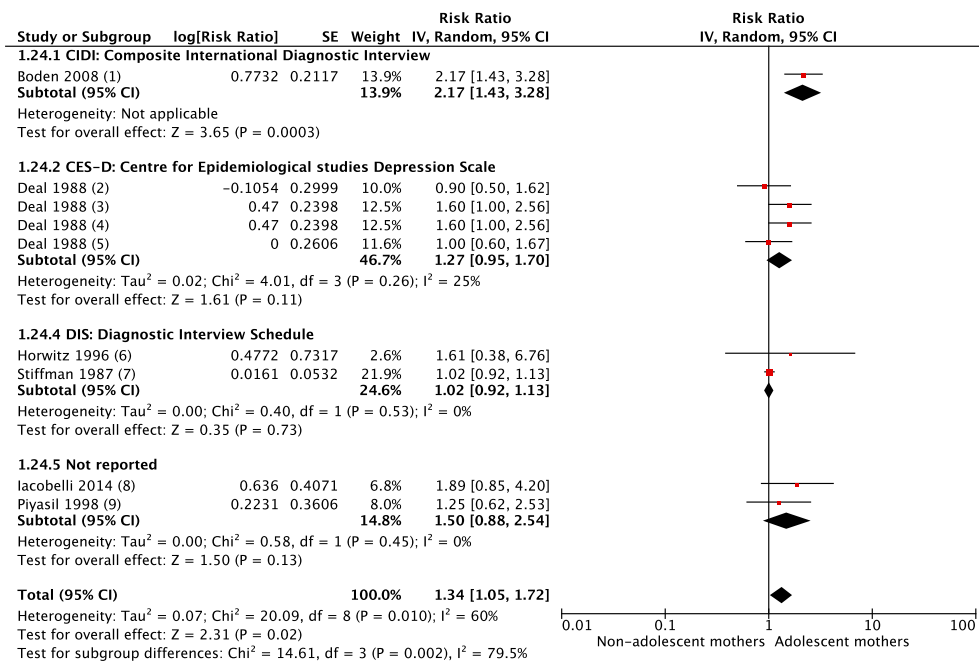
Study ID	Maternal Mental Health Outcomes											
	Self-acceptance	Self-control	Self-esteem	Self-image	MCS	Loneliness	Anxiety	Depression	Somatic symptoms	Antisocial behaviour	Conduct disorders	Emotional problems
Aitken et al. (2016)					X							
Boden et al. (2008)							X (CIDI)	X (CIDI)				
Buckingham-Howes *abstract only (2017)								X (NR)				
Deal (1998)								X (CES-D)				
Gavin et al. (2011)								X (BSI)				
Henretta et al. (2008)								X (CES-D)				
Horwitz et al. (1996)								X (DIS)				
Iacobelli et al. (2014)								X (NR)				
Jaffee (2002)							X (DIS)	X (DIS)				
Kalil 2002 (2002)								X (CES-D)				
Li et al. (2021)												
Maughan 1997 (1997)										X (Rutter B-2 Scale)		X (Rutter B-2 Scale)
Mokwena et al. (2016)							X (GHQ) & insomnia	X (GHQ)	X (GHQ)	X (GHQ)		
Patel 2012 (2012)					X							
Piyasil *abstract only (1998)							X (NR)	X (NR)				
Schmidt et al. (2006)								X (BDI)				
Stiffman et al. (1987)							X (NR)	X (DIS)			X (DICA)	
Taylor (2009)	X							X (CES-D)				
Vicary 2001 (2001)				X		X		X (DIS)				
Walker 2016 (2016)		X	X					X (CES-D)				
Whitworth (2017)								X (CES-D)				

Table 2. Continued.

Study ID	Maternal Mental Health Outcomes											
	coping strategies	other psychiatric disorder /morbidity	Home stress and satisfaction	Conflict	Managing disagreements	Purpose in life	Suicidal ideation	Suicide attempt	Substance dependence	Smoking	Alcohol, Marijuana use	Self-intoxication
Aitken et al. (2016)												
Boden et al. (2008)							X	X	X			
Buckingham-Howes *abstract only (2017)												
Deal (1998)												
Gavin et al. (2011)										X	X	
Henretta et al. (2008)												
Horwitz et al. (1996)												
Iacobelli et al. (2014)		X						X				X
Jaffee (2002)												
Kalil 2002 (2002)												
Li et al. (2021)								X				
Maughan 1997 (1997)		X										
Mokwena et al. (2016)	X (CSS)											
Patel 2012 (2012)											X	
Piyasil *abstract only (1998)												
Schmidt et al. (2006)												
Stiffman et al. (1987)							X		X			
Taylor (2009)						X						
Vicary 2001 (2001)			X (HSSI)	X	X (MDS)							
Walker 2016 (2016)												
Whitworth (2017)												

Abbreviations: BDI: Beck Depression Inventory; BSI: Brief Symptom Inventory; CES-D: Centre for Epidemiological studies Depression Scale; CIDI: Composite International Diagnostic Interview; CSS: Coping Strategy Scale; DI: Depression Inventory; DICA: Diagnostic Interview for Children and Adolescents; DIS: Diagnostic Interview Schedule; GHQ: General Health Questionnaire; HSSI: Home Stress and Satisfaction Indexes; MCS: mental component summary; NR: Not Reported; MDS: Managing Disagreements Scale; SIQYA: Self-image Questionnaire for Young Adults; UCLA-LS: UCLA Loneliness Scale.

Vicary & Corneal, 2016; Walker & Holtfreter, 2017) and five on anxiety (Boden et al., 2008; Jaffee, 2002; Mokwena et al., 2016; Piyasil, 1998; Stiffman et al., 1987). Varied kinds of scales were used for assessing depression, such as the Composite International Diagnostic Interview scale (CIDI) (Boden et al., 2008), Centre for Epidemiological studies Depression Scale (CES-D) (Deal & Holt, 1998; Henretta et al., 2008; Kalil & Kunz, 2002; Taylor, 2009; Vicary & Corneal, 2016; Walker & Holtfreter, 2017), Brief Symptom Inventory scale (BSI) (Gavin et al., 2011), Diagnostic Interview Schedule scale (DIS) (Jaffee, 2002; Stiffman et al., 1987; Vanderkruik et al., 2001), General Health Questionnaire (GHQ) (Mokwena et al., 2016), and Beck Depression Inventory (BDI) (Schmidt et al., 2006). Two studies did not report the scale they used to assess depression (Buckingham-Howes et al., 2017; Iacobelli et al., 2014; Piyasil, 1998). The pooled estimates from included studies showed depression was significantly higher among mothers who became mothers during adolescence than those who became mothers in adulthood (RR 1.34; 95% CI 1.05, 1.72, 6 studies, heterogeneity: Chi^2 P 0.01, I^2 60%) (Figure 2). There were three studies that reported mean depression scores (Kalil & Kunz, 2002; Taylor, 2009; Walker & Holtfreter, 2017). The estimates showed a significantly higher depression mean score among adolescent mothers than non-adolescent mothers (MD 0.76; 95% CI 0.52, 0.99; 3 studies; heterogeneity: Chi^2 P 0.27, I^2 25%).



Footnotes

- (1) Motherhood by 18 years compared to no early motherhood
- (2) Mothers of 15–17 years compared to mothers of 25–34 years – White
- (3) Mothers of 18–19 years compared to mothers of 25–34 years – Black
- (4) Mothers of 15–17 years compared to mothers of 25–34 years – Black
- (5) Mothers of 18–19 years compared to mothers of 25–34 years – Black
- (6) Mothers 13–18 years compared to mothers 32–39 years
- (7) Mothers who are pregnant (13–18 years) compared to never pregnant (13–18 years)
- (8) Mothers younger than 18 years compared to mothers 18–29 years
- (9) mothers less than 18 years compared to 20–35 years

Figure 2. Adolescent pregnancy and depression.

The scales used to measure anxiety were CIDI scale (Boden et al., 2008), DIS (Jaffee, 2002), and GHQ (Mokwena et al., 2016). The remaining two studies did not report the scale used to measure anxiety (Piyasil, 1998; Stiffman et al., 1987). The estimates showed insignificantly higher anxiety scores among adolescent mothers than non-adolescent mothers (RR 1.05; 95% CI 0.26, 4.14, 2 studies; heterogeneity: $\text{Chi}^2 P 0.0003$, $I^2 93\%$).

Substance dependence and substance use

Two studies reported substance dependence (Boden et al., 2008; Stiffman et al., 1987). The pooled estimates showed an insignificantly higher substance dependence among adolescent mothers (RR 1.12; 95% CI 0.60, 2.10; 2 studies; heterogeneity: $\text{Chi}^2 P 0.22$; $I^2 34\%$). Gavin et al. showed a significantly lower alcohol/marijuana use among adolescent mothers (2011). The same study also reported smoking and showed significantly lower smoking among adolescent mothers than non-adolescent mothers (Gavin et al., 2011). Patel et al. reported mean alcohol/marijuana use among adolescent mothers. The estimates from the study showed an insignificantly lower alcohol/marijuana use among adolescent mothers than among non-adolescent mothers (2012) (Table 4).

Table 4. Adolescent pregnancy and mental health outcomes.

Outcomes	Estimate (RR/MD)	95% Confidence Interval	Studies	Heterogeneity
Depression (overall)	1.46	[1.16, 1.84]	5	$\text{Chi}^2 P = 0.25$; $I^2 = 23\%$
CIDI: Composite International Diagnostic Interview	2.17	[1.43, 3.28]	$n = 1$	NA
CES-D: Centre for Epidemiological studies Depression Scale	1.27	[0.95, 1.70]	$n = 1$	NA
DIS: Diagnostic Interview Schedule	1.05	1.05 [0.26, 4.14]	$n = 2$	$\text{Chi}^2 P = 0.0003$; $I^2 = 93\%$
Not reported	1.50	[0.88, 2.54]	$n = 2$	$\text{Chi}^2 P = 0.45$; $I^2 = 0\%$
Mean Depression Scores				
CES-D: Centre for Epidemiological studies Depression Scale	0.76	[0.52, 0.99]	$n = 3$	$\text{Chi}^2 P = 0.27$; $I^2 = 25\%$
Anxiety (overall)	1.05	[0.26, 4.14]	2	$\text{Chi}^2 P = 0.0003$; $I^2 = 93\%$
CIDI: Composite International Diagnostic Interview	2.10	[1.28, 3.43]	$n = 1$	NA
Not reported	0.52	[0.29, 0.91]	$n = 1$	NA
Mental Component Summary	-0.21	[-1.77, 1.35]	$n = 2$	$\text{Chi}^2 P = 0.02$; $I^2 = 73\%$
Somatic Symptoms				
General Health Questionnaire	-2.20	[-3.99, -0.41]	$n = 1$	NA
Antisocial behaviour (Rutter B-2 Scale)	3.11	[2.50, 3.87]	$n = 1$	NA
Conduct Disorder				
DIS: Diagnostic Interview Schedule	0.90	[0.82, 0.99]	$n = 1$	NA
Emotional problems (Rutter B-2 Scale)	1.63	[1.21, 2.20]	$n = 1$	NA
Other psychiatric disorder/ morbidity	1.54	[1.17, 2.03]	$n = 2$	$\text{Chi}^2 P = 0.32$; $I^2 = 1\%$
Suicidal ideation	1.77	[0.51, 6.14]	$n = 2$	$\text{Chi}^2 P = 0.0001$; $I^2 = 93\%$
Suicidal attempts	3.21	[0.17, 59.33]	$n = 3$	$\text{Chi}^2 P < 0.00001$; $I^2 = 98\%$
Substance Dependence	1.12	[0.60, 2.10]	$n = 2$	$\text{Chi}^2 P = 0.22$; $I^2 = 34\%$
Self-intoxication	5.00	[1.10, 22.70]	$n = 1$	NA
Smoking	0.69	[0.56, 0.86]	$n = 1$	NA
Alcohol/ Marijuana use	0.26	[0.19, 0.37]	$n = 1$	NA
Mean Alcohol/ Marijuana use	-0.03	[-0.10, 0.04]	$n = 1$	NA

Suicidal ideation and suicidal attempt

Two studies reported suicidal ideation (Boden et al., 2008; Taylor, 2009) and three studies reported suicidal attempts (Boden et al., 2008; Iacobelli et al., 2014; Li et al., 2021). The pooled estimates showed an insignificantly higher suicidal ideation among adolescent mothers than among non-adolescent mothers (RR 1.77; 95% CI 0.51, 6.14; 2 studies; heterogeneity: Chi^2 P 0.0001, I^2 93%). Similarly, an insignificantly higher suicidal attempt was found among adolescent mother than among non-adolescent mothers (RR 3.21; 95% CI 0.17, 59.33; 3 studies; heterogeneity: Chi^2 P < 0.00001, I^2 98%). One study reported self-intoxication (Iacobelli et al., 2014). However, the estimate showed a significantly higher self-intoxication among adolescent mothers than among non-adolescent mothers (RR 5.00; 95% CI 1.10, 22.70) (Table 4).

Other mental health outcomes

Only one study reported somatic symptoms using the GHQ scale (Mokwena et al., 2016). The estimates showed significantly lower somatic symptoms among adolescent mothers than among non-adolescent mothers. Two studies reported antisocial behaviour using the Rutter B-2 Scale (Maughan & Lindelow, 1997) and the GHQ scale (Mokwena et al., 2016). Maughan et al. showed a significantly higher risk of antisocial behaviour among adolescent mothers than among non-adolescent mothers (1997). Stiffman et al. (1987) used the Diagnostic Interview for Children and Adolescents (DICA) to assess conduct disorders. The estimates from the study showed a significantly lower conduct disorder among adolescent mothers than among non-adolescent mothers (Stiffman et al., 1987). Two studies reported other psychiatric disorders/morbidities (Iacobelli et al., 2014; Maughan & Lindelow, 1997). The pooled estimates from the studies showed a significantly higher psychiatric morbidity among adolescent mothers than among non-adolescent mothers.

A forest plot shows the pooled estimates from the included studies reporting depression in adolescent mothers.

Other outcomes reported in the studies were home stress and satisfaction (Vicary & Corneal, 2001), conflict (Vicary & Corneal, 2001), managing disagreements (Vicary & Corneal, 2001), loneliness (Vicary & Corneal, 2001), self-image (Vicary & Corneal, 2001), self-acceptance (Taylor, 2009), self-control (Walker & Holtfreter, 2016), and self-esteem (Walker & Holtfreter, 2016). The studies did not provide enough information to calculate the estimates. However, they narratively reported no difference in home stress and satisfaction, conflict, managing disagreements, and loneliness (Vicary & Corneal, 2001). Low self-esteem and self-control were significantly correlated with delinquent behaviours among adolescent mothers.

Discussion

The systematic review aimed at assessing the pregnancy-related mental health outcomes in adolescent mothers compared to older mothers. Of the 21 studies, 20 were cross-sectional and cohort studies and only one study was case-control. All the studies used different scales to assess mental outcomes. However, there were fewer studies that

used similar scales; thus, pooled estimates were obtained. There was significantly higher depression, insignificantly higher anxiety, and substance dependence seen among adolescent mothers compared to among non-adolescent mothers. However, mean depression scores were significantly higher in adolescent mothers. Similarly, suicidal ideation and suicidal attempts were insignificantly higher among adolescent mothers. Conversely, self-intoxication was significantly higher among adolescent mothers. Interestingly, smoking and alcohol use showed an inverse relationship with adolescent pregnancy where adolescent mothers were found to smoke less than the non-adolescent mothers.

Of all the mental health outcomes reported, depression and anxiety were the most common mental health conditions experienced by adolescents during their post-partum period. Due to the sparse heterogeneity between the studies, the estimates obtained cannot be directly applied to all adolescent mothers around the globe. There was also a discrepancy in the age categories of adolescent mothers and their comparison with young adult mothers. However, the findings suggested that adolescent pregnancy is associated with poor mental health outcomes. This set the ground for implications for research in the form of more prospective studies so that outcome ascertainment related to adolescent pregnancy can be ensured.

All the included studies were observational. Observational studies are in the middle of the hierarchy of evidence. Of the 21 included studies, 11 were of high quality, three were of moderate quality, five were of low quality, and for two studies quality was not assessed as those were abstract only. Additionally, the association between adolescent pregnancy and mental health outcomes cannot be explained as completely causal. There is a need to conduct more follow-up studies so that a cause-effect relationship can be established. However, a comprehensive search strategy was made with appropriate key terms, databases, and cross-referencing to identify relevant papers. This has resulted in reduced selection bias in this systematic review. The eligibility criteria for the possible inclusion of the studies in the review barely prevent any relevant article from getting missed to be included in the final data synthesis.

Our review showed a potential association between adolescent pregnancy and the occurrence of depression. The findings are consistent with the literature which shows that mild to moderate depressive symptoms are very much common anytime during the post-partum period among adolescent mothers ranging from 2.5% to 57% (Brown et al., 2012). Mutahi et al. conducted a systematic review to identify mental health problems experienced by pregnant adolescents and young mothers only in the African region (2022). The qualitative analysis performed by this review identified depression being the most common mental health problem (Mutahi et al., 2022). Additionally, our findings add to what is already known about the unfavourable effects of early marriage and the frequent expectation of childbirth that follows after teenage pregnancy (UNFPA, 2013). Although reporting of other mental health conditions was limited, our findings showed that anxiety was also insignificantly associated with adolescent pregnancy. A recent review showed a 15–20% of the prevalence of anxiety among mothers during antenatal care, with the rates highest from LMICs (Dennis et al., 2017; Fawcett et al., 2019; Fisher et al., 2012). It is important to note that anxiety is significantly associated with post-partum depression, prematurity, preterm births, and reduced breastfeeding attitude among mothers (Grigoriadis et al., 2019; Staneva et al., 2015). The adolescent population undergoes many unique combinations of changes; this is also accompanied

by life stressors such as those experienced in schools, unplanned pregnancies, societal roles, relationship dynamics, and the transition towards adulthood. All these factors put teenage at higher risk of experiencing mental health issues, and this risk is further amplified during pregnancy (Reid & Meadows-Oliver, 2007). All these experiences can hinder access to available healthcare services because of financial dependence, associated stigma with teenage pregnancy, and poor relationship dynamics with parents or partners (Jorns-Presentati et al., 2021).

The literature highlights developmental and socio-emotional interplay in parenting adolescence that contributes to the higher prevalence of depression and anxiety. Parenting adolescents involves identity formation, autonomy struggles, peer relationships, academic pressures, and challenges posed by technology and social media; communication difficulties, risk-taking behaviours, and mood swings add complexities (Shifflet-Chila et al., 2016). The transition to adulthood and societal expectations contributes to stress for adolescents (Kim & Kim, 2020). Recognizing these stressors within the developmental and socio-emotional context is vital for fostering positive mental health outcomes.

Our review also showed that adolescent mothers were more likely to present with suicidal ideation and suicidal attempts. Regardless of being pregnant, suicidal ideations and suicidal attempts are a huge concern for adolescent population. There are evidence that shows risk of suicide considerably higher amongst teenage mothers as compared to other mothers (Huang et al., 2012). These findings are consistent with a systematic review conducted in 2020 assessed the association between perinatal depression with increased risk of depression among offspring during adolescence and young adulthood period. The findings highlighted a 70% increase in the odds of offspring depression in adolescents whose mothers had perinatal depression (Tirumalaraju et al., 2020). Another qualitative study in Kenya identified that adolescent pregnancy presents with increased suicidal behaviour because of lack of familial support during crucial pregnancy years, intimate partner violence, social isolation and stigmatization from society for getting pregnant at an early age, and chronic physical illnesses (Musyimi et al., 2020).

Our review included most of the studies from developed regions (U.S.A., New Zealand, and France), which may affect the health-seeking behaviours of the adolescent population. In the U.S.A., the age of consent starts from 16 years of age. Given the higher prevalence of teenage pregnancy in the U.S.A., the state has allowed teenage mothers to continue their education in the same school, and they have the right to take time off from school for prenatal visits, childbirth, abortion care, or other health reasons (TACAdmin, 2021). The laws in New Zealand (Pregnancy Rights Your Legal Options during and after Pregnancy, 2021) are also similar. These laws play a pivotal role in increasing the access of adolescent mothers to healthcare services, leading to better pregnancy outcomes as a whole.

It is essential to discuss that discrepancy in age categories between adolescent mothers and young adult mothers might impact pregnancy-related mental health outcomes. Adolescent mothers may confront increased stress, anxiety, and concerns related to social stigma and identity due to their younger age (Hodgkinson et al., 2014). In addition, adolescents may encounter higher levels of societal stigma and judgement about their age and pregnancy, potentially contributing to mental health challenges (Mutahi et al., 2022). Furthermore, adolescents may have limited autonomy in decision-making, potentially contributing to feelings of powerlessness during pregnancy (Mweteni et al., 2021).

On the contrary, young adult mothers may exhibit more developed coping mechanisms and psychological resilience, potentially fostering a more positive mental health outlook during pregnancy (Alves et al., 2023). In addition, young adult mothers may face comparatively less societal judgement, positively influencing their mental well-being during pregnancy (Bedaso et al., 2021). Also, young adult mothers may have greater autonomy and decision-making power, positively impacting their sense of control and agency (Acharya et al., 2010).

There are several strengths and limitations of the study. For this review, a comprehensive search strategy was used for all the databases and thus, the likelihood of missing any relevant study is near minimal. The selection criteria for this review were stringent and detailed. The level of evidence coming from these studies was low given that the majority of studies were cross-sectional. The observational studies, particularly cross-sectional studies, would only provide a snapshot of the exposure and the outcome, making it hard to assess the causal relationship between adolescent pregnancy and mental health outcomes. The majority of the studies provided diverse mental health outcomes. Given the sparse and heterogeneous reporting of the outcomes, a meta-analysis could only be performed with fewer outcomes such as depression, mean depression scores, anxiety, suicidal ideation, and suicidal attempts. There was also a variability seen in the kind of scales used, resulting in more heterogeneous, pooled estimates with increased statistical heterogeneity i.e. $I^2\%$. To account for this, a sub-group analysis was performed based on different scales used by the studies for the same outcomes. It can be noted that the majority of the studies were conducted among adolescents living in developed countries. There were no studies that were from developing, low-and-middle-income countries (LMICs), resulting in limited to no generalizability in these settings. These are the countries with higher adolescent pregnancy rates; (World Health Organization, 2019) thus, this review cannot be transferred to adolescent mothers living in LMICs. This highlighted a big research gap from LMICs and warrants studies to assess the pregnancy-related mental health outcomes in adolescent mothers living in developing and underdeveloped parts of the world. The limitation of the review itself was the restriction to only take articles that are published in the English language.

Conclusion

The findings from this systematic review have opened new doors for the practices and policies. The associations identified through the meta-analysis were significant enough to make direct applications in practice. This might be due to substantial heterogeneity in the methodology and the statistics. There is a need to consider age before predicting mental health in general practice. To mitigate any mental health illnesses for adolescent mothers, it is important to make mental health screening integral in antenatal care right from the beginning, and keeping follow-ups to assess any mental stressors soon after delivery and 1-year after the post-partum period. This will help achieve Goal 3 of the Sustainable Development Goal (SDGs) which aims to 'ensure healthy lives and promote well-being for all at all ages'. In addition, adolescent pregnant mothers being at increased risk of mental illnesses must be tailored with unique interventions such as counselling

and social groups interventions. Thus, effectiveness studies to reducing mental illnesses among adolescent mothers must be explored. Lastly, there is a need to link health services across varied sectors including education and social protection programmes for the adolescent and young adults along with their caregivers.

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Data availability statement

All data used from primary studies are within the manuscript.

Ethics statement

Institutional Review Board Statement: Not applicable.

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