



THE AGA KHAN UNIVERSITY

eCommons@AKU

Brain and Mind Institute

Centres of Excellence

9-2022

Prevalence and risk factors associated with depression in pregnant adolescents in Nairobi, Kenya

Albert Tele

Joseph Kathono

Shillah Mwaniga

Vincent Nyongesa

Obadia Yator

See next page for additional authors

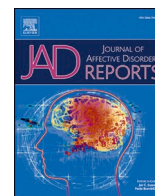
Follow this and additional works at: <https://ecommons.aku.edu/bmi>



Part of the [Psychiatric and Mental Health Commons](#)

Authors

Albert Tele, Joseph Kathono, Shillah Mwaniga, Vincent Nyongesa, Obadia Yator, Onesmus Gachuno, Dalton Wamalwa, Beatrice Amugune, Zul Merali, and Manasi Kumar



Research Paper

Prevalence and risk factors associated with depression in pregnant adolescents in Nairobi, Kenya

Albert Tele^{a,*}, Joseph Kathono^{b,c}, Shillah Mwaniga^{b,c}, Vincent Nyongesa^b, Obadia Yator^b, Onesmus Gachuno^d, Dalton Wamalwa^e, Beatrice Amugune^f, Pim Cuijpers^a, Shekhar Saxena^g, Mary McKay^h, Liliana Carvajalⁱ, Joanna Laiⁱ, Keng Yen Huang^j, Zul Merali^k, Manasi Kumar^{b,k}

^a Department of Clinical, Neuro and Developmental Psychology, Vrije Universiteit Amsterdam, The Netherlands

^b Department of Psychiatry, University of Nairobi, Kenya

^c Nairobi Metropolitan Services, Kenya

^d Department of Obstetrics and Gynaecology, University of Nairobi, Kenya

^e Department of Paediatrics and Child Health, University of Nairobi, Kenya

^f Department of Pharmaceutics and Pharmacy Practice, University of Nairobi, Kenya

^g Department of Global Health and Population, Harvard T Chan School of Public Health, US

^h Washington University at St Louis, US

ⁱ UNICEF NY, US

^j New York University, US

^k Brain and Mind Institute, Aga Khan University, Nairobi, Kenya

ARTICLE INFO

Keywords:

Depressive symptoms
Prevalence
Pregnant adolescents
Kenya
Mental health

ABSTRACT

Background: Adolescent parenthood can be associated with a range of adverse outcomes for young mothers such as depression, substance abuse, and posttraumatic stress disorder. Identification of depression and understanding risk factors among pregnant adolescents is important for development of appropriate interventions and programs focused on adolescent mental health. This paper reports on the findings of the prevalence of depression and its associated risk factors among pregnant adolescents in Nairobi, Kenya.

Methods: We recruited 153 pregnant adolescent (14-18 years) who were accessing maternal health services in one of two Nairobi County primary health care facilities in the cross-sectional survey conducted in 2021. The Patient Health Questionnaire 9 was used to screen for depression. Multivariate Stepwise linear regression modelling was used to identify key predictors of depression.

Results: Using a cut off of 10 and above on PHQ-9, we found that 43.1% of the respondents were depressed. Depressive symptoms in were independently associated with being in school, experience of intimate partner violence, substance use within the family and having experienced pressure to use substances by family or peers.

Limitations: Cross-sectional by design and the applications of our findings are limited to settings that are similar to our study population. The PHQ-9 used has not been psychometrically validated locally in this sample.

Conclusion: We found a high prevalence of depressive symptoms among respondents. These risk factors identified merit further investigation. Comprehensive mental health screening needs to be integrated in primary and community health services on the possible presence of depression.

Background

Introduction

Depression is the leading cause of disease burden in women of reproductive age (Chowdhary et al., 2014; Howard and Khalifeh, 2020).

The prevalence of depression is high among pregnant women, with worldwide estimates of 11-18% (Campbell et al., 2013; Neal et al., 2015) and between 15 and 28% in Low-and-Middle-Income Countries (Ayele et al., 2016; Gust et al., 2017). Depression among pregnant adolescents ranges from 8.3 to 39% (Abiodun et al., 1993; Cox, 1979; Hartley et al., 2011), and in Kenya it is more frequent in high-risk populations such as

* Corresponding author.

E-mail address: telekim01@gmail.com (A. Tele).

<https://doi.org/10.1016/j.jadr.2022.100424>

Received 2 November 2021; Received in revised form 12 September 2022; Accepted 18 September 2022

Available online 19 September 2022

2666-9153/© 2022 The Authors. Published by Elsevier B.V. This is an open access article under the CC BY-NC-ND license (<http://creativecommons.org/licenses/by-nc-nd/4.0/>).

individuals living with HIV and with high risk exposures such as gender based violence depression prevalence increases to over 40% (Yator et al., 2021, 2016).

Adolescents who are pregnant or recently gave birth are more prone to experiencing depression than their non-pregnant peers (Lieberman et al., 2014). Additionally, pregnant and postpartum adolescents live different lives than their non-pregnant peers. Adolescents who are pregnant or just gave birth are more likely to experience physical and sexual abuse, be exposed to domestic or communal violence, and have limited access to healthcare services (Cherry and Dillon, 2014; Hodgkinson et al., 2014; Lieberman et al., 2014).

Early pregnancy increases the risk of negative mental health issues, such as depression, substance abuse, and posttraumatic stress disorder (Cherry and Dillon, 2014). Additionally, adolescent pregnancy and motherhood are linked to stigma, discrimination, gender inequities, and the derailment of educational aspirations (Hodgkinson et al., 2014).

The risk factors associated with clinical depression among pregnant and postpartum adolescents include dysfunctional family structures, low socioeconomic status, lack of family support, social isolation, history of physical and sexual abuse, partner neglect, and elevated stress levels (Do et al., 2018; Getinet et al., 2018).

Globally, the prevalence of depression in pregnant adolescents varies (Fisher et al., 2012; Mutahi et al., 2022). A higher prevalence is reported in low- and middle-income countries as compared to high-income countries (Kerie et al., 2018).

Approximately 20% of adolescents experience symptoms of depression during pregnancy and postpartum (Anderson and Connolly, 2018). However, the rate of depression among pregnant adolescents may be higher because many are not screened for symptoms of depression or are unaware of perinatal depression (Howard and Khalifeh, 2020).

Recent studies have assessed the risk factors for depression during pregnancy including socio-demographic characteristics: such as less education (Ferri et al., 2007), lower socio-economic status (Leigh and Milgrom, 2008), lack of a supportive partner; (Osok et al., 2018b), obstetric complications like pre-term weight, low birth weight, gestational hypertension, anemia (Ganchimeg et al., 2014; Yuce et al., 2015), psychosocial conditions, such as stressful life events (Leigh and Milgrom, 2008; Osok et al., 2018b), intimate violence (Lindhorst and Oxford, 2008; Valentine et al., 2011), and lack of social support (Mutahi et al., 2022; Osok et al., 2018b).

Despite extensive concern for this population, the rate of depression during antenatal period is not well known more so in poorer geographies of the world, since most research on maternal depression focuses on the post-partum period (Reid and Meadows-Oliver, 2007) with much more attention to the infant outcomes. Because antenatal depression is strongly related to postpartum depression (Robertson et al., 2004), it seems imperative to identify factors that are associated with depression during pregnancy in adolescent mothers.

Data from Kenya Data and Health Survey (2014) (Kenya National Bureau of Statistics (KNBS), 2015) show that 1 in every 5 girls between 15 and 19 years is either pregnant or already a mother. Despite this high prevalence of adolescent mothers, there is lack of data on perinatal depression amongst younger women, and on its impact on the development of the newborn.

This study investigated the prevalence of depressive symptoms in pregnant adolescents and studies demographic and psychosocial risk factors of depressive symptoms. We hypothesize that depressive symptoms among pregnant adolescents will be higher than their non-pregnant counterpart found in the reported literature and depression would be associated with key psychosocial risk exposures like intimate partner violence (IPV).

Methods

Participants, setting and design

This study used a cross-sectional design in which the prevalence of depressive symptoms was assessed among pregnant adolescents using a nine item Patient Health Questionnaire (PHQ-9) (Kroenke and Spitzer, 2002). A self-reported PHQ-9 that was culturally adapted after extensive cognitive interviewing (Kumar et al., 2021) was programmed into RedCap software (Harris et al., 2019) and community health volunteers (CHVs) from the two health centers in Kariobangi and Kangemi carried out the assessments under close supervision of community health assistants (CHAs). CHVs and CHAs are lay health workers who are part of the community health strategy and they support primary care clinics. We engaged eight CHVs and two CHAs who were trained in ethical research practice and in identifying mental health problems in adolescents. We worked with the health facility providers to facilitate referrals of adolescents with high scores on PHQ-9 or those expressing signs of distress to receive timely support.

Participant sampling and recruitment

The sample size was calculated using the single population proportion formula (Hajian-Tilaki, 2011) with the assumption: proportion of antenatal depression to be 32.5% based on a previous study of antenatal depression on a sample of Kenyan adolescents (Osok et al., 2018b), 95% certainty, 5% precision, and applying a finite population correction (N=200, approximate number of pregnant adolescents attending antenatal care in the selected MCH clinics) and 15% adjusted for non-response rate. Accordingly, the calculated minimum sample of 150 pregnant adolescents were needed to estimate the prevalence of depression with a $\pm 5\%$ margin of error and a 95% confidence interval.

Purposive sampling was used to identify the study participants. A total of 192 participants who were registered in antenatal care (ANC) clinics at Nairobi Metropolitan Service's Kariobangi and Kangemi health centers were contacted and screened for eligibility. Of these, 21 participants did not meet the eligibility criteria, where eight participants gave birth before the study commenced and 13 were aged more than 18 years and were excluded from the study. Out of 171 eligible participants, 18 refused to consent due to various reasons including unwillingness to participate, difficulty getting time off from work, leaving a total sample size of 153.

Both Kariobangi and Kangemi health centers are classified as level three facilities under the Nairobi Metropolitan Services. A level three facility includes health centers, maternity homes, and sub-district hospitals. Kariobangi health center is located in a low-income residential area in the northeastern part of Nairobi, Kenya. It consists of both lower and middle classes and is a slum-type residential area with a population of 18,903 residents (KNBS, 2019). On the other hand, Kangemi Health Center is located in a slum in Nairobi City within a small valley on the city's outskirts with a population of 116,710 residents (KNBS, 2019). Both facilities are operated through the Nairobi Metropolitan Services (Formerly known as Nairobi County Council) giving free maternity services and caters for low- and middle income wage earners from nearby informal settlements. The two primary care centers are in the vicinity of multicultural, multiethnic informal settlements of Nairobi and are highly representative of urban adolescent population. Both facilities receive approximately 5 to 10 pregnant adolescents every day and operate every weekday.

Inclusion and exclusion criteria

All pregnant adolescents who were of ages 14-18 years, were conversant with either English or Swahili languages, were willing to give written consent, were a resident in the two sites for a minimum of six months and those who did not have any serious health conditions or

cognitive impairments that would limit their participation in this study were eligible and invited to participate in the study. Adolescents who gave birth before the study and those who refused to consent were excluded from the study. The CHVs who were supervised by a CHA (under guidance from authors VN, JK and OY) helped recruit pregnant adolescents.

Sampling criteria

The adolescents were recruited using purposive sampling where CHVs recruited participants both from the community (using snowballing) covering the health centers as well as those who were visiting the two ANC clinics in the respective centers (see Fig. 1). Once it was established that eligibility criteria were met, consent for participation was given and their socio-demographic characteristics and the PHQ-9 was administered. The participants were offered to do the assessment themselves on the tablet or with assistance from a CHV. Once assessment was completed, a referral for specialist services was made if the scores were above a cut off of 13, if the participant scored positive to any level of self-harm assessed in item 9 of PHQ-9 (which asks about thoughts of hurting self or being better off dead), or expressed other distress signs, such as missed ANC appointments, food insecurity, IPV or indicated experiencing several of these challenges altogether. An information brochure was shared with the participants (see supplementary information sheet).

We carried out the survey from March to June 2021 during the COVID-19 pandemic. We took all the safety precautions and adhered to the Ministry of Health guidelines on COVID-19. Requirements of sanitization, distancing and hand washing along with the use of face masks were adhered by all study participants, researchers, CHVs, and CHAs. We adhered to the curfew hours and health facility guidance, as and when they were issued during the pandemic.

Measures

A researcher-designed socio-demographic questionnaire was used to capture respondent's demographic information and other characteristics that included age, living conditions, occupation, whether they lived with parents, relatives or partners, income source/s, parental and partner social support and education, key psychosocial risk exposures like self or family alcohol/substance abuse, experience of sexual/domestic violence, and peer pressure to use alcohol and other substances were also assessed. These are social risk factors known to be associated

with adolescent pregnancy and are also commonly found in adolescents with depression.

PHQ-9 was used to measure depression (Kroenke et al., 2001). Each of the nine questions asks how often the respondent has experienced a particular symptom of depression during the past two weeks. There are four possible responses for each question: Not at all – 0 points, Several days – 1 point, More than half the days- 2 points, and Nearly every day – 3 points. Item scores are summed and PHQ-9 total scores range from 0 to 27.

Scores of 5, 10, 15 and 20 represent cutoff points for mild, moderate, moderately severe and severe depression, respectively. A score of 10 or more is indicative of probable clinical depression.. PHQ-9 has been widely used in both adolescent and peripartum populations in Kenya and other Sub-Saharan Africa (SSA) countries (Kumar et al., 2021; Larsen et al., 2021; Osok et al., 2018b). We also used a mnemonic to depict the PHQ-9 response options in a form of a water glass diagram to offer an improved understanding of rating frequency of distress experienced against each item.

Adaptation, translation, piloting and adoption of the PHQ-9

The PHQ-9 was formally translated and culturally contextualized using a multistakeholder driven process, which has been documented elsewhere (Kumar et al., 2021, 2015). BM and OY translated the tool into Kiswahili from English and then VN, JK, and SM back-translated it into English adjusting for differences through group discussions and note-taking on the most appropriate words and phrases. Both English and Kiswahili versions were contextualized for adolescent use and were prepared for Kenyan context. Both translations were piloted using cognitive interviews and discussed with CHVs engaged in this work.

Statistical analysis

Prior to running the analysis, all regression assumptions were checked; the assumption of normality was found to be violated on the depression scores, therefore, PHQ depression scores were transformed by a two-step approach using inverse distribution function (IDF) using maximum likelihood estimator (MLE) in which we retained the original series mean and standard deviations to improve the interpretation of results (Templeton, 2011). A multivariate forward stepwise linear regression was used to identify predictors of depression from all variables of interest. Stepwise regression is a simple and powerful model selection method which has been widely accepted by practical analysts

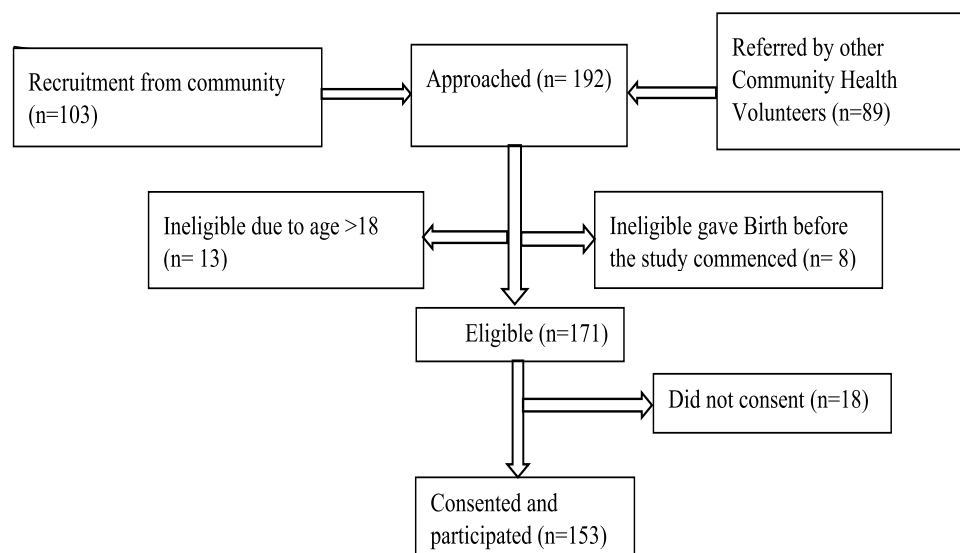


Fig. 1. Recruitment Flow Chart.

(Johnsson, 1992). A forward-selection rule starts with no explanatory variables and then adds variables, one by one, based on which variable has the strongest relation to the criterion variable, until there are no remaining statistically significant variables. At every step, the candidate variables are evaluated, one by one, typically using the *t* statistics for the coefficients of the variables being considered. P-value of <0.05 was set as a threshold used to limit the number of variables to be included in the final model. A sensitivity analysis was carried using all the variables of interest in a regression model using the enter method. All analyses were conducted using the Statistical Package for Social Sciences (SPSS, version 23.0).

Ethical approval

Ethical approval was obtained from the Kenyatta National Hospital and University of Nairobi Ethics and Research Committee (Approval No. P694/09/2018). Permission was obtained from Nairobi County Health Directorate (Approval No. CMO/NRB/OPR/VOL1/2019/04). A research license was also obtained from the National Commission for Science, Technology and Innovation (Approval No. NACOSTI/P/19/77705/28063).

Results

Socio-demographic characteristics

Table 1 presents the socio-demographic and related family characteristics of the respondents. Their mean age was 17.2 years ranging from 14 to 18 years. Almost 80.0% of participants were single, while the rest were either married or living with a partner. The majority had secondary school level of education. Most respondents were students and the rest were staying at home assisting with family chores. More than half of the participants had monthly household income of <4,999 Kenyan Shillings (Ksh) approximately 43 USD. A majority of the respondents were living with parents. With regards to the gestational age of participants, 16.3% were <12 weeks (1st trimester), 70.6% were at 12–28 weeks (2nd trimester) and 13.1% >28 weeks (3rd trimester). A majority indicated that their pregnancy was unplanned. The mean parity was 1.7 and ranged from 0 to 9. The mean age of sexual debut was 16.2 years and ranged from 13 to 18 years. Most said that they had social support from family, friends and relatives. Almost 8% of the respondents indicated that they had experienced IPV. Respondents living with someone who is a problem drinker or alcoholic were 13.1%, and 12.4% of the respondents indicated that they had ever consumed alcohol in their life; while 16.3% indicated that they had ever been pressured into using alcohol or other substances by friends or peers.

Depressive symptoms

Depression was measured using modified and contextualized patient health questionnaire (PHQ-9).

Table 2 summarizes the prevalence of various levels of depression among our sample. About 43% (n=66; 95% C.I 35.3-51.0) of the sample had a PHQ-9 score indicative of probable depression (PHQ-9 ≥ 10) (Kroenke and Spitzer, 2002).

Using a cut-off of ≥ 15 (consistent with some studies assessing clinically relevant depression), the prevalence was 13.1% (n=20; 95% C.I 8.5 - 18.3).. The cut-off of 10 and above was used in the discussion of results. The Mean, SD were 8.9 (5.3) Range and Interquartile Range of depression scores were 0-27 and 7 respectively

Factors associated with depression

Table 3 presents the results of factors associated with depression at the bivariate level. Participants who were single had significantly higher depression scores as compared to those who were married/staying with

Table 1
Socio-Demographic and Other Characteristics of the Participants.

Variable	Category	Frequency (N=153)	Percentage (%)
Age	14-16 Years	26	17.0
	17-18 Years	127	83.0
Age	Mean; SD; Range	17.2; 1.0; 14-18	
Marital status	Single	122	79.7
	Married/ With partner	31	20.3
Highest level of education	Primary and below	42	27.5
	Secondary	111	72.5
Current Occupation	Student	98	64.1
	Staying at home	55	35.9
Monthly Family Income	<4,999	82	53.6
	5,000-9,999	34	22.2
	>10,000	37	24.2
Person Living With	Parents	103	67.3
	Spouse	32	20.9
	Others	18	11.8
Week of gestation of first ANC visit	< 12 weeks	25	16.3
	12-28 weeks	108	70.6
	>28weeks	20	13.1
Pregnancy not Planned	Yes	96	62.7
Attitude of the father towards the pregnancy	Positive	92	60.1
	Negative	40	26.1
	Ambivalent	21	13.7
Presence of social support	Yes	120	78.4
Experienced intimate partner violence in pregnancy	Yes	12	7.8
Parity	0	14	9.2
	1	113	73.9
	2+	26	17.0
Parity	Mean; SD; Range	1.7; 1.9; 0-9	
Age sexual debut	Mean; SD; Range	16.2; 1.1; 13-18	
Age At Sex Debut	14-16 Years	79	52.0
	17-18 Years	73	48.0
	Non-Response	1	
Live with anyone who is a problem drinker/ alcoholic or who uses street drugs	Yes	20	13.1
Ever consumed alcohol at any time in your life	Yes	19	12.4
Ever been pressured into using alcohol or other substances by your friends or peers	Yes	25	16.3

Table 2
Prevalence of Depression among the Respondents.

Depression Level	Frequency (N=153)	Percent (%)	95% C.I.	
			Lower	Upper
1.No Depressive Symptoms (0-4)	32	20.92	14.38	28.10
2.Mild Depressive Symptoms (5-9)	55	35.95	28.12	43.79
3.Moderate Depression (10-14)	46	30.07	23.53	37.91
4.Moderately Severe Depression (15-19)	13	8.50	4.58	13.07
5.Severe Depression (20-27)	7	4.58	1.32	7.84
■ Not Depressed (<10)	87	56.9	49.0	64.7
■ Probable Depression (≥10)	66	43.1	35.3	51.0
■ Not Depressed (<14)	133	86.9	81.7	91.5
■ Depressed (≥15)	20	13.1	8.5	18.3
Mean; Median; SD; Range	8.9	9.0	0	27

their partner (*p*=0.014). Respondents who were schooling had significantly higher depression scores as compared to those who were staying at home (*p*=0.002). Participants who were living with their spouses had significantly lower depression scores as compared to those who were living with parents (*p*=0.011). Participants whose spouses had a negative attitude towards pregnancy had significantly higher depression

Table 3
Independent Predictors of Depression.

Variable	Category	Bivariate		Multivariate Analysis			
		β (s.e.)	Sig.	Enter method β (s.e.)	Sig.	Stepwise Forward β (s.e.)	Sig.
Age (Ref: 17-18 Years)	14-16 Years	-0.19 (1.15)	0.868	-2.82(1.51)	0.063	-	-
Marital status (Ref: Married/ With a partner)	Single	2.62 (1.06)	0.014	0.24(1.87)	0.897	-	-
Highest level of education (Ref: Secondary)	Primary and below	0.03 (0.97)	0.973	0.91(1.14)	0.427	-	-
Current Occupation (Ref: Staying at home)	Student	2.81 (0.87)	0.002	2.65(1.18)	0.026	2.55(0.84)	0.003
Monthly Family Income	<4,999	-0.98 (0.86)	0.261	-1.54(1.16)	0.186	-	-
	5,000-9,999	-0.06 (1.04)	0.955	-0.90(1.27)	0.481	-	-
	>10,000	Ref.		Ref.		-	-
Person Living With	Parents	Ref.		Ref.		-	-
	Spouse	-2.68 (1.04)	0.011	-0.27(2.01)	0.892	-	-
	Others	1.78 (1.34)	0.184	1.70(1.31)	0.197	-	-
Week of gestation of first ANC visit	< 12 weeks	1.52 (1.16)	0.194	2.60(1.65)	0.116	-	-
	12-28 weeks	-0.39 (0.95)	0.686	1.87(1.34)	0.164	-	-
	>28weeks	Ref.		Ref.		-	-
Pregnancy not Planned (Ref: No)	Yes	-0.53 (0.89)	0.551	-1.90(1.00)	0.058	-	-
Attitude of the father towards the pregnancy	Positive	Ref.		Ref.		-	-
	Negative	2.20 (0.97)	0.025	1.79(1.08)	0.1	-	-
	Ambivalent	0.64 (1.26)	0.614	1.12(1.36)	0.412	-	-
Presence of social support (Ref: No)	Yes	2.19 (1.04)	0.037	1.01(1.14)	0.38	-	-
Experienced IPV in pregnancy (Ref: No)	Yes	3.51 (1.59)	0.028	3.06(1.63)	0.062	3.80(1.50)	0.012
Parity	0	0.32 (1.50)	0.834	-1.33(1.89)	0.482	-	-
	1	-0.64 (0.98)	0.517	-1.74(1.26)	0.17	-	-
	2+	Ref.		Ref.		-	-
Age At Sex Debut (Ref:17-18 Years)	14-16 Years	0.02 (0.87)	0.984	0.14(0.96)	0.888	-	-
Live with anyone who is a problem drinker/ alcoholic or who uses street drugs (Ref: No)	Yes	2.79 (1.26)	0.029	2.95(1.28)	0.023	2.48(1.20)	0.041
Ever consumed alcohol at any time in your life (Ref: No)	Yes	0.56 (1.31)	0.669	-0.24(1.32)	0.853	-	-
Ever been pressured into using alcohol or other substances by your friends or peers (Ref: No)	Yes	2.72 (1.15)	0.02	2.28(1.24)	0.069	2.68(1.09)	0.015

scores compared to participants whose spouses had a positive attitude ($p=0.025$). Respondents who had experienced intimate partner violence had significantly higher depression scores as compared to those who had not ($p=0.028$). Participants who lived with anyone who is a problem drinker/ alcoholic or who uses street drugs, and those who had ever been pressured into using alcohol or other substances by their friends or peers had significantly higher depression levels as compared to those who had not ($p=0.023$) and ($p=0.020$), respectively.

Independent predictors of depression

In the multivariate analyses, students had significantly higher depression scores [$\beta=2.55(0.84)$, $p=0.044$] as compared to those who were staying at home. Respondents who reported to have experienced intimate partner violence had significantly higher depression scores [$\beta=3.80(1.50)$, $p=0.012$] compared to those who had not experienced it. Respondents who resided with a problem drinker/alcoholic or who uses street drugs had significantly higher depression scores [$\beta=2.48$

(1.20), $p=0.041$] as compared to those who are not living with such persons. Participants who had ever been pressured into using alcohol or other substances by friends or peers had significantly higher depression scores [$\beta=2.68(1.09)$, $p=0.015$] compared to those who had not.

Discussion

The aim of this study was to examine the prevalence and associated factors of antenatal depression among adolescents. To the best of our knowledge, this is the first study in Kenya reporting mental health outcomes of pregnant adolescents living in the informal urban settings during the ongoing COVID-19 pandemic. The prevalence of antenatal depression was high i.e., two in every five pregnant adolescents were depressed (43%, 95% C.I. 35.3-51.0). Significant predictors of depression were: being a student, having experienced IPV, staying with someone who is a problem drinker or alcoholic and being pressured into using alcohol or other substances by one’s peers.

The high prevalence rate in this study is comparable to other studies

(Alvarado-Esquivel et al., 2015; Hodgkinson et al., 2010; Kimbui et al., 2018; Osok et al., 2018b). The prevalence rate in this study was higher than the previous studies reported elsewhere among pregnant adolescents (Govender et al., 2020; Mosanya et al., 2022). In South Africa, for example, the prevalence of depression among the pregnant participants was found to be 15.9%, as measured by Edinburgh postnatal depression scale (EPDS) (Govender et al., 2020) and in Nigeria it was found to be 17.7% (Oladeji et al., 2022). Some of these variations may be explained by the use of different depression measures, different cut-off points for depression diagnosis, sampling errors and cultural differences (Haroz et al., 2016). Further, PHQ-9 used in this study has previously not been psychometrically validated in pregnant adolescent sample in our settings though the tool is recommended by Kenyan National Ministry of Health and used in many primary care maternal and child health centers. This may, therefore, account for differences in antenatal depression as revealed in the current study as we carried out modifications to improve understanding of the items and response options based on cognitive interviews and qualitative inquiry with pregnant adolescent participants.

Being pregnant while a student was identified as a risk factor in this study and another study published in 2018 covering the same health facilities (Kimbui et al., 2018). Fear of disruption of education and sadness around lost educational opportunities have been identified as major risk factors associated with stress and depression in unintended early pregnancies (Birungi et al., 2014; Oladeji et al., 2022)

Being pressured into using alcohol or other substances by their peers was found to be a risk factor associated with higher depressive scores. Exposure to harmful substance use, peer influences, and adverse family experiences and conflictual relationships have also been reported as risk factors of depression in other studies from South Africa (Field et al., 2020; Hodgkinson et al., 2014) and in Osok et al. (2018a, 2018b) and Kimbui et al. (2018) from Kenya (Kimbui et al., 2018; Osok et al., 2018a, 2018b). Substance use disorder has serious implications in general but consumption of alcohol during pregnancy has long lasting neurobiological impacts on the fetus and maternal health. It has been reported that a combination of factors determine women's drug use, ranging from personal reasons, such as lack of self-efficacy and internal stressors, identity crisis, depression, and structural reasons, such as lack of information, or inability to understand risk because of the way it is communicated (Mburu et al., 2020).

Respondents who have experienced intimate partner violence were at higher risk of developing depressive symptoms than respondents who have not experienced violence. A prospective cohort study among 390 postnatal women in Recife, Brazil (Mendonça and Ludermir, 2017) and a study in Ethiopia (Abebe et al., 2019; Woollett et al., 2021) support this finding. Intimate partner violence has well-documented severe adverse effects on women's mental health during pregnancy and post-pregnancy (Bacchus et al., 2004; Pámanes-González et al., 2007; Sharps et al., 2007).

Limitations

Despite addressing a gap in the literature around depression prevalence and the associated risk factors for this sub-group of adolescents, the findings of this study may be limited for several reasons: our data is cross-sectional by design and cannot capture the causal directions of associations between the factors we studied. The PHQ-9 used in our study is not a diagnostic tool but a screening tool for probable depression, further the PHQ-9 used has not been psychometrically validated in pregnant adolescents in our settings albeit has been extensively used in adolescent or adult perinatal women populations. The applications of our findings remain limited to urban informal settlements. These settlements tend to be socioeconomically and ethnically diverse in their own right so the current study can inform future research. A larger sample size and enrolling adolescent girls from different segments of the Kenyan society would minimize errors in estimating depression and

allow the generalizability of the findings to this vulnerable population.

Conclusion

We found a considerable number of pregnant adolescents experienced depressive symptoms with a prevalence of 43.1 % using PHQ-9 cut off of ≥ 10 . Associated independent predictors of depression included being a student, exposure to IPV, living with someone who used substances and being pressured into substances by a peer. These risk factors merit further investigation.

Declarations

Ethical approval: The Institutional Ethics review committee of Kenyatta National Hospital and University of Nairobi gave approval (No. P694/09/2018), and a research permit from Kenya National Commission for Science, Technology and Innovation (NACOSTI/P/21/8757) was obtained. Permission was also sought from these study sites through their respective research regulating bodies. This study is nested under the first author's ongoing work on implementing mental health interventions for pregnant adolescents in primary care LMIC settings (INSPIRE) study.

Ethical standards: The authors assert that all procedures contributing to this work comply with the ethical standards of the relevant national and institutional committees on human experimentation and with the Helsinki Declaration of 1975, as revised in 2008.

Consent for publication: not applicable

Availability of Data and Materials: The datasets used and/or analyzed during the current study available from the corresponding author on reasonable request.

Competing interests

To the best of our knowledge, no conflict of interest, financial or other, exists. All the authors read and approved the manuscript.

Funding: Research reported in this publication was supported by the Fogarty International Center of the National Institutes of Health under Award Number K43TW010716, which also supported the contributions of MK to this work. The content is solely the responsibility of the authors and does not necessarily represent the official views of the National Institutes of Health.

Authors' contributions: AT, MK- Conception of the study, study design, implementation, interpretation of data; drafting and revising the paper, approval of the final draft, overall oversight. AT, JK, VN, OY, SM- Study design, Data quality control, interpretation of the data, literature review and initial drafting. PC, MM, LC, DW, SS, KYH, BA, ZM, OG-. interpretation of data; literature review and manuscript revision and approval of the final draft. JL, ML, AT, JK, SS, ZM, LC, VN, OY, SM, PC, DW, MM, KYH, BA, OG - commented, reviewed and approved the draft.

Authors statement

This is an original manuscript and has not been submitted to any other journal for publication and is not under consideration for publication elsewhere.

All authors affirm that they contributed sufficiently to project implementation, manuscript writing and share public responsibility of the manuscript. They participated in reviewing, approving and submission of the final article.

The authors have no competing interests with respect to the publication of this manuscript.

Declaration of Competing Interest

To the best of our knowledge, no conflict of interest, financial or other, exists. All the authors read and approved the manuscript.

Acknowledgements

Authors would like to thank other mentors in INSPIRE Kenya work, adolescents and their caregivers who participated and fantastic team of community health workers and health facility workers of Kariobangi and Kangemi for their support.

Supplementary materials

Supplementary material associated with this article can be found, in the online version, at doi:10.1016/j.jadr.2022.100424.

References

- Abebe, A, Tesfaw, G, Mulat, H, Hibde, G, 2019. Postpartum depression and associated factors among mothers in Bahir Dar Town, Northwest Ethiopia. *Ann. Gen. Psychiatry* 18, 1–8.
- Abiodun, OA, Adetoro, OO, Ogunbode, OO, 1993. Psychiatric morbidity in a pregnant population in Nigeria. *Gen. Hosp. Psychiatry* 15, 125–128. [https://doi.org/10.1016/0163-8343\(93\)90109-2](https://doi.org/10.1016/0163-8343(93)90109-2).
- Alvarado-Esquivel, C, Sifuentes-Alvarez, A, Salas-Martinez, C, 2015. Depression in teenager pregnant women in a public hospital in a northern Mexican city: prevalence and correlates. *J. Clin. Med. Res.* 7, 525.
- Anderson, CA, Connolly, JP, 2018. Predicting posttraumatic stress and depression symptoms among adolescents in the extended postpartum period. *Heliyon* 4, e00965.
- Ayele, TA, Azale, T, Alemu, K, Abdissa, Z, Mulat, H, Fekadu, A, 2016. Prevalence and associated factors of antenatal depression among women attending antenatal care service at gondar university hospital, Northwest Ethiopia. *PLoS One* 11, e0155125. <https://doi.org/10.1371/journal.pone.0155125>.
- Bachus, L, Mezey, G, Bewley, S, 2004. Domestic violence: prevalence in pregnant women and associations with physical and psychological health. *Eur. J. Obstet. Gynecol. Reprod. Biol.* 113, 6–11.
- Birungi, H, Undie, C-C, Onyango, F, 2014. Education sector response to early and unintended pregnancy (EUP): a review of country experiences in East and Southern Africa.
- Campbell, B, Martinelli-heckadon, S, Wong, S, 2013. UNPFA State of the World's Population. *Motherhood in Childhood* ii-116.
- Cherry, AL, Dillon, M, 2014. *International handbook of adolescent pregnancy*. Int. Handb. Adolesc. Pregnancy.
- Chowdhry, N, Jotheeswaran, AT, Nadkarni, A, Hollon, SD, King, M, Jordans, MJD, Rahman, A, Verdeli, H, Araya, R, Patel, V, 2014. The methods and outcomes of cultural adaptations of psychological treatments for depressive disorders: a systematic review. *Psychol. Med.* 44, 1131–1146. <https://doi.org/10.1017/S0033291713001785>.
- Cox, JL, 1979. Psychiatric morbidity and pregnancy: a controlled study of 263 semi-rural Ugandan women. *Br. J. Psychiatry* 134, 401–405. <https://doi.org/10.1192/bjp.134.4.401>.
- Do, TKL, Nguyen, TTH, Pham, TTH, 2018. Postpartum depression and risk factors among Vietnamese women. *Biomed Res. Int.* 2018.
- Ferri, CP, Mitsuhiro, SS, Barros, MCM, Chalem, E, Guinsburg, R, Patel, V, Prince, M, Laranjeira, R, 2007. The impact of maternal experience of violence and common mental disorders on neonatal outcomes: a survey of adolescent mothers in Sao Paulo, Brazil. *BMC Public Health* 7, 209. <https://doi.org/10.1186/1471-2458-7-209>.
- Field, S, Honikman, S, Abrahams, Z, 2020. Adolescent mothers: a qualitative study on barriers and facilitators to mental health in a low-resource setting in Cape Town, South Africa. *Afr. J. Prim. Health Care Fam. Med.* 12, 1–9.
- Fisher, J, Mello, MC, 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. *Bull. World Health Organ.* 90, 139–149.
- Ganchimeg, T, Ota, E, Morisaki, N, Laopaiboon, M, Lumbiganon, P, Zhang, J, Yamdamsuren, B, Temmerman, M, Say, L, Tunçalp, Ö, 2014. Pregnancy and childbirth outcomes among adolescent mothers: a World Health Organization multicountry study. *BJOG An Int. J. Obstet. Gynaecol.* 121, 40–48.
- Getinet, W, Amare, T, Boru, B, Shumet, S, Worku, W, Azale, T, 2018. Prevalence and risk factors for antenatal depression in Ethiopia: systematic review. *Depress. Res. Treat.* 2018.
- Govender, D, Naidoo, S, Taylor, M, 2020. Antenatal and postpartum depression: prevalence and associated risk factors among adolescents' in KwaZulu-Natal, South Africa. *Depress. Res. Treat.* 2020.
- Gust, DA, Gvetadze, R, Furtado, M, Makanga, M, Akelo, V, Ondenge, K, Nyagol, B, McLellan-Lemal, E, 2017. Factors associated with psychological distress among young women in Kisumu, Kenya. *Int. J. Womens Health* 9, 255–264. <https://doi.org/10.2147/IJWH.S125133>.
- Hajian-Tilaki, K, 2011. Sample size estimation in epidemiologic studies. *Casp. J. Intern. Med.* 2, 289.
- Haroz, EE, Bolton, P, Gross, A, Chan, KS, Michalopoulos, L, Bass, J, 2016. Depression symptoms across cultures: an IRT analysis of standard depression symptoms using data from eight countries. *Soc. Psychiatry Psychiatr. Epidemiol.* 51, 981–991. <https://doi.org/10.1007/s00127-016-1218-3>.
- Harris, PA, Taylor, R, Minor, BL, Elliott, V, Fernandez, M, O'Neal, L, McLeod, L, Delacqua, G, Delacqua, F, Kirby, J, 2019. The REDCap consortium: building an international community of software platform partners. *J. Biomed. Inform.* 95, 103208.
- Hartley, M, Tomlinson, M, Greco, E, Comulada, WS, Stewart, J, le Roux, I, Mbewu, N, Rotheram-Borus, MJ, 2011. Depressed mood in pregnancy: prevalence and correlates in two Cape Town peri-urban settlements. *Reprod. Health* 8, 9. <https://doi.org/10.1186/1742-4755-8-9>.
- Hodgkinson, S, Beers, L, Southammakosane, C, Lewin, A, 2014. Addressing the mental health needs of pregnant and parenting adolescents. *Pediatrics* 133, 114–122.
- Hodgkinson, SC, Colantuoni, E, Roberts, D, Berg-Cross, L, Belcher, HME, 2010. Depressive symptoms and birth outcomes among pregnant teenagers. *J. Pediatr. Adolesc. Gynecol.* 23, 16–22.
- Howard, LM, Khalifeh, H, 2020. Perinatal mental health: a review of progress and challenges. *World Psychiatry* 19, 313–327.
- Johnsson, T, 1992. A procedure for stepwise regression analysis. *Stat. Pap.* 33, 21–29. <https://doi.org/10.1007/BF02925308>.
- Kenya National Bureau of Statistics (KNBS), 2015. Kenya Demographic and Health Survey 2014.
- Kerie, S, Menberu, M, Niguse, W, 2018. Prevalence and associated factors of postpartum depression in Southwest Ethiopia, 2017: a cross-sectional study. *BMC Res. Notes* 11, 1–7.
- Kimbui, E, Kuria, M, Yator, O, Kumar, M, 2018. A cross-sectional study of depression with comorbid substance use dependency in pregnant adolescents from an informal settlement of Nairobi: drawing implications for treatment and prevention work. *Ann. Gen. Psychiatry* 17, 1–15.
- Kroenke, K, Spitzer, RL, 2002. The PHQ-9: a new depression diagnostic and severity measure. *Psychiatr. Ann.*
- Kroenke, K, Spitzer, RL, Williams, JBW, 2001. The PHQ-9: validity of a brief depression severity measure. *J. Gen. Intern. Med.* 16, 606–613. <https://doi.org/10.1046/j.1525-1497.2001.016009606.x>.
- Kumar, M, Huang, KY, Othieno, C, Kagoya, M, Nyongesa, V, Yator, O, Madeghe, B, Unutzer, J, Saxena, S, McKay, M, 2021. Testing the EPDS and PHQ-9 among peripartum adolescents in Nairobi, Kenya: a mixed-methods study. *Clin. Med. Insights Psychiatry* 12, 1179557321991093.
- Kumar, M, Ongeri, L, Mathai, M, Mwayo, A, 2015. Translation of EPDS questionnaire into Kiswahili: understanding the cross-cultural and translation issues in mental health research. *J. Pregnancy Child Health* 2, 1000134. <https://doi.org/10.4172/2376-127X.1000134>.
- Larsen, A, Pintye, J, Bhat, A, Kumar, M, Kinuthia, J, Collins, PY, John-Stewart, G, 2021. Is there an optimal screening tool for identifying perinatal depression within clinical settings of sub-Saharan Africa? SSM - Ment. Health 1, 100015. <https://doi.org/10.1016/j.ssmh.2021.100015>.
- Leigh, B, Milgrom, J, 2008. Risk factors for antenatal depression, postnatal depression and parenting stress. *BMC Psychiatry* 8, 24. <https://doi.org/10.1186/1471-244X-8-24>.
- Lieberman, K, Le, H-N, Perry, DF, 2014. A systematic review of perinatal depression interventions for adolescent mothers. *J. Adolesc.* 37, 1227–1235.
- Lindhorst, T, Oxford, M, 2008. The long-term effects of intimate partner violence on adolescent mothers' depressive symptoms. *Soc. Sci. Med.* 66, 1322–1333. <https://doi.org/10.1016/j.socscimed.2007.11.045>.
- Mburu, G, Ayon, S, Mahinda, S, Kaveh, K, 2020. Determinants of women's drug use during pregnancy: perspectives from a qualitative study. *Matern. Child Health J.* 24, 1170–1178.
- Mendonça, MFS, Ludermer, AB, 2017. Intimate partner violence and incidence of common mental disorder. *Rev. Saude Publica* 51.
- Mosanya, JT, Adebite, TA, Adebayo, KO, Egbewale, BE, Ijadunola, KT, 2022. A comparative analysis of depression between pregnant and non-pregnant adolescents in a southwestern town in Nigeria. *medRxiv*.
- Mutahi, J, Larsen, A, Cuijpers, P, Peterson, SS, Unutzer, J, McKay, M, John-Stewart, G, Jewell, T, Kinuthia, J, Gohar, F, Lai, J, Wamalwa, D, Gachuno, O, Kumar, M, 2022. Mental health problems and service gaps experienced by pregnant adolescents and young women in Sub-Saharan Africa: a systematic review. *eClinicalMedicine* 44, 101289. <https://doi.org/10.1016/j.eclinm.2022.101289>.
- Neal, SE, Chandra-Mouli, V, Chou, D, 2015. Adolescent first births in East Africa: disaggregating characteristics, trends and determinants. *Reprod. Health* 12, 13. <https://doi.org/10.1186/1742-4755-12-13>.
- Oladeji, BD, Bello, T, Ayinde, O, Idowu, P, Gureje, O, 2022. Prevalence and correlates of depression among pregnant adolescents in primary maternal care in Nigeria. *Arch. Womens Ment. Health* 25, 441–450.
- Osok, J, Kigamwa, P, Huang, K-Y, Grote, N, Kumar, M, 2018a. Adversities and mental health needs of pregnant adolescents in Kenya: identifying interpersonal, practical, and cultural barriers to care. *BMC Womens. Health* 18, 1–18.
- Osok, J, Kigamwa, P, Vander Stoep, A, Huang, K-Y, Kumar, M, 2018b. Depression and its psychosocial risk factors in pregnant Kenyan adolescents: a cross-sectional study in a community health Centre of Nairobi. *BMC Psychiatry* 18, 1–10.
- Pámanes-González, V, Billings, DL, Torres-Arreola, L, del, P, 2007. Violencia de pareja en mujeres embarazadas en la Ciudad de México. *Rev. Saude Publica* 41, 582–590.
- Reid, V, Meadows-Oliver, M, 2007. Postpartum depression in adolescent mothers: an integrative review of the literature. *J. Pediatr. Health Care Off. Publ. Natl. Assoc.*

- Pediatr. Nurse Assoc. Pract. 21, 289–298. <https://doi.org/10.1016/j.pedhc.2006.05.010>.
- Robertson, E, Grace, S, Wallington, T, Stewart, DE, 2004. Antenatal risk factors for postpartum depression: a synthesis of recent literature. *Gen. Hosp. Psychiatry* 26, 289–295. <https://doi.org/10.1016/j.genhosppsych.2004.02.006>.
- Sharps, PW, Laughon, K, Giangrande, SK, 2007. Intimate partner violence and the childbearing year: maternal and infant health consequences. *Trauma, Violence, Abuse* 8, 105–116.
- Templeton, GF, 2011. A two-step approach for transforming continuous variables to normal: implications and recommendations for IS research. *Commun. Assoc. Inf. Syst.* 28, 4.
- Valentine, JM, Rodriguez, MA, Lapeyrouse, LM, Zhang, M, 2011. Recent intimate partner violence as a prenatal predictor of maternal depression in the first year postpartum among Latinas. *Arch. Womens Ment. Health* 14, 135–143. <https://doi.org/10.1007/s00737-010-0191-1>.
- Woollett, N, Bandeira, M, Marunda, S, Mudekunye, L, Ebersohn, L, 2021. Adolescent pregnancy and young motherhood in rural Zimbabwe: findings from a baseline study. *Health Soc. Care Community* 29, e377–e386.
- Yator, O, Mathai, M, Albert, T, Kumar, M, 2021. Burden of HIV-related stigma and postpartum depression: a cross-sectional study of patients attending prevention of mother-to-child transmission clinic at Kenyatta national hospital in Nairobi. *Front. Psychiatry* 1619.
- Yator, O, Mathai, M, Vander Stoep, A, Rao, D, Kumar, M, 2016. Risk factors for postpartum depression in women living with HIV attending prevention of mother-to-child transmission clinic at Kenyatta National Hospital, Nairobi. *AIDS Care Psychol. Socio Med. Asp. AIDS/HIV* 28, 884–889. <https://doi.org/10.1080/09540121.2016.1160026>.
- Yuce, T, Aker, SS, Seval, MM, Kalafat, E, Soylemez, F, 2015. Obstetric and neonatal outcomes of adolescent pregnancy. *North. Clin. Istanbul* 2, 122–127. <https://doi.org/10.14744/nci.2015.86158>.