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ABSTRACT

In South Africa, high rates of adolescent pregnancy and HIV pose prominent public health challenges with potential implications for mental wellbeing. It is important to understand risk factors for mental health difficulties among adolescent mothers affected by HIV. This study aims to identify the prevalence of likely common mental disorder among adolescent mothers (both living with and not living with HIV) and explores hypothesised risk factors for likely common mental disorder. Cross-sectional data from adolescent mothers (10–19 years; n=1002) utilised within these analyses are drawn from a cohort of young mothers residing in the Eastern Cape Province, South Africa. All mothers completed a detailed questionnaire consisting of standardised measures of sociodemographic characteristics, mental health, and hypothesised risk factors. Logistic regression models were utilised to explore associations between hypothesised risk factors and likely common mental disorder. Risk factors were clustered within a hypothesised socioecological framework and entered into models using a stepwise sequential approach. Interaction effects with maternal HIV status were additionally explored. The prevalence of likely common mental disorder among adolescent mothers was 12.6%. Adolescent mothers living with HIV were more likely to report likely common mental disorder compared to adolescent mothers not living with HIV (16.2% vs 11.2%, X2=4.41, p=0.04). Factors associated with likely common mental disorder were any abuse exposure (OR=2.54 [95% CI:1.20–5.40], p=0.01), a lack of perceived social support (OR=4.09 [95%CI:2.48–6.74], p=<0.0001), and community violence exposure (OR=2.09 [95%CI:1.33–3.27], p=0.001). There was limited evidence of interaction effects between risk factors, and maternal HIV status.

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Violence exposure and a lack of perceived support are major risk factors for poor mental health among adolescent mothers in South Africa. Violence prevention interventions and social support may help to reduce risk. Identified risk factors spanning individual, inter-personal, and community levels have the potential to impact adolescent maternal mental health.

Introduction

The growth of the adolescent population (10–19 years) (WHO, 2017) in sub-Saharan Africa (SSA) is the fastest in the world, projected to be 435 million by 2050 (United Nations Department of Economic and Socail Affairs, 2017). This increase is largely driven by improvements in child health and mortality, alongside high fertility rates (Gupta, 2014). Given this rise, securing adolescent well-being – of which mental health is a critical component – remains essential to ensure the success and prosperity of individuals, the SSA region, and future generations. Poor mental health within adolescents has broad negative implications for the individual themselves (as they progress to adulthood) and, wider society (e.g., healthcare systems, workforce engagement) and, as a consequence, regional socio-economic outcomes (Copeland et al., 2009; Das et al., 2009; Eyre & Thapar, 2014; Gupta, 2014; Kessler et al., 2007; Lund et al., 2011; Prince et al., 2007). Approximately 10–20% of children and adolescents globally experience mental health disorders (WHO, 2019; Kieling et al., 2011), an estimate likely underreported given the scarcity of prevalence estimates from low- and middle-income countries (Belfer, 2007; Erskine et al., 2017; Patel, Araya et al., 2007; Remschmidt & Belfer, 2005). To promote adolescent potential within SSA region, both now and for future generations, it is critical to develop an increased understanding of mental health in the region within the context of the realities of adolescents' lives, inclusive of when poor mental health may be compounded by comorbidities or syndemic conditions. These analyses explore risk factors for poor mental health within the context of adolescent motherhood and HIV. Such explorations are critical to ensure the development of impactful policy and programming to promote adolescent wellbeing and enhance adolescent potential.

South Africa has one of the highest rates of adolescent pregnancy (10–19 years) in the world – estimates suggest that 19% (95% confidence interval: 16–22%) of female adolescents have experienced pregnancy (Yah et al., 2020). In addition to navigating a broad development period, denoted by substantial psychological, social, and biological changes, pregnant and parenting adolescents must also traverse pregnancy, parenting, and child-rearing. Adolescent pregnancy and parenting has also been found to be associated with adverse outcomes including a higher likelihood of complications during pregnancy and childbirth, adverse neonatal outcomes, repeat pregnancy, and development difficulties among their children (Elfenbein & Felice, 2003; Siegel & Brandon, 2014). Adolescent pregnancy has previously been found to be associated with poor mental health (Dahmen et al., 2019; Siegel & Brandon, 2014), and recent study undertaken in South Africa identified that the prevalence of likely mental disorder was higher among a sample of adolescent mothers compared to adolescents who had never experienced pregnancy

(18.2% vs. 9.6%). Poor mental health within pregnancy and parenthood may have negative implications for maternal and child health, attachment and bonding, child development outcomes (Dahmen et al., 2019; Kingston & Tough, 2014; O'Connor et al., 2016) and, at its worst, mortality – with maternal suicide linked to poor mental health. Within South Africa adolescents are additionally exposed to numerous risk factors for poor mental health including poverty, violence exposure, and high levels of communicable disease (e.g., HIV). Risk of poor mental health may therefore be further compounded by the experience of adolescent pregnancy within such settings.

South Africa has one of the highest prevalence rates of HIV in the world [a fifth of the population, 15+ years, are living with HIV] (Simbayi et al., 2019). Among adolescents, HIV has been found to be associated with poor mental health. A recent systematic review identified a high prevalence of mental health problems among adolescents living with HIV (ALHIV), with 24–27% of adolescents identified as experiencing psychiatric disorder and 30–50% showing behavioural or emotional difficulties (Dessauvagie et al., 2020). For adolescents living with HIV, poor mental health has implications for treatment adherence (Dow et al., 2016; Fawzi et al., 2016) which in turn has implications for health outcomes and onward HIV transmission.

Given that both pregnancy and living with HIV have been found to be independently associated with poor mental health among adolescents (Breuer et al., 2011; Corcoran, 2016; Siegel & Brandon, 2014), experiencing the syndemic of both adolescent pregnancy and living with HIV may compound poor mental health experience. Yet, the mental health of adolescents experiencing pregnancy within the context of HIV is a neglected topic within existing literature (Roberts, Smith, Cluver, Toska, Sherr et al., 2021a). A recent study identified that the prevalence of likely mental disorder was higher among adolescent mothers living with HIV (23.0%) compared to adolescent mothers who were not living with HIV (12.2%), and non-mothers (9.6%) (Roberts, Smith, Cluver, Toska, Zhou, et al., 2022). As such, adolescent mothers (particularly those living with HIV), are seemingly at risk of likely mental disorder compared to their peers who have not experienced pregnancy (Roberts, Smith, Cluver, Toska, Zhou, et al., 2021a). The next challenge is to explore factors associated with poor mental health among adolescent mothers, and to understand risk and protective factors for mental health among this group (Roberts, Smith, Cluver, Toska, Zhou, et al., 2021a).

Existing research exploring risk factors for poor mental health among populations that may have potentially included adolescent mothers (but did not stratify according to age) identify having an older spouse (Stranix-Chibanda et al., 2005), abuse exposure (Christodoulou et al., 2019; Groves et al., 2012; Nyamukoho et al., 2019; Osok et al., 2018; Uriyo et al., 2013), relationship difficulties (Stewart et al., 2010; Uriyo et al., 2013), younger maternal age (Osok et al., 2018; Wong et al., 2017), living with HIV (Osok et al., 2018; Stewart et al., 2010), economic difficulties (Christodoulou et al., 2019), food insecurity (Natamba et al., 2017), unintended pregnancy (Choi et al., 2019) and previous history of poor mental health (Nyamukoho et al., 2019) as factors that may be associated with a heightened likelihood of common mental disorder (CMD). Within some of these previous explorations, social support was also identified as being protective of mental health (Duby et al., 2021; Osok et al., 2018; Stewart et al., 2015). Further insight into risk and protective factors for mental health in this specific age group remains critical to better understand the mental health experience of

adolescent mothers generally and those living with HIV specifically, within SSA and how best to support this population. This study set out to test if the above established risk factors (for which there are available measures) are correlated with likely common mental disorder specifically among adolescent mothers affected by HIV. To acknowledge the broader social context and the lived realities of adolescents' lives, these analyses utilise Bronfenbrenner' ecological model (Bronfenbrenner, 1994) as a framework to explore hypothesised factors at an individual, interpersonal and community level.

Methods

Participants and procedure

Cross-sectional data utilised within these analyses is drawn from a larger cohort of adolescent and young mothers (10–24 years) and their child(ren) residing in the Eastern Cape Province, South Africa. Data for adolescent mothers (those who had given birth between the ages of 10–19 years who had at least one living child; n = 1002) is described.

Participants were interviewed between March 2018 and July 2019. Six parallel sampling strategies were utilised. Sampling strategies were developed with an advisory group of adolescent mothers and regional expert and consisted of recruitment through 73 health facilities, 43 secondary schools, service provider referrals, 9 maternity obstetric units, neighbouring adolescents of participants, and referrals from mothers recruited to the study.

All data collection tools were piloted with adolescent mothers (n = 9) and adolescents living with HIV (n = 25). All mothers completed 1) a detailed adolescent health and wellbeing questionnaire and, 2) a caregiver questionnaire collecting data on health (both maternal and child), access to care, support, child development and parenting experience. All questionnaires were administered using electronic tablets by trained data collectors. Participants completed all components of data collection in their language of choice (isiXhosa or English) and data was translated as appropriate. Questionnaires can be accessed via https://www.heybaby.org.za/.

Ethical considerations

All mothers (and their caregivers; if participants were <18 years of age) provided informed voluntary consent. Additional consent was obtained from the child's primary caregiver if the adolescent/young mother identified that they were not the main caregiver for their child, or if the adolescent mother was less than 18 years of age. Ethical approvals were obtained from the Universities of Oxford (R48876/RE002) and Cape Town (HREC:226/2017) as well as University College London (14795/001). Additional local approvals and permissions were obtained from participating education and health facilities as well as the Provincial Departments (Eastern Cape, South Africa) of Health, Social Development, and Education.

Measures

Bronfenbrenner' ecological model (Bronfenbrenner, 1994) was utilised as a framework to explore the relationship between hypothesised risk factors (clustered at an individual, interpersonal, and community level) and adolescent maternal mental health status (outcome measure) within the sample.

Maternal mental health status

Four standardised mental health measures with established cutoff points for potential mental health difficulties were utilised. Participants were classified as experiencing likely CMD (Roberts, Smith, Cluver, Toska, Sherr et al., 2021a; Roberts, Smith, Cluver, Toska, Zhou, et al., 2021) if they scored above the cutoff on any of the four mental health symptomology measures utilised within the study (depressive symptoms [Child Depression Inventory ≥3/10 items (Kovacs, 1992; Kovacs & Staff, 2003)] anxiety symptoms [Revised Children's Manifest Anxiety Scale ≥10/14 items ((Gerard & Reynolds, 1999; Reynolds & Richmond, 1978)] posttraumatic stress symptoms [Child PTSD checklist-12 items over four domains of PTSD, scoring ≥1 on each of the four domains of the scale: re-experience, voidance, hyperarousal and dysphoria (Amaya-Jackson et al., 1995; Boyes et al., 2012; Newman & Amaya-Jackson, 1996)], and suicidality [any; Mini International Psychiatric Interview for Children and Adolescents ≥1/5 items (Sheehan et al., 2010)].

Sociodemographic characteristics were obtained via maternal report and corroborated with health records on a case-by-case basis. Characteristics included maternal age at time of birth, maternal HIV status, number of children given birth to, relationship status, dwelling type, and location. Child characteristics (child age[months] and biological sex) were collected from adolescent mother/caregiver report and cross-checked with child health records.

Individual-level factors were obtained via maternal self-report. Mothers reported on whether they had experienced any previous abuse (emotional, physical[weekly/monthly] or sexual abuse[ever]). Socioeconomic circumstances were captured utilising a series of measures relating to food security, access to necessities (from a list of 8 basic necessities recognised by over 80% of the population in the nationally representative South African Social Attitudes Survey), government cash grant receipt and, being in paid work or education. Whether adolescent mothers were in an age disparate relationship was calculated utilising maternal age and maternal reporting of partner/father of child age. Relationships were classified as age disparate if the fathers of the children born to adolescent mothers were 5+ years older than the mother (Cluver et al., 2013; Pettifor et al., 2005; Toska et al., 2015).

Interpersonal-level factors focused on support and were based on adolescent self-report. Perceived social support was measured using 8-items from the Medical Outcomes Study (MOS) Social Support Survey (Sherbourne & Stewart, 1991). Participants were classified as receiving a lack of social support if they did not score positively on all survey items.

The MOS Social Support Survey has been previously utilised among adolescents and young people in South Africa.(Casale et al., 2019; Filiatreau et al., 2020; West et al., 2019) Support during pregnancy was measured utilising a single self-report item.

Community-level factors included adolescent report of exposure to community violence, assessed utilising a single item.

Statistical analyses

Analyses examined cross-sectional associations between hypothesised risk factors (at an individual, interpersonal and community level) and adolescent maternal mental health status (defined as any likely CMD). Sample characteristics (inclusive of prevalence rates of likely CMD) were described and explored according to maternal HIV status using chi-square tests, t-tests and, Kruskal Wallis tests, as appropriate. Logistic regression analyses were used to explore associations between hypothesised risk factors and likely CMD independently (model 1) and, within multivariate models (models 2–5). Within multivariate models, factors were clustered based on a hypothesised framework (based on Bronfenbrenner's socioecological framework [i.e., sociodemographic characteristics, individual-level, interpersonal-level, community-level; see, Figure 1]) and entered into the models within a stepwise sequential approach to identify independent factors. To explore potential differences according to maternal HIV status, interactions with maternal HIV status were additionally explored using logistic regression models. The Benjamini Hochberg procedure was undertaken to account for multiple testing within regression models (utilising a false discovery rate of 10% (Benjamini & Hochberg, 1995). All analyses were undertaken using Stata v.15 (StataCorp, 2017).

Results

Sociodemographic characteristics

The median age of adolescent mothers at the birth of their first child in the total sample was 17 years (IQR:16–18 years). Almost a third (27.2%; 272/1002) of the sample were living with HIV. Adolescent mothers living with HIV were older

Individual-level
Abuse exposure
Lack of food security
Lack of access to necessities
No grant receipt
Not in work or education
Age disparate relationship

Interpersonal-level
Lack of perceived social support
Lack of support during pregnancy
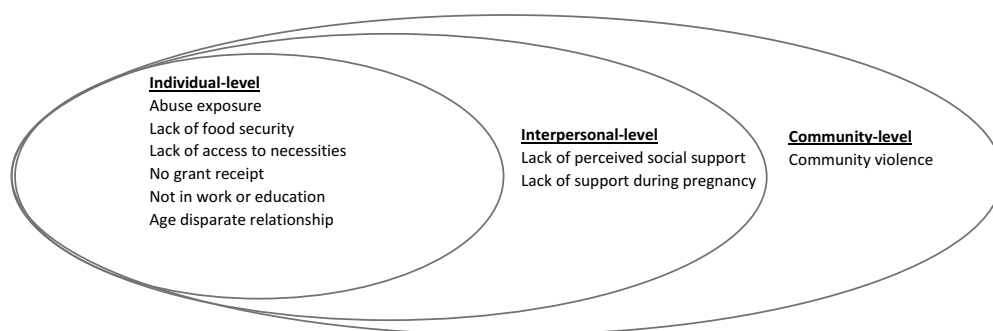
Community-level
Community violence

Figure 1. Hypothesised risk factors for likely common mental disorder among adolescent mothers affected by HIV clustered according to a socioecological framework.

compared to adolescent mothers not living with HIV at the birth of their first child (17 vs.16 years $t = 59.64$, $p = 0.0001$). 8.8% of adolescent mothers had more than one child and adolescent mothers living with HIV were more likely to report having more than one child (19.9% vs 4.7%, $X^2 = 57.11$, $p = <0.0001$). Almost of a third (28.9%) of adolescent mothers lived in a rural area and, 22.3% in informal housing. Two-thirds of adolescent mothers were in a relationship at the time of the study (659/1002; 66.4%), adolescent mothers living with HIV were more likely to report being in a relationship compared to adolescent mothers not living with HIV (71.9% vs 64.3%; $X^2 = 5.03$, $p = 0.03$). The median age of children born to adolescent mothers in the sample was 15 months (IQR: 6–29 months), and 48.7% of children were female. Children born to adolescent mothers living with HIV were older compared to those of adolescent mothers not living with HIV (25 vs 13 months; t = 51.334, $p = 0.0001$).

Prevalence of common mental disorder among adolescent mothers

One hundred and twenty-six (12.6%) participants scored above the cutoff on at least one mental health symptomology measure and were classified as experiencing likely CMD. The prevalence of mental health comorbidities (defined as scoring above the cutoff on two or more mental health symptomology measures) was 2.7%. Within the four individual mental health symptomology scales, 8.1% were classified as experiencing depressive symptoms, 0.8% anxiety symptoms, 0.6% posttraumatic stress symptoms and 6.4% suicidality symptoms (see, Figure 2/Supplementary Table S1).

Compared to adolescent mothers not living with HIV, adolescent mothers living with HIV reported at greater prevalence of likely CMD (16.2% vs 11.2%; $X^2 = 4.41$, $p = 0.04$), mental health comorbidities (4.8% vs 1.9%, $X^2 = 6.19$, p = 0.01) and depressive symptoms (11.4% vs 6.9%; $X^2 = 5.52$, $p = 0.02$). Symptomology scores relating to anxiety, posttraumatic stress, and suicidality were similar among mothers regardless of HIV status (see, Figure 2/Supplementary Table S1).

Frequency of hypothesised risk factors for adolescent maternal mental health

Table 1 presents the frequencies of the hypothesised risk factors for adolescent maternal mental health utilised within subsequent logistic regression models exploring cross-sectional associations between maternal factors and maternal mental health. *Individual-level*: 4.5% of adolescent mothers reported experience of abuse (physical/emotional [weekly/monthly] or sexual abuse [ever]), 29.0% were food insecure, 80.5% did not have access to all assessed basic necessities, 44.5% were not in paid work or education and, 40.1% had experienced an age disparate relationship with the father of their child (5+ years). *Interpersonal-level*: 12.2% of adolescent mothers were not classified as experiencing high social support and 17.9% did not feel supported during their pregnancy. *Community-level*: over a quarter (26.7%) of mothers reported experience of violence within their community (see, Table 1).
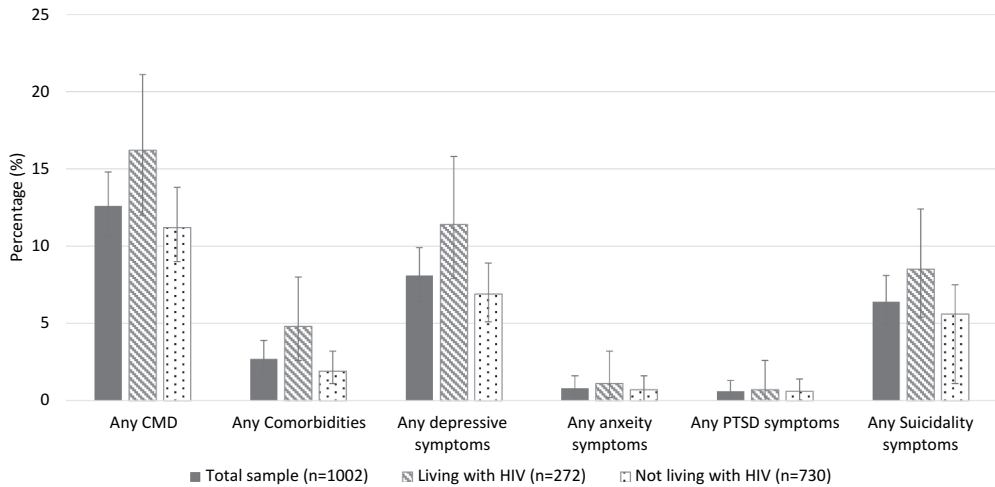
Figure 2. Prevalence of mental health symptoms among adolescent mothers stratified according to maternal HIV status (n = 1002). NB. CMD: Common mental disorder(scoring above the cut-off on one or more screen measure for mental health), Mental health comorbidities(experiencing two or more common mental disorders concurrently)

Risk factors for common mental disorder

Table 2 presents as series of logistic regression models exploring associations between (binary) hypothesised risk factors for maternal mental health and the presence of any likely CMD among adolescent mothers in the sample. Models (1–5) progress in a stepwise manner. Model 1 presents the univariate associations between hypothesised factors and any CMD. Models 2–5 present multivariate associations and progress sequentially to include socio-demographic factors (2), individual-level (3), interpersonal-level (4) and community-level (5). When all sociodemographic characteristics, and hypothesised, individual-level, inter-personal-level, and community-level factors were entered simultaneously within a logistic regression model (see, Table 2, Model 5); probable risk factors for likely CMD among adolescent mothers were any experience of abuse (OR = 2.54[1.20–5.50], p = 0.01), a lack of perceived social support (OR = 4.09[2.48–6.74],p = <0.0001), and exposure to community violence (OR = 2.09[1.33–3.27],p = 0.001). Identified risk factors spanned individual-level, interpersonal-level, and community-level factors. Statistically significant factors remained significant after using the Benjamini Hochberg procedure for multiple testing (utilising a false discovery rate of 10% (Benjamini & Hochberg, 1995)). To explore potential differences in risk factors for likely CMD among adolescent mothers living with HIV and those not living with HIV interaction terms were additionally explored. However, there was limited evidence of interaction effects between risk factors and maternal HIV status.

Discussion

This is the first known study exploring the relationship between hypothesised risk factors (identified within existing literature) and likely CMD among adolescent mothers affected by HIV within South Africa. The prevalence of likely CMD among

Table 1. Sociodemographic characteristics of adolescent mothers and their children (including hypothesised risk factors for adolescent maternal mental health) stratified according to maternal HIV status (n = 1002).

	M(IQR)/M(SD)/N(%)			
	Total sample (n = 1002)	Living with HIV (n = 272)	Not living with HIV (n = 730)	X2/t, p-value
Maternal characteristics				
Maternal age (current; years)	18 (17–19)	19 (18–21)	18 (17–19)	175.86, 0.0001
Maternal age at birth of first child (years)	17 (16–18)	17 (16–18)	16 (15–17)	59.64, 0.0001
Has more than one child	88 (8.8%)	54 (19.9%)	34 (4.7%)	57.11, <0.0001
Living in a rural area	290 (28.9%)	68 (25.0%)	222 (30.4%)	2.82, 0.09
Informal housing	219 (22.3%)	67 (25.6%)	152 (21.1%)	2.18, 0.14
In a relationship (current)	659 (66.4%)	192 (71.9%)	467 (64.3%)	5.03, 0.03
Child characteristics				
Child age (months)	15 (6–29)	25 (8–39)	13 (5.5–24)	51.34, 0.0001
Child biological sex (female)	488 (48.7%)	137 (50.4%)	351 (48.1%)	0.41, 0.52
Hypothesised risk factors for adolescent maternal mental health				
Individual-level factors				
Any abuse	45 (4.5%)	15 (5.5%)	30 (4.1%)	0.91, 0.34
Lack of food security	291 (29.0%)	89 (32.7%)	202 (27.7%)	2.45, 0.12
Number of necessities (0–8)	5.22 (2.22)	4.71 (2.33)	5.42 (2.15)	19.08, 0.0001
Lack of access to all basic necessities (8)	807 (80.5%)	227 (83.5%)	580 (79.5%)	2.03, 0.16
No grant receipt	74 (7.4%)	9 (3.3%)	65 (8.9%)	9.07, 0.003
Highest school grade completed	9.63 (1.67)	9.55 (1.87)	9.66 (1.59)	0.94, 0.35
Not in work or education	446 (44.5%)	187 (68.8%)	259 (35.5%)	88.81, <0.0001
Age disparity with father of child (how many years older is the father of the child than the mother?)	4 (2–6)	5 (2–8)	3 (2–5)	20.31, 0.0001
Age disparate relationship (father of child; ≥5 years)	368 (40.1%)	128 (52.0%)	240 (35.8%)	19.82, <0.0001
Interpersonal-level factors				
Perceived social support score	13.39 (2.06)	13.22 (2.16)	13.45 (2.02)	1.63, 0.10
Lack of social support	122 (12.2%)	44 (16.2%)	78 (10.7%)	5.59, 0.02
Not supported during pregnancy	179 (17.9%)	51 (18.8%)	128 (17.5%)	0.20, 0.65
Community-level factors				
Any exposure to community violence	267 (26.7%)	64 (23.5%)	203 (27.8%)	1.86, 0.17

NB. Missing data: Informal housing n = 981 |In a relationship (father of child; ≥5 years[n = 917]) n = 993 |Age disparate relationship (father of child; ≥5 years[n = 917])

Table 2. Logistic regression models exploring associations between hypothesised risk factors and maternal mental health (n = 1002).

	Any common mental disorder									
	Model 1		Model 2		Model 3		Model 4		Model 5	
	OR (95% CI)	p	AOR (95%CI)	p	AOR (95%CI)	p	AOR (95%CI)	p	AOR (95%CI)	p
Sociodemographic factors										
Maternal age at birth of first child (years)	0.99 (0.87–1.12)	0.82	1.01 (0.88–1.16)	0.91	0.98 (0.84–1.14)	0.77	0.98 (0.84–1.14)	0.77	0.96 (0.82–1.12)	0.66
Maternal HIV	1.53 (1.02–2.27)	0.04	1.34 (0.85–2.12)	0.21	1.18 (0.73–1.91)	0.52	1.12 (0.67–1.87)	0.66	1.23 (0.75–2.11)	0.39
Child age (months)	1.01 (1.00–1.02)	0.006	1.01 (1.00–1.02)	0.14	1.01 (1.00–1.02)	0.10	1.01 (1.00–1.03)	0.07	1.01 (0.99–1.02)	0.14
More than one child	1.92 (1.10–3.34)	0.02	1.60 (0.82–3.13)	0.17	1.30 (0.64–2.63)	0.47	1.16 (0.56–2.42)	0.69	1.28 (0.61–2.66)	0.51
In a relationship (current)	0.96 (0.65–1.43)	0.85	0.90 (0.60–1.34)	0.60	0.94 (0.61–1.47)	0.80	0.94 (0.60–1.48)	0.80	0.94 (0.59–1.48)	0.79
Living in a rural area	0.64 (0.41–0.97)	0.05	0.66 (0.42–1.05)	0.08	0.72 (0.43–1.20)	0.20	0.81 (0.48–1.35)	0.42	0.91 (0.53–1.53)	0.70
Informal housing	1.17 (0.76–1.81)	0.48	1.06 (0.68–1.65)	0.81	0.88 (0.54–1.43)	0.60	0.82 (0.50–1.36)	0.45	0.76 (0.46–1.27)	0.30
Individual level factors										
Any abuse	3.81 (1.99–7.30)	<0.0001	-	-	3.17 (1.52–6.56)	0.002	2.83 (1.33–5.98)	0.007	2.54 (1.20–5.40)	0.01
Lack of food security	1.06 (0.71–1.60)	0.77	-	-	0.94 (0.59–1.49)	0.80	0.84 (0.52–1.35)	0.46	0.86 (0.53–1.40)	0.54
Lack of access to basic necessities	0.97 (0.61–1.55)	0.91	-	-	1.05 (0.62–1.80)	0.86	0.96 (0.55–1.65)	0.87	0.94 (0.55–1.64)	0.84
No grant receipt	1.38 (0.72–2.64)	0.33	-	-	1.41 (0.70–2.87)	0.34	1.55 (0.75–3.19)	0.23	1.50 (0.73–3.09)	0.27
Not in work or education	1.79 (1.22–2.61)	0.003	-	-	1.70 (1.07–2.68)	0.02	1.62 (1.01–2.58)	0.05	1.57 (0.98–2.52)	0.06
Age disparate relationship	1.35 (0.93–1.96)	0.11	-	-	1.11 (0.73–1.70)	0.61	1.21 (0.79–1.86)	0.38	1.22 (0.79–1.88)	0.38
Interpersonal level factors										
Lack of social support	4.28 (2.75–6.65)	<0.0001	-	-	-	-	3.88 (2.37–6.36)	<0.0001	4.09 (2.48–6.74)	<0.0001
Not supported during pregnancy	1.52 (0.97–2.38)	0.06	-	-	-	-	1.31 (0.80–2.17)	0.29	1.42 (0.85–2.36)	0.18
Community factors										
Exposure to community violence	2.08 (1.41–3.06)	<0.0001	-	-	-	-	-	-	2.09 (1.33–3.27)	0.001
			$R^2 = 0.02$		$R^2 = 0.05$		$R^2 = 0.09$		$R^2 = 0.11$	

Common mental disorder (scoring above the cut-off on one or more screen measure for mental health) |Model 1.Univariate model |Model 2. Multivariate model including all sociodemographic factors listed |Model 3. Multivariate model including all sociodemographic and individual- level factors listed| Model 4. Multivariate model including all sociodemographic, individual-, and interpersonal- level factors listed|Model 5. Multivariate model including all sociodemographic, individual-, interpersonal- and community- level factors listed

adolescent mothers was 12.6% and, adolescent mothers living with HIV were more likely to report probable CMD and probable mental health comorbidities (largely driven by depressive and suicidality symptomology) when compared to adolescent mothers not living with HIV (16.2% vs. 11.2% and, 4.8% vs .1.9%, respectively). Identified risk factors for likely CMD among adolescent mothers in the sample, were any experience of abuse (verbal, physical or sexual), a lack of perceived social support and, exposure to community violence. There was limited evidence of interaction effects between hypothesised risk factors and maternal HIV status, suggesting that risk factors for likely CMD are similar among adolescent mothers living with and without HIV. Findings highlight mental health burden among adolescent mothers and provide an initial exploration of possible risk factors for likely CMD within this population. Given this, and previously identified studies suggesting a causal link between the identified risk factors and poor mental health among differing populations, it is reasonable to suggest that these risk factors have potential implications for the design of policy and programming to support adolescent mothers and their children within the context of HIV. Violence prevention is seemingly a critical component of adolescent mothers' psychosocial wellbeing, if unaddressed. Support groups may be of benefit to the psychosocial wellbeing of adolescent mothers within this context (Casale et al., 2019). It is likely that the perceived support received by adolescent mothers in the sample is provided at an inter-personal level by adolescents' immediate social networks (e.g., family members) – the positive impacts of which are often hard to replicate within interventions (Ertel et al., 2009; Holt-Lunstad et al., 2010). However, group participation has previously been linked with greater resilience among adolescents within similar contexts and may provide benefit (Casale et al., 2019).

These findings support the limited literature currently available in relation to this population that highlights worse mental health burden among adolescent mothers (18.2%) compared to adolescent non-mothers (9.6%), particularly among adolescent mothers living with HIV (Roberts et al., 2021a), and extends the evidence to explore known risk factors for mental health burden among this population. Previous studies of broader samples, which may have included adolescent mothers (both living with and not living with HIV), have identified poor maternal mental health as being associated with reported abuse exposure (Christodoulou et al., 2019; Groves et al., 2012; Nyamukoho et al., 2019; Osok et al., 2018; Uriyo et al., 2013), and social support (Duby et al., 2021; Osok et al., 2018; Stewart et al., 2015). The data within the current analyses highlight the importance of abuse exposure, social support, and community violence for adolescent maternal mental health (within the context of HIV) within South Africa. These data highlight that established risk factors for poor mental health may be relevant to the current population of interest, and additionally extends previous literature to include mothers (including mothers beyond the postpartum period), as much of the previous evidence focuses on the pregnancy or the immediate postpartum period.

Comparable associations have been found within previous studies exploring risk and protective factors for maternal mental health within adult populations affected by HIV in SSA (Dyer et al., 2012; Parcesepe et al., 2021) and, adolescent mothers (not necessarily affected by HIV) in the USA (Brown et al., 2012; Lesser & Koniak-Griffin, 2000). Findings also support broader evidence from the field of mental health identifying abuse and violence exposure (Briere, 1992; Warshaw et al., 2009) as being associated with worse

mental health outcomes, and social support (Fisher et al., 2012) as being associated with improved mental health outcomes – our findings highlight a lack of social support as being a potential risk factor for likely CMD and therefore the presence of social support is likely protective. However, it should be noted that these models are exploratory (i.e., only a modest amount of variation within the sample was explained by the model and the relationships are cross-sectional) and thus additional factors are likely to impact on CMD among adolescent mothers affected by HIV in South Africa. Further exploration of the influence of differing exposures on likely CMD and the impact of such factors on the familial and social environment of adolescent mothers may be useful within the development of preventative programming and interventions to support adolescent maternal mental health. Findings also identify how possible contributors to poor maternal mental health span beyond the individual level, and in line with the complex associations suggested in the Bronfenbrenner model (Bronfenbrenner, 1994), may also include factors from the broader social environment (i.e., interpersonal, and community level). This may have implications for the development of policy and intervention to promote mental health which often focuses on the individual, as broader influences may also have an impact. Further research is required to explore a broader range of factors and, possible avenues to reduce risk factors and promote protective factors for mental health and wellbeing among adolescent mothers within the South African context.

Study limitations should be considered within the interpretation of findings. First, data are cross-sectional, and therefore the direction of causality, and causality itself, cannot be determined. Explorations utilising longitudinal data are required to further examine the possible causal effects of identified risk factors on likely CMD. Second, these analyses only include a limited number of risk factors that likely only reflect a small proportion of the factors expected to contribute to likely CMD. Additionally, analyses do not explore how different factors interact to impact on mental health. As such, analyses represent a partial view, and provide a foundation to future investigations into contributors to the mental health of adolescent mothers within South Africa. Given the novelty of the research undertaken with this population, a selection of risk factors identified from existing literature were included within analyses as an exploratory first step within the field. Additional factors that were not assessed within this study (e.g., grief (Atif et al., 2015), child health (Atif et al., 2015; Stewart et al., 2015)) may also be associated with likely CMD (Patel, Flisher et al., 2007). Third, the data relating to mental health were obtained from self-report. However, this is common practice within the field of global mental health and was considered the best available data given the study setting e.g., the scarcity of mental health services with the locality. Symptomology scores above a cutoff are not diagnostic but give a strong indication of probable referral need and disorder. It remains important not to diminish the contextual understanding of the mental health experience or pathologise adolescence through labelling; however, it is critical to identify potential need and provide support where required. The measures utilised in this study give detail of the experience of poor mental health symptomology within the past 2 weeks/month. As such, the prevalence estimates within this study provide a snapshot of current mental health symptoms, and do not include previous experience of poor mental health symptoms or an indication of how mental health symptoms might vary over time. Despite limitations, these initial findings are drawn from a robust sample of

adolescent mothers within South Africa, the largest study of its kind, and offer insight into mental health need within this population. Findings identify areas for future research and potential resource allocation within programming for adolescent mothers.

Conclusions

Little is known about to the mental health of adolescent mothers affected by HIV within SSA, and this group remain substantially underserved regarding mental health provision. These analyses address a critical evidence gap relating to risk factors associated with the mental health of adolescent mothers. While exploratory, these findings have implications for the design of interventions, policy and programming for adolescent mothers and their children within SSA. Analyses suggest high-risk groups of adolescent mothers for likely CMD including those living with HIV, those who have experienced abuse, those lacking social support and those experiencing community violence. Identified factors span individual, interpersonal, and community levels have the potential to impact adolescent maternal mental health within South Africa. Rigorous intervention research is needed to determine avenues in which risk factors can be reduced and protective factors promoted for mental health burden among this population. However, these data provide a foundation for further research required to inform health policy and scalable interventions to promote improved outcomes for adolescents and their children.

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Data sharing and accessibility

Prospective users, policymakers/government agencies/researchers (internal/external) will be required to contact the study team to discuss and plan the use of data. Research data will be available on request subject to participant consent and having completed all necessary documentation. All data requests should be sent to the Principal Investigators.

References

Amaya-Jackson, L., McCarthy, G., Cherney, M., & Newman, E. (1995). *Child PTSD checklist*. Duke University Medical Center.

Atif, N., Lovell, K., & Rahman, A. (2015). Maternal mental health: The missing "m" in the global maternal and child health agenda. Seminars in perinatology

Belfer, M. L. (2007). Critical review of world policies for mental healthcare for children and adolescents. *Current Opinion in Psychiatry*, *20*(4), 349–352. https://doi.org/10.1097/YCO.0b013e3281bc0cf4

Benjamini, Y., & Hochberg, Y. (1995). Controlling the false discovery rate: A practical and powerful approach to multiple testing. *Journal of the Royal Statistical Society: Series B (Methodological)*, *57*(1), 289–300.

Boyes, M. E., Cluver, L. D., & Gardner, F. (2012). Psychometric properties of the child PTSD checklist in a community sample of South African children and adolescents. *PloS one*, *7*(10), e46905. https://doi.org/10.1371/journal.pone.0046905

Breuer, E., Myer, L., Struthers, H., & Joska, J. A. (2011). HIV/AIDS and mental health research in sub-Saharan Africa: A systematic review. *African Journal of AIDS Research*, *10*(2), 101–122. https://doi.org/10.2989/16085906.2011.593373

Briere, J. N. (1992). *Child abuse trauma: Theory and treatment of the lasting effects*. Sage Publications, Inc.

Bronfenbrenner, U. (1994). Ecological models of human development. *Readings on the Development of Children*, *2*(1), 37–43.

Brown, J. D., Harris, S. K., Woods, E. R., Buman, M. P., & Cox, J. E. (2012). Longitudinal study of depressive symptoms and social support in adolescent mothers. *Maternal and Child Health Journal*, *16*(4), 894–901. https://doi.org/10.1007/s10995-011-0814-9

Casale, M., Boyes, M., Pantelic, M., Toska, E., & Cluver, L. (2019). Suicidal thoughts and behaviour among South African adolescents living with HIV: Can social support buffer the impact of stigma? *Journal of Affective Disorders*, *245*, 82–90. https://doi.org/10.1016/j.jad.2018.10.102

Choi, K. W., Smit, J. A., Coleman, J. N., Mosery, N., Bangsberg, D. R., Safren, S. A., & Psaros, C. (2019). Mapping a syndemic of psychosocial risks during pregnancy using network analysis. *International Journal of Behavioral Medicine*, *26*(2), 207–216. Pagination Specified. https://doi.org/10.1007/s12529-019-09774-7

Christodoulou, J., Le Roux, K., Tomlinson, M., Le Roux, I. M., Katzen, L. S., & Rotheram-Borus, M. J. (2019). Perinatal maternal depression in rural South Africa: Child outcomes over the first

two years [Empirical study; Followup study; Quantitative study]. *Journal of Affective Disorders*, *247*, 168–174. https://doi.org/10.1016/j.jad.2019.01.019

Cluver, L., Boyes, M., Orkin, M., Pantelic, M., Molwena, T., & Sherr, L. (2013). Child-focused state cash transfers and adolescent risk of HIV infection in South Africa: A propensity-score-matched case-control study. *The Lancet Global Health*, *1*(6), e362–e370. https://doi.org/10.1016/S2214-109X(13)70115-3

Copeland, W. E., Shanahan, L., Costello, E. J., & Angold, A. (2009). Childhood and adolescent psychiatric disorders as predictors of young adult disorders. *Archives of General Psychiatry*, *66* (7), 764–772. https://doi.org/10.1001/archgenpsychiatry.2009.85

Corcoran, J. (2016). Teenage pregnancy and mental health. *Societies*, *6*(3), 21. https://doi.org/10.3390/soc6030021

Dahmen, B., Konrad, K., Jahnen, L., Herpertz-Dahlmann, B., & Firk, C. (2019). *Mental health of teenage mothers: Impact on the next generation*. Der Nervenarzt.

Das, J., Do, Q.-T., Friedman, J., & McKenzie, D. (2009). Mental health patterns and consequences: Results from survey data in five developing countries. *The World Bank Economic Review*, *23*(1), 31–55. https://doi.org/10.1093/wber/lhn010

Dessauvagie, A. S., Jörns-Presentati, A., Napp, A.-K., Stein, D. J., Jonker, D., Breet, E., Charles, W., Swart, R., Lahti, M., Suliman, S., Jansen, R., van den Heuvel, L. L., Seedat, S., & Groen, G. (2020). The prevalence of mental health problems in sub-Saharan adolescents living with HIV: A systematic review. *Global Mental Health*, *7*(e29), 1–13. https://doi.org/10.1017/gmh.2020.18

Dow, D. E., Turner, E. L., Shayo, A. M., Mmbaga, B., Cunningham, C. K., & O'Donnell, K. (2016). Evaluating mental health difficulties and associated outcomes among HIV-positive adolescents in Tanzania. *AIDS Care*, *28*(7), 825–833. https://doi.org/10.1080/09540121.2016.1139043

Duby, Z., Appollis, T. M., Jonas, K., Maruping, K., Dietrich, J., LoVette, A., Kuo, C., Vanleeuw, L., & Mathews, C. (2021). "As a young pregnant girl . . . The challenges you face": Exploring the intersection between mental health and sexual and reproductive health amongst adolescent girls and young women in South Africa. *AIDS and Behavior*, *25*(2), 344–353. https://doi.org/10.1007/s10461-020-02974-3

Dyer, T. P., Stein, J. A., Rice, E., & Rotheram-Borus, M. J. (2012). Predicting depression in mothers with and without HIV: The role of social support and family dynamics. *AIDS and Behavior*, *16* (8), 2198–2208. https://doi.org/10.1007/s10461-012-0149-6

Elfenbein, D. S., & Felice, M. E. (2003). Adolescent pregnancy. *Pediatric Clinics of North America*, *50*(4), 781–800. https://doi.org/10.1016/s0031-3955(03)00069-5

Erskine, H., Baxter, A., Patton, G., Moffitt, T., Patel, V., Whiteford, H., & Scott, J. (2017). The global coverage of prevalence data for mental disorders in children and adolescents. *Epidemiology and Psychiatric Sciences*, *26*(4), 395–402. https://doi.org/10.1017/S2045796015001158

Ertel, K. A., Glymour, M. M., & Berkman, L. F. (2009). Social networks and health: A life course perspective integrating observational and experimental evidence. *Journal of Social and Personal Relationships*, *26*(1), 73–92. https://doi.org/10.1177/0265407509105523

Eyre, O., & Thapar, A. (2014). Common adolescent mental disorders: Transition to adulthood. *The Lancet*, *383*(9926), 1366–1368. https://doi.org/10.1016/S0140-6736(13)62633-1

Fawzi, M. C. S., Ng, L., Kanyanganzi, F., Kirk, C., Bizimana, J., Cyamatare, F., Mushashi, C., Kim, T., Kayiteshonga, Y., & Binagwaho, A. (2016). Mental health and antiretroviral adherence among youth living with HIV in Rwanda. *Pediatrics*, *138*(4), 1-9. https://doi.org/10.1542/peds.2015-3235

Filiatreau, L. M., Giovenco, D., Twine, R., Gómez-Olivé, F. X., Kahn, K., Haberland, N., & Pettifor, A. (2020). Examining the relationship between physical and sexual violence and psychosocial health in young people living with HIV in rural South Africa. *Journal of the International AIDS Society*, *23*(12), e25654. https://doi.org/10.1002/jia2.25654

Fisher, J., Mello, M. C. D., Patel, V., Rahman, A., Tran, T., Holton, S., & Holmes, W. (2012). Prevalence and determinants of common perinatal mental disorders in women in low-and lower-middle-income countries: A systematic review. *Bulletin of the World Health Organization*, *90*(2), 139–149. https://doi.org/10.2471/BLT.11.091850

Gerard, A. B., & Reynolds, C. R. (1999). Characteristics and applications of the Revised Children's Manifest Anxiety Scale (RCMAS).

Groves, A. K., Kagee, A., Maman, S., Moodley, D., & Rouse, P. (2012). Associations between intimate partner violence and emotional distress among pregnant women in Durban, South Africa. *Journal of Interpersonal Violence*, *27*(7), 1341–1356. https://doi.org/10.1177/0886260511425247

Gupta, M. D. (2014). *The power of 18 billion: Adolescents, youth, and the transformation of the future. The State of World Population*. UNFPA.

Holt-Lunstad, J., Smith, T. B., & Layton, J. B. (2010). Social relationships and mortality risk: A meta-analytic review. *PLoS Medicine*, *7*(7), e1000316. https://doi.org/10.1371/journal.pmed.1000316

Kessler, R. C., Angermeyer, M., Anthony, J. C., De Graaf, R., Demyttenaere, K., Gasquet, I., De Girolamo, G., Gluzman, S., Gureje, O., Haro, J. M., Kawakami, N., Karam, A., Levinson, D., Medina Mora, M. E., Oakley Browne, M. A., Posada-Villa, J., Stein, D. J., Adley Tsang, C. H., Aguilar-Gaxiola, S., . . . Ustün, T. B. (2007). Lifetime prevalence and age-of-onset distributions of mental disorders in the world health organization's world mental health survey initiative. *World Psychiatry: Official Journal of the World Psychiatric Association (WPA)*, *6*(3), 168.

Kieling, C., Baker-Henningham, H., Belfer, M., Conti, G., Ertem, I., Omigbodun, O., Rohde, L. A., Srinath, S., Ulkuer, N., & Rahman, A. (2011). Child and adolescent mental health worldwide: Evidence for action. *The Lancet*, *378*(9801), 1515–1525. https://doi.org/10.1016/S0140-6736(11)60827-1

Kingston, D., & Tough, S. (2014). Prenatal and postnatal maternal mental health and school-age child development: A systematic review. *Maternal and Child Health Journal*, *18*(7), 1728–1741. https://doi.org/10.1007/s10995-013-1418-3

Kovacs, M. (1992). *Children's depression inventory (CDI): Technical manual update*. Multi-Health Systems.

Kovacs, M., & Staff, M. (2003). *Children's depression inventory (CDI): Technical manual update*. Multi-Health Systems North Tonawanda.

Lesser, J., & Koniak-Griffin, D. (2000). The impact of physical or sexual abuse on chronic depression in adolescent mothers. *Journal of Pediatric Nursing*, *15*(6), 378–387. https://doi.org/10.1053/jpdn.2000.16714

Lund, C., De Silva, M., Plagerson, S., Cooper, S., Chisholm, D., Das, J., Knapp, M., & Patel, V. (2011). Poverty and mental disorders: Breaking the cycle in low-income and middle-income countries. *The Lancet*, *378*(9801), 1502–1514. https://doi.org/10.1016/S0140-6736(11)60754-X

Natamba, B. K., Mehta, S., Achan, J., Stoltzfus, R. J., Griffiths, J. K., & Young, S. L. (2017). The association between food insecurity and depressive symptoms severity among pregnant women differs by social support category: A cross-sectional study. *Maternal & Child Nutrition*, *13*(3), Article e12351. https://doi.org/10.1111/mcn.12351

Newman, E., & Amaya-Jackson, L. (1996). Assessment of trauma instruments for children. *Proceedings of the 12th International Conference for Traumatic Stress Studies, San Francisco, CA*.

Nyamukoho, E., Mangezi, W., Marimbe, B., Verhey, R., & Chibanda, D. (2019). Depression among HIV positive pregnant women in Zimbabwe: A primary health care based cross-sectional study. *BMC Pregnancy and Childbirth*, *19*(1), Article 53. https://doi.org/10.1186/s12884-019-2193-y

O'Connor, T. G., Monk, C., & Burke, A. S. (2016). Maternal affective illness in the perinatal period and child development: Findings on developmental timing, mechanisms, and intervention. *Current Psychiatry Reports*, *18*(3), 24. https://doi.org/10.1007/s11920-016-0660-y

Osok, J., Kigamwa, P., Stoep, A. V., Huang, K. Y., & Kumar, M. (2018). Depression and its psychosocial risk factors in pregnant Kenyan adolescents: A cross-sectional study in a community health Centre of Nairobi. *BMC Psychiatry*, *18*(1), 136. https://doi.org/10.1186/s12888-018-1706-y

Parcesepe, A. M., Cordoba, E., Gallis, J. A., Headley, J., Tchatchou, B., Hembling, J., Soffo, C., & Baumgartner, J. N. (2021). Common mental disorders and intimate partner violence against pregnant women living with HIV in Cameroon: A cross-sectional analysis. *BMC Pregnancy and Childbirth*, *21*(1), 1–14. https://doi.org/10.1186/s12884-021-03673-0

Patel, V., Araya, R., Chatterjee, S., Chisholm, D., Cohen, A., De Silva, M., Hosman, C., McGuire, H., Rojas, G., & Van Ommeren, M. (2007). Treatment and prevention of mental disorders in low-income and middle-income countries. *The Lancet*, *370*(9591), 991–1005. https://doi.org/10.1016/S0140-6736(07)61240-9

Patel, V., Flisher, A. J., Hetrick, S., & McGorry, P. (2007). Mental health of young people: A global public-health challenge. *The Lancet*, *369*(9569), 1302–1313. https://doi.org/10.1016/S0140-6736(07)60368-7

Pettifor, A. E., Rees, H. V., Kleinschmidt, I., Steffenson, A. E., MacPhail, C., Hlongwa-Madikizela, L., Vermaak, K., & Padian, N. S. (2005). Young people's sexual health in South Africa: HIV prevalence and sexual behaviors from a nationally representative household survey. *AIDS*, *19*(14), 1525–1534. https://doi.org/10.1097/01.aids.0000183129.16830.06

Prince, M., Patel, V., Saxena, S., Maj, M., Maselko, J., Phillips, M. R., & Rahman, A. (2007). No health without mental health. *The Lancet*, *370*(9590), 859–877. doi:10.1016/S0140-6736(07)61238-0

Remschmidt, H., & Belfer, M. (2005). Mental health care for children and adolescents worldwide: A review. *World Psychiatry: Official Journal of the World Psychiatric Association (WPA)*, *4*(3), 147. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC1414760/

Reynolds, C. R., & Richmond, B. O. (1978). What I think and feel: A revised measure of children's manifest anxiety. *Journal of Abnormal Child Psychology*, *6*(2), 271–280. https://doi.org/10.1007/BF00919131

Roberts, K. J., Smith, C., Cluver, L., Toska, E., & Sherr, L. (2021a). Understanding mental health in the context of adolescent pregnancy and HIV in Sub-Saharan Africa: A systematic review identifying a critical evidence gap. *AIDS and Behavior*, *25*(7), 2094–2107. https://doi.org/10.1007/s10461-020-03138-z

Roberts, K. J., Smith, C., Cluver, L., Toska, E., Zhou, S., Boyes, M., & Sherr, L. (2021b). Adolescent motherhood and HIV in South Africa: Examining prevalence of common mental disorder. *AIDS and Behavior. In press.*

Roberts, K. J., Smith, C., Cluver, L., Toska, E., Zhou, S., Boyes, M., & Sherr, L. (2022). Adolescent motherhood and HIV in South Africa: Examining prevalence of common mental disorder. *AIDS and Behavior*, *26*, 1197–1210. https://doi.org/10.1007/s10461-021-03474-8

Sheehan, D. V., Sheehan, K. H., Shytle, R. D., Janavs, J., Bannon, Y., Rogers, J. E., Milo, K. M., Stock, S. L., & Wilkinson, B. (2010). Reliability and validity of the mini international neuropsychiatric interview for children and adolescents (MINI-KID). *The Journal of Clinical Psychiatry*, *71*(3), 313–326. https://doi.org/10.4088/JCP.09m05305whi

Sherbourne, C. D., & Stewart, A. L. (1991). The MOS social support survey. *Social Science & Medicine*, *32*(6), 705–714. https://doi.org/10.1016/0277-9536(91)90150-B

Siegel, R. S., & Brandon, A. R. (2014). Adolescents, pregnancy, and mental health. *Journal of Pediatric and Adolescent Gynecology*, *27*(3), 138–150. https://doi.org/10.1016/j.jpag.2013.09.008

Simbayi, L., Zuma, K., Zungu, N., Moyo, S., Marinda, E., Jooste, S., Mabaso, M., Ramlagan, S., North, A., & Van Zyl, J. (2019). South African National HIV prevalence, incidence, behaviour and communication survey, 2017: Towards achieving the UNAIDS 90-90-90 targets. *International Journal for Equity in Health*, *18*(1), 1-252. https://doi.org/10.1186/s12939-019-1055-6

StataCorp. (2017). *Stata Statistical Software: Release 15.*

Stewart, R. C., Bunn, J., Vokhiwa, M., Umar, E., Kauye, F., Fitzgerald, M., Tomenson, B., Rahman, A., & Creed, F. (2010). Common mental disorder and associated factors amongst women with young infants in rural Malawi. *Social Psychiatry and Psychiatric Epidemiology*, *45*(5), 551–559. https://doi.org/10.1007/s00127-009-0094-5

Stewart, R. C., Umar, E., Gleadow-Ware, S., Creed, F., & Bristow, K. (2015). Perinatal distress and depression in Malawi: An exploratory qualitative study of stressors, supports and symptoms [Empirical study; Interview; Focus Group; Qualitative study]. *Archives of Women's Mental Health*, *18*(2), 177–185. https://doi.org/10.1007/s00737-014-0431-x

Stranix-Chibanda, L., Chibanda, D., Chingono, A., Montgomery, E., Wells, J., Maldonado, Y., Chipato, T., & Shetty, A. K. (2005). Screening for psychological morbidity in HIV-infected and

HIV-uninfected pregnant women using community counselors in Zimbabwe. *Journal of the International Association of Physicians in AIDS Care (Chicago, Ill,: 2002)*, *4*(4), 83–88. https://doi.org/10.1177/1545109706286555

Toska, E., Cluver, L. D., Boyes, M., Pantelic, M., & Kuo, C. (2015). From 'sugar daddies' to 'sugar babies': Exploring a pathway among age-disparate sexual relationships, condom use and adolescent pregnancy in South Africa. *Sexual Health*, *12*(1), 59–66. https://doi.org/10.1071/SH14089

United Nations Department of Economic and Social Affairs. (2017). *Revision of world population prospects*. United Nations Secretariat Department of Economic and Social Affairs.

Uriyo, J. G., Abubakar, A., Swai, M., Msuya, S. E., & Stray-Pedersen, B. (2013). Prevalence and correlates of common mental disorders among mothers of young children in Kilimanjaro region of Tanzania. *Plos one*, *8*(7), Article e69088. https://doi.org/10.1371/journal.pone.0069088

Warshaw, C., Brashler, P., & Gil, J. (2009). Mental health consequences of intimate partner violence.

West, N., Schwartz, S., Mudavanhu, M., Hanrahan, C., France, H., Nel, J., Mutunga, L., Bernhardt, S., Bassett, J., & Van Rie, A. (2019). Mental health in South African adolescents living with HIV. *AIDS Care*, *31*(1), 117–124. https://doi.org/10.1080/09540121.2018.1533222

WHO. (2017). *Adolescent development*.

WHO. (2019). *Child and adolescent mental health*.

Wong, M., Myer, L., Zerbe, A., Phillips, T., Petro, G., Mellins, C. A., Remien, R. H., Shiau, S., Brittain, K., & Abrams, E. J. (2017). Depression, alcohol use, and stigma in younger versus older HIV-infected pregnant women initiating antiretroviral therapy in Cape Town, South Africa [Clinical Trial; Empirical study; Followup study; Interview; Quantitative study]. *Archives of Women's Mental Health*, *20*(1), 149–159. https://doi.org/10.1007/s00737-016-0688-3

Yah, C. S., Ndlovu, S., Kutywayo, A., Naidoo, N., Mahuma, T., & Mullick, S. (2020). The prevalence of pregnancy among adolescent girls and young women across the Southern African development community economic hub: A systematic review and meta-analysis. *Health Promotion Perspectives*, *10*(4), 325. https://doi.org/10.34172/hpp.2020.51