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Depression, anxiety, and stress among HIV-positive pregnant women during the COVID-19 pandemic: a hospital-based cross-sectional study in India

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Abstract

Background The COVID-19 pandemic has caused an unparalleled increase in psychological distress among everyone and everywhere. Perinatal depression, anxiety, and stress (DAS) are more prominent among HIV-positive pregnant women and are associated with poor maternal and neonatal outcomes. Therefore, this study aimed to assess the prevalence and explore the factors associated with DAS among HIV-positive pregnant women in India.

Methods A multicentric, cross-sectional, analytical study was conducted among all HIV-positive pregnant women, aged more than 18 years, taking antiretroviral therapy, and attending antenatal care visits at two hospitals that are offering HIV care services in Anantapur District, Andhra Pradesh, India. Women who were unable to communicate were mentally ill, and refused to give consent were excluded. The study was conducted for a period of eighteen months from April 2020 to September 2021. A validated and interview-based data collection form was used to capture sociodemographic, obstetric profiles, clinical and support-related profiles, and COVID-19 stressors among study participants. The DASS-21 scale was used to assess depression, anxiety, and stress among study participants. Univariable and multivariable Poisson regression analyses were used to identify factors associated with DAS among study participants.

Results The prevalence of depression, anxiety, and stress among HIV-positive pregnant women was found to be 50.3% (95% CI 23.6–76.4), 56.2% (95% CI 28.3–80.3), and 42.2% (95% CI 18.5–69.9), respectively. A multivariate Poisson regression analysis showed that participants living in a rural area (adj. PR 1.43, 1.08–1.91), primigravidae (adj. PR 1.37, 1.09–1.72), less number of ANC visits (adj. PR 1.41, 1.12–1.76), identified HIV during pregnancy (adj. PR 1.42, 1.13–1.77), non-disclosure of HIV status with one's partner (adj. PR 1.43, 1.11–1.83), no partner support (adj. PR 1.84, 1.31–2.59), and having a negative HIV status sexual partner (adj. PR 1.35, 1.02–1.79) were all significantly associated with depression. Factors such as lack of partner support (adj. PR 1.48, 1.09–1.99) and known HIV status during pregnancy (adj. PR 1.24, 1.01–1.52) were significantly associated with anxiety. Participants who had less ANC visits (adj. PR 1.50, 1.12–2.02), non-disclosure of HIV status with partner (adj. PR 1.47, 1.08–2.02), known HIV status during pregnancy (adj. PR 1.62,

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1.23–2.15), negative HIV status of sexual partner (adj. PR 1.44, 1.02–2.02), and no partner's support (adj. PR 1.85, 1.25–2.74) were significantly associated with stress.

Conclusion The study concludes that about one-third of the HIV-positive pregnant women reported anxiety, and more than half of the women were feeling stressed and depressed during COVID-19. Factors such as residence and primigravidae were linked with antenatal depression. Whereas variables like ANC visits, knowing HIV status during pregnancy, non-disclosure of HIV status, no partner's support, and sexual partner HIV negative status were associated with depression and stress. The anxiety symptoms are very high among women who are HIV positive during pregnancy, and not having a partner's support. Demographic, clinical, and support-related determinants and COVID-19 stressors of DAS provide insights for interventions to reduce the burden of mental health problems among HIV-positive pregnant women.

Keywords Antenatal, Anxiety, Depression, HIV, India, Mental health, Pregnant women, Stress

Background

Depression, anxiety, and stress (DAS) are the most common symptoms experienced during the antenatal and postnatal periods of pregnancy [1, 2]. Antenatal depression is a common mental disorder that is characterized by a depressed mood, diminished interest or pleasure in activities, reduced energy, feelings of guilt or low self-worth, disrupted sleep patterns or appetite, and impaired concentration during pregnancy [3]. During the gestational period, women undergo behavioral and psychological transformations in anticipation of assuming the maternal role [4]. These changes render women more susceptible to stress and the development of depressive symptoms [4]. Evidence shows that the prevalence of anxiety and depression among pregnant women was higher in low- and middle-income countries (LMICs) [5]. The fetus's growth depends on the woman's psychological status during pregnancy [6]. Untreated depression during pregnancy heightens the risk of miscarriage, premature birth, low Apgar score at birth, postnatal depression, intrauterine growth restriction, prenatal infections, and low birth weight [7]. The observed growth changes can be ascribed to the activation of the hypothalamic–pituitary–adrenal axis due to the presence of physical and psychological stressors associated with maternal depression and anxiety [8].

People living with HIV (PLHIV) are more likely to have common mental disorders such as depression, anxiety, and stress [9, 10]. HIV-positive pregnant women have a great fear of the transmission of HIV to their unborn babies [11]. Additionally, stigma and discrimination due to the disclosure of HIV status will continue among pregnant women [12]. Expectedly, HIV-positive pregnant women have a heightened rate of DAS than HIV-negative pregnant women. Several factors contribute to depression among pregnant women living with HIV, ranging from individual to health system-level factors [13]. Previous studies showed that factors such as birth outcome, gravida, para, and history of pregnancy complications

were significant predictors of depression among HIV-positive women [3, 11, 13–18]. Depression in HIV-positive pregnant women is linked to poor adherence to care and therapy, leading to treatment failure and vertical transmission of HIV [14]. Moreover, HIV-positive pregnant women with depression have a higher rate of progression to advanced HIV and twofold increased risk of AIDS-related mortality, particularly in low- and middle-income countries (LMICs) [14].

The exponential rise in the incidence of COVID-19 infections and fatalities has significantly disturbed the mental well-being of the general public [3, 19]. Evidence shows that pregnant women faced challenges accessing antenatal care services during the COVID-19 pandemic, particularly in resource-constrained countries [20]. Maternal distress during the COVID-19 pandemic is influenced by various factors, including the fear of infection, the risk of severe illness or hospitalization due to COVID-19, and the potential negative impact on perinatal health outcomes [21]. Evidence shows that several patient groups, such as geriatrics, patients suffering from chronic disorders, and HIV-positive patients, were found to be greatly affected by COVID-19 infection [22–24]. HIV-positive pregnant women greatly struggle due to social distancing, isolation, access to regular HIV care, and antenatal care [3]. To prevent perinatal complications linked to DAS, it is imperative to consider the mental health implications of the COVID-19 pandemic on HIV-positive pregnant women. Exploring factors associated with DAS among HIV-positive pregnant women provides insights to develop effective prevention and management strategies against mental health disorders.

In India, previous evidence shows that the prevalence of depression among HIV patients ranges between 30.0 to 58.7% [25–27]. Factors such as low self-esteem, low social support, poor quality of life, family income, unemployment, not being married, low education, and poor relationship with spouse were significantly associated with depression among HIV-positive patients [26–30].

Whereas, the prevalence of anxiety ranges between 19 to 54% which was significantly influenced by social support, low psychological well-being, adjustment disorders, and alcohol dependence [26, 28, 29]. A study conducted among HIV-positive perinatal women in India before the COVID pandemic revealed 52.5% of depressive symptoms and 23% have self-harm thoughts [31]. Poor illness perception is the main factor for depression among the study population [31]. However, there is a scarcity of evidence related to the assessment of depression, anxiety, and stress among pregnant women living with HIV/AIDS in India. The current study aimed to assess the prevalence and explore the factors associated with DAS among HIV-positive pregnant women during the COVID-19 pandemic in India.

Materials and methods

Study setting and design

A multicentric, analytical, cross-sectional study was conducted in two hospitals in the socioeconomically backward district of Anantapur, Andhra Pradesh, India. These hospitals provide all types of healthcare services, including HIV and perinatal care services, to the residing population. The government owns one hospital, and it is an 800-bed teaching hospital that serves more than 4 million people in the catchment area. The other hospital is an NGO charity hospital, i.e., Rural Development Trust (RDT) Hospital, situated in a small village called Bathalapalli, and serves the healthcare needs of the rural population in the district. These two hospitals offer a major proportion of COVID-19, maternity, and HIV care services in the Anantapur city. So, we selected these two hospitals to capture study participants for our research. The study was conducted for a period of eighteen months from April 2020 to September 2021.

Study participants and eligibility

All HIV-positive pregnant women, aged over 18 years, taking antiretroviral (ARV) medication regimens, and attending antenatal care (ANC) in the two selected hospitals during the study period were included. HIV-positive pregnant women who were unable to communicate, mentally ill, and refused to give consent were excluded from the study.

Sample size and sampling technique

Since there has been no similar study during COVID-19, we used the 82% of depression among HIV-positive pregnant women from the previous study to estimate the sample size [32]. We estimated the sample size as 227 using a single proportional population formula, considering a 5% margin of error and a 95% confidence interval. With a 5% nonresponse rate, the final sample size

was 249 [32]. The estimated sample size was divided into two equal portions (50%) and enrolled the participants by using a non-probable convenient sampling technique from the two selected hospitals.

Ethical considerations

The study protocol, data collection tools, and informed consent procedure were approved by the Raghavendra Institute of Pharmaceutical Education Research (RIPER)—Institutional Review Board (RIPER/IRB/PP/2020/053). The study was conducted following the provisions of the Declaration of Helsinki regarding research with human subjects. All the eligible participants were approached by a female researcher who could speak Telugu and English. The researcher explained the study protocol and objectives to the eligible participants and received oral and written consent voluntarily. Informed consent was obtained from illiterate participants through the testimony of a literate representative or local guardian. The participants were encouraged to share their thoughts and inquiries about the study openly and received clarifications from the principal investigator. All the participants had the complete right to withdraw from the study at any stage of the research process (consent, initiation, process, and completion). The study participants were not subjected to any harm, as the survey was conducted through interviews and did not involve any invasive procedures. All the eligible participants were given an oral and written informed consent to participate in the study.

Data collection tool

Based on an extensive literature review, we developed a structured and interview-based data collection tool for DAS among HIV-positive pregnant women during the COVID-19 pandemic. The data collection tool comprised five sections: 1. Sociodemographic and obstetric characteristics; 2. Clinical and support-related characteristics; 3. Coronavirus Disease 2019 stressors; 4. Depression, Anxiety, and Stress Scale.

Sociodemographic and obstetric characteristics

Sociodemographic details such as participant age, marital status, educational level, residence, and occupation are included in the data collection tool. Obstetric characteristics such as gravida, planned pregnancy, ANC follow-up, history of abortion, history of stillbirth, and history of previous pregnancy problems are also included in the study tool.

Clinical and support-related information

Participants' clinical characteristics, such as duration of HIV, antiretroviral therapy (ART) initiation, duration

of ART, viral load, CD4 count, disclosure of HIV status to partner, partners' HIV status, support from the partner, and support from friends and family members, were included in the survey tool.

Coronavirus disease 2019 (COVID-19) stressors

The present study aimed to evaluate the psychological changes among HIV-positive pregnant women during COVID-19 pandemic. This was achieved by identifying stressors related to COVID-19 from literature and examining their correlation with the Depression, Anxiety, and Stress Scale (DAS) scores among this specific population. Closed-ended questions were utilized to collect information on stressors related to COVID-19. These questions are focused on positive results on COVID-19 tests, living close to a person infected with COVID-19, recently visiting a COVID-19-infected person, experiencing COVID-19 symptoms, adherence to infection control measures, concerns about COVID-19-mediated adverse perinatal outcomes, concerns about HIV-mediated adverse perinatal outcomes, challenges encountered in accessing ANC services during the pandemic, challenges encountered in accessing HIV care services during the pandemic, and undergoing COVID-19 counseling in the health facility.

Depression, anxiety, and stress scale

Lovibond and Lovibond created the DASS questionnaire to assess depression, anxiety, and stress [33]. The questionnaire has demonstrated adequate psychometric properties, and various studies support its validity as an authorized tool for assessing depression, anxiety, and stress in both patients and non-patients [34–36]. The DASS-21 was used to assess the prevalence of DAS among HIV-positive pregnant women during the COVID-19 pandemic. The scale consists of 21 items, with 7 items allocated to each of the 3 subscales: depression (items 3, 5, 10, 13, 16, 17, and 21), anxiety (items 2, 4, 7, 9, 15, 19, and 20), and stress (items 1, 6, 8, 11, 12, 14, and 18). The responses provided by participants for each item are graded on a four-point Likert scale (did not apply to me at all=0, applied to me to some degree=1, applied to me to a considerable degree=2, and applied to me very much=3). The scores were assessed, and the subscales were categorized using the Lovibond version of DASS-21 as normal, mild, moderate, severe, and extremely severe DAS [33]. The DASS subscales (Depression, Anxiety, and Stress) were dichotomized into normal (No DAS) and abnormal (Presence DAS) outcomes by combining the mild to extremely severe categories.

Validation of the data collection tool

An appropriately designed, structured, interviewer-based data collection tool was prepared by including various

components, such as sociodemographics, obstetrics, clinical profile, support-related information, COVID-19 stressors, and the DASS-21 scale. The data collection tool was subjected to face validity and reliability tests.

The data collection tool underwent evaluation by a multidisciplinary panel of experts, including obstetricians (female), ART specialists, psychologists, anthropologists, and public health professionals. The assessment of expert opinion regarding the incorporation of a question, statement, or component in the data collection tool was evaluated using a four-point Likert scale, with the following scale values: strongly disagree (1), disagree (2), agree (3), and strongly agree (4). We checked the content for scale-level content validity indicators such as S-CVI (average number), S-CVI (utility agreement), and item-level content validity (I-CVI). For each indicator, the content was modified to meet the acceptable margin (>0.8). Questions, statements, and components about COVID-19 stressors and DASS-21 subscales in the survey tool were tested for reliability. The pilot sample ($n=20$) reliability test showed acceptable internal consistency with Cronbach's alpha coefficients of 0.88 for COVID-19 stressors, 0.81 for depression, 0.85 for anxiety, and 0.84 for stress subscales.

Initially, the questionnaire was prepared in English; later, it was translated into a local language (Telugu) for interview purposes. Before actual data collection, the translated tool was applied through the interview technique in a sample of 20 (the same sample included in the reliability test) for language clarity and understanding of the data collectors.

Modifications are done after content validation and reliability

There were no changes in the original DASS-21 scale-related questions. We obtained high internal consistency for all domains of DAS and experts graded agree or strongly agree in the inclusion of DASS-21 questions. Whereas, we removed the cost of HIV, antenatal, and COVID-19 care services in COVID-19 stressors. Experts advised that these are free of service which may not have a great impact on the cost. Original DASS-21 was used to interview the participants in the context of COVID-19, HIV, and pregnancy.

Data collection and quality control

A total of 256 HIV-positive pregnant women who met the eligibility criteria were recruited for the study after obtaining informed consent. During the designated research period, a pretested, validated, structured, interview-based data collection form was used to acquire the data from the eligible participants. The data acquisition process took place in a private setting, facilitated

by a female researcher. From each participant, information such as sociodemographics, obstetrics, clinical profile, support-related information, COVID-19 stressors, and DASS-21 responses was collected by a face-to-face interview. The interview was conducted for 8–10 min to collect the survey data from each participant. The data collection was performed by strictly adhering to infection control measures to prevent COVID-19 transmission. The collected data were subjected to data analysis to estimate the prevalence and factors associated with depression, anxiety, and stress among HIV-positive pregnant women during the COVID-19 pandemic.

Before beginning the study, all research team members were trained in participant recruitment, obtaining informed consent, and data collection. The principal investigator (NG) checked the correctness of the data abstraction according to the research protocol. On the site of data collection, a quality check was performed every day to remove errors made in the data collection process. The collected data were checked for completeness, clarity, and consistency by the principal investigators and data collectors. If any missing data was observed in the data collection process that, it was not subjected for data analysis.

Data processing and analysis

To analyze the data collected from the study participants, IBM SPSS Statistics for Windows, version 22.0 (IBM Corp., Armonk, NY, USA) was used. Before commencing the analysis, the data underwent cleaning, sorting, and processing within a Microsoft Excel spreadsheet. Descriptive statistics such as frequency and percentages were used to represent the categorical data. The mean with standard deviation (SD) and median with interquartile range (IQR) were reported for normally and nonnormally distributed data.

A collinearity test was performed for socio-demographics, clinical characteristics, and COVID-19 stressors to identify tolerance and Variance Inflation Factor (VIF). Variables having VIF more than 3 were considered collinear with each other. Prevalence ratios (PRs) were a measure of association between the dependent (sociodemographics, obstetrics, clinical, support-related characteristics, and COVID-19 stressors among HIV-positive pregnant women) and the independent variable (presence of depression, anxiety, and stress). PRs were estimated by using a modified Poisson regression model with robust standard error methods. All variables with a P value ≤ 0.20 in the bivariate analysis were subjected to multivariate Poisson regression analysis to adjust for potential confounders associated with the dependent variable. A two-way P -value of less than 0.05 was considered statistically significant. Variables considered in

the adjusted analysis included participant age, residence, occupation, gravida, planned pregnancy, ANC follow-up, history of stillbirth, problems in a previous pregnancy, duration of HIV status, awareness of HIV status during pregnancy, viral load, disclosure of HIV status with a partner, partner's support, and all COVID-19 stressors except participants visited COVID-19-positive patients or individuals in their immediate circle affected by COVID-19.

Results

Sociodemographic, obstetric, clinical, and support-related characteristics of HIV-positive pregnant women

A total of 264 participants were approached who met the inclusion criteria. Four participants were not interested in enrolling in the study, two were diagnosed with depressive disorder before COVID-19, and two were unable to communicate due to severe illness. Finally, the study included a cohort of 256 pregnant women who tested positive for HIV. The study participants had a mean age of 27.41 ± 4.26 . The sociodemographic analysis revealed that most of the participants were under the age of 30 (158; 61.7%), married (184; 71.9%), had no formal education (129; 50.4%), resided in rural areas (128; 50.0%), and were unemployed (183; 71.5%). The obstetric profile of the study participants revealed that most of them were multigravida (had several pregnancies) (172; 67.2%), had planned pregnancies (185; 72.3%), attended regular antenatal care (ANC) visits (192; 75.0%), had no history of abortion (220; 85.9%), stillbirth (235; 91.8%), and complications in previous pregnancies (209; 81.6%). The clinical profile findings indicate that the majority of patients were diagnosed with HIV within a year (144; 56.2%), were aware of their HIV status prior to pregnancy (164; 64.1%), had been taking antiretroviral therapy (ART) for over a year (135; 52.7%), had a viral load below 50 copies/mL (139; 54.3%), and had a CD4 count below or equal to 600 cells/mm (141; 55.1%). The support-related factors indicate that most individuals received assistance from their partner (180; 70.3%) but did not receive any support from their relatives or friends (172; 67.2%). Most individuals refrain from revealing their HIV status to their spouse (162; 63.3%), while the HIV status of their partner remains undisclosed (96; 37.5%). Table 1 displays the distribution of sociodemographic, obstetric, clinical, and support-related factors among HIV-positive pregnant women.

Distribution of COVID-19 stressors among HIV-positive pregnant women

HIV-positive pregnant women responded to COVID-19 stressors asked by the interviewer. The results of the

Table 1 Sociodemographic, obstetric, clinical, and support-related characteristics of HIV-positive pregnant women ($n = 256$)

Variables	Frequency (%)
Age in years (Mean \pm SD)	27.41 \pm 4.26
< 30 Years	158 (61.7)
≥ 30 Years	98 (38.3)
Marital status	
Single	23 (9.0)
Married	184 (71.9)
Divorced	38 (14.8)
Widowed	11 (4.3)
Educational level	
No formal education	129 (50.4)
Primary school	35 (13.7)
Middle school	29 (11.3)
High school	17 (6.6)
Intermediate	30 (11.7)
Graduate or postgraduate or above	16 (6.3)
Residence	
Rural	128 (50.0)
Semiurban	72 (28.1)
Urban	56 (21.9)
Occupation	
Employed	73 (28.5)
Unemployed	183 (71.5)
Gravida	
Primigravida	84 (32.8)
Multigravida	172 (67.2)
Planned pregnancy	
Yes	185 (72.3)
No	71 (27.7)
ANC follow-up	
Yes	192 (75.0)
No	64 (25.0)
History of abortion	
Yes	36 (14.1)
No	220 (85.9)
History of stillbirth	
Yes	21 (8.2)
No	235 (91.8)
History of problems in previous pregnancy	
Yes	47 (18.4)
No	209 (81.6)
Awareness of HIV status prior to pregnancy	
Yes	144 (56.3)
No	112 (43.7)
Knowing HIV status	
Before pregnancy	164 (64.1)
During pregnancy	92 (35.9)
Duration of ART (months)	
< 12 months	121 (47.3)
≥ 12 months	135 (52.7)

Table 1 (continued)

Variables	Frequency (%)
Viral load	
< 50 copies/ml	139 (54.3)
≥ 50 copies/ml	117 (45.7)
CD4 Cells/mm	
≤ 600	141 (55.1)
> 600	115 (44.9)
Discussed HIV status with a sexual partner	
Yes	94 (36.7)
No	162 (63.3)
Partners HIV status	
Positive	88 (34.4)
Negative	72 (28.1)
Do not know	96 (37.5)
Support from partner	
Present	180 (70.3)
Absent	76 (29.7)
Support from family and friends	
Yes	84 (32.8)
No	172 (67.2)
Family history of psychiatric problems	
Yes	42 (16.4)
No	214 (83.6)

ANC Antenatal Care, ART Antiretroviral Therapy, HIV Human Immunodeficiency Virus, SD Standard Deviation

study indicate that most of the participants tested negative for COVID-19 (198; 77.3%), visited someone who tested positive for COVID-19 (172; 67.2%) and did not exhibit any symptoms of the infection (201; 78.5%). Less than half of the participants had individuals in their social circle who contracted COVID-19 (112; 43.7%), followed infection control measures (89; 34.8%), expressed concerns about the adverse effects of COVID-19 on pregnancy outcomes (94; 36.7%), expressed concerns about the negative impact of HIV on pregnancy outcomes (106; 41.4%), experienced difficulties in accessing ART and ANC services (128; 50.0%), and received counseling about COVID-19 during health visits (112; 43.7%). The distribution of the COVID-19 stressor among HIV-positive pregnant women is represented in Table 2.

Prevalence of depression, anxiety, and stress levels among HIV-positive pregnant women

The findings of the study indicate that the prevalence of depression, anxiety, and stress among HIV-positive pregnant women was (129; 50.3%, 95% CI 44.3–56.5), (144; 56.2%, 95% CI 50.2–62.3), and (108; 42.2%, 95% CI 36.1–48.2), respectively. Among abnormal patients, most HIV-positive pregnant women had moderate levels

Table 2 Distribution of COVID-19 stressors among HIV-positive pregnant women ($n = 256$)

COVID-19 stressor	Frequency (%)
CS-1. Have you got a positive COVID-19 test result?	
Yes	58 (22.7)
No	198 (77.3)
CS-2. Have you recently visited an individual who has tested positive for COVID-19?	
Yes	172 (67.2)
No	84 (32.8)
CS-3. Has an individual in your immediate social circle contracted the COVID-19 virus?	
Yes	112 (43.8)
No	144 (56.2)
CS-4. Are you experiencing COVID-19 symptoms?	
Yes	55 (21.5)
No	201 (78.5)
CS-5. Do you consistently adhere to infection control measures?	
Yes	89 (34.8)
No	167 (65.2)
CS-6. Are you concerned about the potential negative impact of COVID-19 on pregnancy outcomes?	
Yes	94 (36.7)
No	162 (63.3)
CS-7. Are you concerned about the potential negative impact of HIV on pregnancy outcomes during COVID-19?	
Yes	106 (41.4)
No	150 (58.6)
CS-8. Have you encountered any difficulties in accessing antenatal care services during the COVID-19 pandemic?	
Yes	128 (50.0)
No	128 (50.0)
CS-9. Have you encountered any difficulties in accessing ART services during the COVID-19 pandemic?	
Yes	86 (33.6)
No	170 (66.4)
CS-10. Ongoing COVID-19 counseling during each visit to the health facility	
Yes	112 (43.8)
No	144 (56.2)

ART Antiretroviral Therapy, HIV Human Immunodeficiency Virus

of depression (64; 25.0%), anxiety (51; 19.9%), and stress (38; 14.8%). The distribution of the levels of DAS is represented in Fig. 1.

Determinants of depression, anxiety, and stress among HIV-positive pregnant women

Findings of the collinearity statistics revealed that the participant's history of abortion and previous pregnancy problems were collinear with each other with VIF of 5.312 and 4.015 respectively. Also, variables such as duration of knowing their HIV status and duration of ART were collinear with VIF of 3.513 and 3.507 respectively. All COVID-19 stressors were non-collinear with each other. Based on the collinearity statistics, previous history of abortion and duration of ART were not included in the adjusted analysis. Findings of collinearity statistics were represented in the Supporting file.

Findings from multivariate Poisson regression analysis showed that the participants living in a rural area (adj. PR 1.43, 95% CI 1.08–1.91), primigravidae (adj. PR 1.37, 95% CI 1.09–1.72), not going to regular ANC visits (adj. PR 1.41, 95% CI 1.12–1.76), finding out they were HIV-positive during pregnancy (adj. PR 1.42, 95% CI 1.13–1.77), non-disclosure of HIV status with their sexual partner (adj. PR 1.43, 95% CI 1.11–1.83), not receiving support from their partner (adj. PR 1.84, 95% CI 1.31–2.59), and having a partner who does not have HIV (adj. PR 1.35, 95% CI 1.02–1.79) were all significantly linked to depression. Factors such as lack of partner support (adj. PR 1.48, 95% CI 1.09–1.99) and knowing one's HIV status during pregnancy (adj. PR 1.24, 95% CI 1.01–1.52) were found to have a strong positive association with anxiety levels in HIV-positive pregnant women. Participants who had poor attendance at antenatal care visits (adj. PR 1.50, 95%

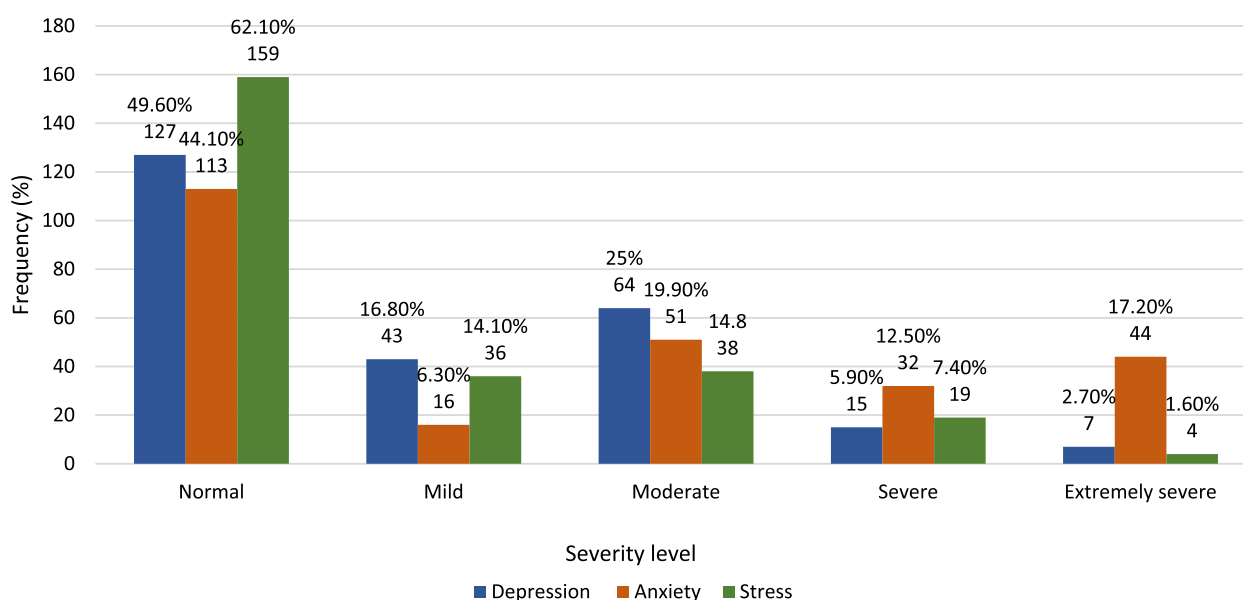


Fig. 1 Depression, anxiety, and stress levels among HIV-positive pregnant women

CI 1.12–2.02), non-disclosure of HIV status to their partner (adj. PR 1.47, 95% CI 1.08–2.02), and became aware of their HIV status during pregnancy (adj. PR 1.62, 95% CI 1.23–2.15), sexual partners HIV status was negative (adj. PR 1.44, 95% CI 1.02–2.02) and no support from the partner (adj. PR 1.85, 95% CI 1.25–2.74) were significantly positively associated with stress. Poisson regression analysis of variables predicting depression, anxiety, and stress among HIV-positive pregnant women is represented in Table 3.

COVID-19 stressors associated with DAS among HIV-positive pregnant women

The presence of COVID-19 stressors, such as receiving positive test results for coronavirus (adj. PR 1.32, 95% CI 1.05–1.66), concerns about the negative impact of COVID-19 on pregnancy outcomes (adj. PR 1.34, 95% CI 1.07–1.68), concerns about the influence of HIV on pregnancy outcomes during COVID-19 (adj. PR 1.47, 95% CI 1.18–1.84), difficulties in accessing ANC services (adj. PR 1.59, 95% CI 1.23–2.04) and ART services (adj. PR 1.34, 95% CI 1.07–1.69) due to COVID-19, were found to be strongly associated with depression among HIV-positive pregnant women. The study identified a significant association between individuals who expressed worries about the negative impact of COVID-19 on pregnancy outcomes (adj. PR 1.29, 95% CI 1.05–1.59), and faced challenges in obtaining antenatal care (ANC) services during the pandemic (adj. PR 1.39, 95% CI 1.11–1.76) with the development of anxiety. The advent of stress among participants was significantly associated with factors such

as recognizing the adverse impact of HIV on pregnancy outcomes (adj. PR 1.51, 95% CI 1.16–1.99) and encountering challenges in receiving ANC (adj. PR 1.78, 95% CI 1.31–2.41) and ART (adj. PR 1.37, 95% CI 1.04–1.81) care services during the COVID-19 pandemic. The association of COVID-19 stressors with depression, anxiety, and stress among HIV-positive pregnant women is represented in Table 4. Collinearity statistics, comprehensive results of Poisson regression analysis of variables predicting DAS were presented in supplementary file.

Discussion

The COVID-19 pandemic has caused an unparalleled increase in psychological distress among everyone and everywhere. The current study revealed a high magnitude of depression, anxiety, and stress among HIV-positive pregnant women during the COVID-19 pandemic. Factors such as residence, gravidae, ANC attendance, HIV identification during pregnancy, partner support and HIV status, and COVID-19 stressor were significantly associated with antenatal DAS among HIV-positive pregnant women.

Prevalence of depression among HIV-positive pregnant women during the COVID-19 pandemic

The prevalence of depression among HIV-positive pregnant women was found to be 50.4% with 95% CI (44.3–56.5). Studies conducted in Tanzania (11.5%), Northwest Ethiopia (11.8%), China (9.2%), southern Ethiopia (16.3%), Ghana (26.9%), Pakistan (27%), Norway (17.9%), and India (23.9%) have shown a lower

Table 3 Bivariate and multivariate Poisson regression analysis of variables predicting DAS among HIV-positive pregnant women ($n = 256$)

Variables	DASS-Depression		DASS-Anxiety		DASS-Stress	
	Univariate	Multivariate	Univariate	Multivariate	Univariate	Multivariate
	PR (95% CI), <i>P</i> value	PR (95% CI), <i>P</i> value	PR (95% CI), <i>P</i> value	PR (95% CI), <i>P</i> value	PR (95% CI), <i>P</i> value	PR (95% CI), <i>P</i> value
Age in years						
< 30 Years	1.33 (1.01–1.75)*	1.01 (0.78–1.31)	1.24 (0.98–1.57)	1.06 (0.84–1.34)	1.09 (0.81–1.48)	-
≥ 30 Years	1.00	1.00	1.00	1.00	1.00	-
Educational level						
No formal education	0.94 (0.74–1.20)	-	0.98 (0.79–1.22)	-	0.91 (0.68–1.22)	-
Formal education	1.00	-	1.00	-	1.00	-
Residence						
Rural	1.51 (1.09–2.10)*	1.43 (1.08–1.91)*	1.33 (1.01–1.75)*	1.25 (0.97–1.62)	1.18 (0.84–1.68)	1.17 (0.84–1.62)
Semiurban	0.71 (0.45–1.13)	0.85 (0.56–1.29)	0.72 (0.49–1.07)	0.78 (0.54–1.13)	0.62 (0.38–1.01)	0.75 (0.47–1.19)
Urban	1.00	1.00	1.00	1.00	1.00	1.00
Occupation						
Unemployed	0.92 (0.71–1.19)	-	0.97 (0.76–1.23)	-	0.80 (0.59–1.01)	0.77 (0.59–1.01)
Employed	1.00	-	1.00	-	1.00	1.00
Gravida						
Primigravida	1.34 (1.06–1.70)*	1.37 (1.09–1.72)**	1.19 (0.96–1.48)	1.17 (0.95–1.44)	1.35 (1.02–1.79)*	1.26 (0.96–1.67)
Multigravida	1.00	1.00	1.00	1.00	1.00	1.00
Planned pregnancy						
No	1.40 (1.10–1.77)**	1.17 (0.94–1.85)	1.22 (0.98–1.52)	1.13 (0.92–1.39)	1.19 (0.89–1.62)	-
Yes	1.00	1.00	1.00	1.00	1.00	-
ANC follow-up						
No	1.35 (1.06–1.72)*	1.41 (1.12–1.76)**	1.00 (0.78–1.28)	-	1.38 (1.03–1.84)*	1.50 (1.12–2.02)**
Yes	1.00	1.00	1.00	-	1.00	1.00
History of abortion						
Yes	0.80 (0.53–1.21)	-	0.93 (0.67–1.29)	-	1.06 (0.71–1.58)	-
No	1.00	-	1.00	-	1.00	-
History of Stillbirth						
Yes	1.25 (0.87–1.80)	-	1.30 (0.97–1.75)	1.22 (0.95–1.57)	1.53 (1.06–2.22)*	1.41 (0.99–2.00)
No	1.00	-	1.00	1.00	1.00	1.00
History of problems in previous pregnancy						
Yes	0.72 (0.49–1.06)	0.76 (0.54–1.06)	0.84 (0.62–1.16)	-	0.89 (0.59–1.32)	-
No	1.00	1.00	1.00	-	1.00	-
Duration of knowing their HIV status (months)						
< 12 months	1.31 (1.01–1.70)*	1.23 (0.98–1.55)	1.19 (0.95–1.49)	1.11 (0.90–1.37)	1.09 (0.81–1.46)	-
≥ 12 months	1.00	1.00	1.00	1.00	1.00	-
Awareness of HIV status prior pregnancy						
No	1.55 (1.23–1.96)***	1.42 (1.13–1.77)**	1.35 (1.09–1.66)**	1.24 (1.01–1.52)*	1.72 (1.30–2.27)***	1.62 (1.23–2.15)**
Yes	1.00	1.00	1.00	1.00	1.00	1.00
Duration of ART (months)						
< 12 months	1.00 (0.78–1.28)	-	0.99 (0.80–1.24)	-	0.93 (0.69–1.24)	-
≥ 12 months	1.00	-	1.00	-	1.00	-
Viral load						
< 50 copies/ml	0.83 (0.65–1.06)	0.83 (0.66–1.03)	0.94 (0.76–1.17)	-	0.87 (0.66–1.16)	-
≥ 50 copies/ml	1.00	1.00	1.00	-	1.00	-

Table 3 (continued)

Variables	DASS-Depression		DASS-Anxiety		DASS-Stress	
	Univariate	Multivariate	Univariate	Multivariate	Univariate	Multivariate
	PR (95% CI), <i>P</i> value	PR (95% CI), <i>P</i> value	PR (95% CI), <i>P</i> value	PR (95% CI), <i>P</i> value	PR (95% CI), <i>P</i> value	PR (95% CI), <i>P</i> value
CD4 Cells/mm						
≤ 600	0.97 (0.76–1.23)	-	0.94 (0.78–1.16)	-	0.99 (0.74–1.31)	-
> 600	1.00	-	1.00	-	1.00	-
Discussed HIV status with a sexual partner						
No	1.56 (1.16–2.09)**	1.43 (1.11–1.83)**	1.36 (1.06–1.75)*	1.25 (0.99–1.58)	1.58 (1.12–2.22)**	1.47 (1.08–2.02)*
Yes	1.00	1.00	1.00	1.00	1.00	1.00
Partners HIV status						
Do not know	1.25 (0.91–1.72)	1.21 (0.90–1.62)	1.08 (0.82–1.40)	-	1.22 (0.84–1.78)	1.15 (0.81–1.63)
Negative	1.49 (1.09–2.04)*	1.35 (1.02–1.79)*	1.17 (0.89–1.53)	-	1.56 (1.08–2.28)*	1.44 (1.02–2.02)*
Positive	1.00	1.00	1.00	-	1.00	1.00
Support from partner						
Absent	2.05 (1.41–2.98)***	1.84 (1.31–2.59)***	1.60 (1.19–2.16)**	1.48 (1.09–1.99)*	1.98 (1.30–3.00)**	1.85 (1.25–2.74)**
Present	1.00	1.00	1.00	1.00	1.00	1.00
Support from family and friends						
Yes	1.02 (0.79–1.32)	-	1.12 (0.90–1.40)	-	1.11 (0.83–1.49)	-
No	1.00	-	1.00	-	1.00	-
Family history of psychiatric problems						
Yes	0.93 (0.66–1.32)	-	0.82 (0.59–1.15)	-	1.02 (0.69–1.49)	-
No	1.00	-	1.00	-	1.00	-

PR Prevalence Ratio, ANC Antenatal Care, ART Antiretroviral Therapy, HIV Human Immunodeficiency Virus

* *P* < 0.05** *P* < 0.01*** *P* < 0.001

prevalence of antenatal depression compared to our study [37–43]. Findings of a study conducted in South West Nigeria revealed that the prevalence of major depressive disorder and severe anxiety disorder were significantly high among HIV-positive pregnant women compared HIV-negative pregnant women [19]. The potential explanation for the increased occurrence of prenatal depression in comparison to other studies could be attributed to the differences in the characteristics of the study population, COVID-19 associated deaths during study period. These studies focused on pregnant women who did not have HIV status. This suggests that the HIV positivity status of the pregnant women in our study is primary reason for high rate of depression compared to other studies. Additionally, the fact that the current study was performed during the COVID-19 era might be a reason for the elevated depression level observed in our research. Also, evidence shows that COVID-19 deaths reported in the month of April, 2020, in Andhra Pradesh [44]. This may

also a possible reason for elevated depression levels in our study. The prevalence of depression observed in the current study is nearly similar to the finding (49.5%) of the study conducted among HIV-positive pregnant women during the COVID-19 pandemic in Nigeria [45]. However, two Ethiopian studies presented a lower rate of depression (28.7%, 37.6%) than our study [3, 36]. The underlying reason for the low prevalence reported in the two Ethiopian studies is due to less number of COVID-19 cases (2746/Million) and associated deaths (44/Million) during study period compared to India [46]. Moreover, the elevated prevalence of depression shown in our study could be attributed to the fact that the survey was carried out promptly following the implementation of the lockdown in India. The implementation of a countrywide lockdown has caused significant concern among the general population, particularly HIV-positive pregnant women, who are deeply worried about their ability to obtain HIV care and antenatal care services. Previous research conducted in Tanzania (25.0%), Ethiopia (47.6%), Uganda (39.0%),

Table 4 Bivariate and multivariate Poisson regression analysis of COVID-19 stressors predicting DAS among HIV-positive pregnant women ($n = 256$)

COVID-19 stressor	DASS-Depression		DASS-Anxiety		DASS-Stress	
	Univariate	Multivariate	Univariate	Multivariate	Univariate	Multivariate
	PR (95% CI), <i>P</i> value	PR (95% CI), <i>P</i> value	PR (95% CI), <i>P</i> value	PR (95% CI), <i>P</i> value	PR (95% CI), <i>P</i> value	PR (95% CI), <i>P</i> value
CS-1						
Yes	1.53 (1.22–1.93)***	1.32 (1.05–1.66)*	1.31 (1.06–1.63)*	1.17 (0.94–1.46)	1.31 (0.97–1.78)	1.13 (0.84–1.52)
No	1.00	1.00	1.00	1.00	1.00	1.00
CS-2						
Yes	0.98 (0.76–1.26)	-	0.98 (0.78–1.23)	-	0.98 (0.72–1.32)	-
No	1.00	-	1.00	-	1.00	-
CS-3						
Yes	1.03 (0.81–1.32)	-	1.01 (0.81–1.26)	-	0.90 (0.67–1.21)	-
No	1.00	-	1.00	-	1.00	-
CS-4						
Yes	1.53 (1.21–1.93)***	1.14 (0.89–1.45)	1.45 (1.18–1.79)***	1.24 (0.99–1.55)	1.61 (1.21–2.13)**	1.18 (0.89–1.57)
No	1.00	1.00	1.00	1.00	1.00	1.00
CS-5						
Yes	1.23 (0.96–1.56)	1.22 (0.98–1.53)	1.03 (0.82–1.29)	-	1.29 (0.97–1.71)	1.27 (0.97–1.65)
No	1.00	1.00	1.00	-	1.00	1.00
CS-6						
Yes	1.41 (1.11–1.78)**	1.34 (1.07–1.68)*	1.30 (1.06–1.61)**	1.29 (1.05–1.59)*	1.33 (1.00–1.76)*	1.29 (0.99–1.69)
No	1.00	1.00	1.00	1.00	1.00	1.00
CS-7						
Yes	1.57 (1.24–2.00)***	1.47 (1.18–1.84)**	1.23 (0.99–1.52)	1.15 (0.94–1.41)	1.64 (1.23–2.18)**	1.51 (1.16–1.99)**
No	1.00	1.00	1.00	1.00	1.00	1.00
CS-8						
Yes	1.63 (1.26–2.11)***	1.59 (1.23–2.04)***	1.44 (1.15–1.80)**	1.39 (1.11–1.76)**	1.84 (1.35–2.51)***	1.78 (1.31–2.41)***
No	1.00	1.00	1.00	1.00	1.00	1.00
CS-9						
Yes	1.42 (1.13–1.80)**	1.34 (1.07–1.69)*	1.26 (1.02–1.55)*	1.17 (0.95–1.44)	1.41 (1.07–1.87)*	1.37 (1.04–1.81)*
No	1.00	1.00	1.00	1.00	1.00	1.00
CS-10						
Yes	0.69 (0.53–0.89)**	0.49 (0.28–0.88)*	0.82 (0.65–1.03)	0.86 (0.69–1.07)	0.79 (0.58–1.06)	0.81 (0.61–1.07)
No	1.00	1.00	1.00	1.00	1.00	1.00

PR Prevalence Ratio

* $P < 0.05$ ** $P < 0.01$ *** $P < 0.001$

Ethiopia (36.4%), and Zimbabwe (39.4%) among pregnant women with HIV during non-pandemic times has demonstrated a lower prevalence of depression compared to our study [13, 14, 17, 18, 47]. These findings suggest that the COVID-19 pandemic has a significant impact on the mental well-being of HIV-positive pregnant women.

Determinants of depression among HIV-positive pregnant women during the COVID-19 pandemic

Findings of the multivariate Poisson regression analysis revealed that variables such as participants residing in rural areas, primigravidae, not attending regular ANC visits, becoming aware of HIV status during pregnancy, non-disclosure of HIV status with their sexual partner, having a sexual partner with a negative HIV status, and not receiving support from the partner were significantly positively associated with the presence of depression.

HIV-positive pregnant women residing in rural areas were significantly associated with the development of depression. Our study results contrast with the findings of a study carried out in Ethiopia's Amhara Referral Hospital, which found that women living in urban regions had a higher rate of depression than women living in rural areas [3]. In India, healthcare services such as antenatal care services are well provided in urban areas compared to rural areas during the lockdown phase of the COVID-19 pandemic. An Indian study conducted among rural respondents revealed a 15.5% prevalence of healthcare utilization avoidance across six states during the COVID-19 pandemic [48]. In our study, the possible reason for the high rate of depression reported among rural residents might be due to the presence of concerns regarding access to antenatal care and ART services during the COVID-19 pandemic. No other study reported that rural residence could impact the mental well-being of HIV-positive pregnant women. As our study was conducted immediately after the first phase of lockdown in India, the majority of the population faced challenges accessing healthcare services, including HIV-positive pregnant women [20]. The study suggests incorporating telehealth services to meet the needs of antenatal and HIV care, which can build confidence among rural HIV-positive pregnant women to sustain their mental health and wellbeing.

During the COVID-19 pandemic, participant absence from routine ANC visits was significantly associated with the development of depression. Women regularly visiting ANC centers were aware of COVID-19 preventive measures after receiving COVID-19 information from healthcare workers. This might be a reason for the higher rate of depression among women who missed regular ANC visits. The current study also proposes incorporating maternal mental health care into ANC in all primary healthcare settings that are accessible to all women.

Women knew that their HIV status after pregnancy was 2.58 times more depressed than that of their counterparts. Similar findings are also observed among studies conducted in Iran and Ethiopia [3, 49]. The possible reason might be the combined effect of HIV and COVID-19 on depression levels during the pregnancy period in women.

The study found that pregnant women whose sexual partners had a negative HIV status experienced a higher rate of depression than pregnant women whose partners were HIV positive. This finding is consistent with a study carried out in a regional referral hospital located in Amhara, Ethiopia [36]. These women might be experiencing constant worry about the longevity of their relationship with their spouse and the potential for future uncertainties in their relationship, which can negatively

impact their mental well-being and contribute to elevated levels of depression during pregnancy and COVID-19. Women who knew that their husband was HIV-positive did not worry about potential abandonment by their spouse. This could provide a genuine conversation with their sexual partner, leading to the provision of social support that can alleviate pregnancy depression.

In the current study, non-disclosure of their HIV status with their partner was more likely to suffer from depression than their counterparts. Mostly, the partner's seronegative for HIV could be a possible reason for the lack of mutual discussion and support between partners to overcome the worries surrounding them during the pregnancy period. Additionally, the study found that women who were not receiving support from their partners were significantly more likely to have depression. This finding is supported by various studies conducted among HIV-positive pregnant women in Thailand and Uganda [50, 51]. The current study was conducted during the pandemic period and again heightened the risk of depression among study participants. The study recommends incorporating partners in antenatal and HIV care counseling sessions to address worries present in HIV-positive pregnant women. The counseling sessions also need to address infection control and preventive measures to overcome the mental health issues raised due to the COVID-19 pandemic.

Prevalence of anxiety among HIV-positive pregnant women during the COVID-19 pandemic

The prevalence of depression among HIV-positive pregnant women was found to be 56.3% with 95% CI (50.2–62.3). This is higher compared to studies conducted in Ethiopia (42.1%) and Nigeria (21.2%) among HIV-positive pregnant women during the COVID-19 pandemic [15, 36]. The current research commenced immediately after the lockdown in India, which is the primary reason for the higher prevalence of anxiety observed in our study. The utilization of the General Anxiety Disorder seven-point scale (GAD-7) in evaluating anxiety symptoms among the participants in the Nigerian study could account for the observed difference with our study. The prevalence of anxiety found in our study was higher than that in studies conducted among pregnant women in Ethiopia (32.2%), Malaysia (18.8%), and Brazil (26.8%) [29, 52, 53]. These findings suggest that HIV infection aggravates anxiety symptoms among pregnant women. A study conducted among HIV-positive pregnant women during the non-pandemic period revealed a prevalence of anxiety of 23.5%, which is lower than that in our study. This indicates that the COVID-19 pandemic greatly influenced the prevalence of anxiety in our study participants. Additionally, evidence shows that existing

mental health services have been badly affected by the lockdown in India [54, 55]. Lack of mental health services is also one of the reasons for the high prevalence of anxiety in our study. It was recommended to provide teleconsultations to meet the mental health care needs of the population. The anxiety might be elevated due to concern about maternal transmission of HIV to unborn child. Evidence supports that high anxiety level among HIV-positive women is due to fear of transmission of HIV to the unborn child [11, 56].

Determinants of anxiety among HIV-positive pregnant women during the COVID-19 pandemic

Findings of the multivariate Poisson regression analysis revealed that variables such as participants becoming aware of HIV status during pregnancy and lack of support from the partner were significantly positively associated with the presence of anxiety.

Women who knew their HIV status during pregnancy were more anxious about potential negative consequences on their relationship with their partner, family support, birth, and maternal outcomes. These anxiety levels were further increased due to the COVID-19 pandemic. This finding was supported by a study conducted among HIV-positive pregnant women in rural Uganda [11]. Partner support plays an important role in reducing anxiety during the perinatal period of pregnancy [57]. The current study revealed that a lack of partner support was significantly associated with the development of anxiety during pregnancy. The COVID-19 pandemic has greatly affected all populations, including pregnant women, in the timely acquisition of antenatal and ART care services. Therefore, interventions need to be developed to enhance partner support in dealing with anxiety among HIV-positive pregnant women and improve pregnancy outcomes.

Prevalence of stress among HIV-positive pregnant women during the COVID-19 pandemic

The prevalence of stress among HIV-positive pregnant women was found to be 42.2% with 95% CI (36.1–48.2). An Ethiopian study showed a 34.8% prevalence of stress among HIV-positive pregnant women during the COVID-19 pandemic [36]. While both studies utilized the same scales (DASS-21), the timing of our study immediately following the initial phase of the lockdown may explain the higher occurrence of stress observed in our findings, in contrast to an Ethiopian study. Compared to our study, studies carried out in Tanzania (25.0%) and Malaysia (4.2%) reported a lower prevalence of antenatal distress [53, 58]. The differences noted in other research could be due to the inclusion of pregnant women regardless of their HIV status, as well as the

time of commencement of those studies. These results imply that women living with HIV experience significant distress, which was amplified during the COVID-19 pandemic. Evidence shows that HIV-positive pregnant women experience diverse psychological changes that can cause decreased adherence to ART and increased suicidal thoughts [59, 60]. The COVID-19 pandemic created havoc of stress in the entire population due to loss of jobs, no physical activity, restricted social gathering, lack of transportation facilities, food crises, closure of educational institutes, and even restrictions in attending spiritual centers. In the general population, the pandemic created great distress, and we can imagine the impact of these changes on the mental health of HIV-positive pregnant women. The current study findings emphasize the need for closer monitoring of the mental health of the participants and reducing the distress associated with HIV and the COVID-19 pandemic by providing appropriate holistic interventions.

Determinants of stress among HIV-positive pregnant women during the COVID-19 pandemic

Findings of the multivariate Poisson regression analysis revealed that variables such as participants' poor attendance at ANC visits, becoming aware of HIV status during pregnancy, and not disclosing HIV status to their partner were significantly positively associated with the presence of stress.

Antenatal care visits offer pregnant women assistance, encouragement, and knowledge regarding pregnancy and childbirth. Additionally, they involve assessments and evaluations to determine the well-being of both the mother and the baby. Missing ANC visits make women more worried about their and their child's health, which increases stress. The COVID-19 pandemic stops pregnant women from accessing ANC services which can increase distress. The study encourages the incorporation of telehealth services to assist women in dealing with stress during pregnancy.

Women who were aware of their HIV status during pregnancy exhibited higher levels of distress than women who were not aware of their HIV status. This is due to their apprehension about the potential consequences of HIV on their family, intimate relationships, social connections, reproductive health, and the health of their offspring. This fear was heightened because of the rising number of COVID-19 cases observed during the study period. The present investigation revealed that concealing the HIV status of women from their partners could escalate stress levels in pregnant women. This finding suggests that disclosing HIV status with a partner, periodic counseling, and providing emotional support to women can reduce stress and improve perinatal outcomes.

COVID-19 stressors associated with DAS among HIV-positive pregnant women

The presence of COVID-19 stressors, such as receiving positive test results for coronavirus, concerns about the negative impact of COVID-19 on pregnancy outcomes, concerns about the influence of HIV on pregnancy outcomes during COVID-19, difficulties in accessing ANC services, and ART services due to COVID-19, were found to be associated with depression among HIV-positive pregnant women. Variables such as participants suffering from symptoms of COVID-19, expressed worries about the negative impact of COVID-19 on pregnancy outcomes, and faced challenges in obtaining antenatal care (ANC) services during the pandemic were significantly associated with anxiety. The advent of stress among participants was significantly associated with factors such as recognizing the adverse impact of HIV on pregnancy outcomes and encountering challenges in receiving ANC and ART care services during the COVID-19 pandemic. Similar triggers associated with DAS were explored in studies conducted among the general population of India and Austria [61, 62]. The study recommends designing educational programs targeting COVID-19 stressors and implementing them at the institutional level to improve the mental health of HIV-positive pregnant women during the COVID-19 pandemic.

Such interventions should be a holistic one that need to delivered by a multidisciplinary team composed with clinical psychologist, obstetrician, and HIV prevention and treatment specialist. A holistic approach targeting importance of regular ANC visits, HIV care, providing telehealth services for rural residents, COVID-19 infection control measures, counseling partners about antenatal and HIV care, and techniques available to combat COVID-19 stressors and counseling about importance of mental health can improve the mental health and pregnancy outcomes during COVID-19 pandemic. By considering the key determinants of our study, it was recommended to integrate mental health services into ANC and HIV care by using a holistic approach.

The current study was conducted between 2020–2021. As we move into the post-covid era, the current study findings provide evidence regarding management of mental health concerns of HIV-positive pregnant women in future outbreaks. Pandemic preparedness involves not only just development of healthcare infrastructure for the management of cases, it is equally important in handling mental health challenges in the public and special populations. Though the study was conducted during the COVID-19 pandemic, there was

no study found in the literature that addressed mental health problems among HIV-positive pregnant women in the selected area. So, this study may act as a basis for future research in the targeted population or these findings can be used to address the mental health concerns among the source population in the study area.

Strengths and limitations

The study was conducted over a span of eighteen months to obtain the necessary sample size. Throughout this period, the impact of COVID-19 transitioned from the initial implementation of a lockdown to the subsequent lifting of the lockdown to address the daily requirements of the general population. First, the researcher must consider the impact of timing bias on the outcomes of the study. Second, the utilization of a cross-sectional study design impedes the ability to establish causal relationships between the variables being examined. A longitudinal study design would have been more appropriate for establishing the temporal relationship between perinatal depression, perceived anxiety, stress, and related factors. Third, the study utilized self-report measures to evaluate depression, anxiety, and stress, which are subjective and susceptible to biases such as recall or social desirability. Moreover, the study's findings may have limited generalizability, as it was conducted in a specific hospital setting in Anantapur District, India. Cultural, social, and economic factors unique to this context may have influenced the prevalence of depression, anxiety and stress among HIV-positive pregnant women. Hence, it is advisable to exercise caution when extrapolating these findings to different regions or countries. Fourth, the study exclusively relied on quantitative data, disregarding qualitative data that could have offered a better understanding of the experiences and perspectives of HIV-positive pregnant women concerning perinatal depression, anxiety, and stress. Fifth, the study used a non-probable sampling technique (convenient) that can cause selection bias as participants may not be representative of the broader population of IV positive pregnant women. Sixth, self-reported data of COVID-19 stressors and DAS are subject to recall and social desirability biases, especially in a sensitive population of HIV positive women. Seventh, variables such as access to psychosocial support, history of mental health issues, or exposure to intimate partner violence can have residual confounding effect on DAS. It was recommended to include these variables in future research to examine the effect of specific variable. Eighth, the sample size was calculated based on the assumption of high prevalence of 82% which may not accurately reflect the target population characteristics. This could affect the study's power and precision. Finally, to improve the credibility, applicability, and thoroughness

of the results, it is important to address these limitations in future research. This will allow for a more detailed understanding of perinatal depression, anxiety, and stress among pregnant women who are HIV-positive during the COVID-19 pandemic. Although the study is entangled with so many limitations, this is the primary study that was conducted to address the mental health needs of HIV-positive pregnant women during pandemic period. The study offers valuable insights for future researchers and practitioners to enhance the mental health services of HIV-positive pregnant women in pandemic situations.

Conclusion

One-third of the HIV-positive pregnant women reported having anxiety symptoms, while more than half of the women reported feeling stressed and depressed during the COVID-19 pandemic. Variables such as rural residence and primigravidae were significantly associated with antenatal depression. Factors like missing ANC appointments, knowing HIV status during pregnancy, non-disclosure of HIV status with their partner, no partner's support, and sexual partner HIV negative status were significantly associated with depression and stress during the antenatal period. The anxiety symptoms are very high among women who are HIV positive during pregnancy and have no partner's support. COVID-19 stressors such as COVID-19 test positivity, concerns about COVID-19 and HIV impact on pregnancy outcomes, and difficulties in accessing ANC and ART services due to COVID-19 were significantly associated with DAS among HIV-positive pregnant women. Determinants of DAS identified in our study provide insights for public or institutionally-based healthcare interventions to reduce the burden of mental health issues among HIV-positive pregnant women. These interventions need to address the importance of regular ANC visits, HIV care, providing telehealth services for rural residents, COVID-19 infection control measures, counseling partners about antenatal and HIV care, and techniques available to combat COVID-19 stressors to improve the mental health pregnancy outcomes during COVID-19 pandemic.

Abbreviations

DAS	Depression, Anxiety, and Stress
HIV	Human Immune Deficiency Virus
AIDS	Acquired immune deficiency syndrome
AOR	Adjusted odds ratio
ANC	Antenatal Care
RIPER	Raghavendra Institute of Pharmaceutical Education and Research
RDT	Rural Development Trust
ART	Anti-retroviral Therapy
PLHIV	People living with HIV
LMIC	Low- and middle-income country
NGO	Nongovernmental Organization
CVI	Content Validity Index
S-CVI	Scale-level content validity index

I-CVI	Item-level content validity index
GAD	General Anxiety Disorder

Supplementary Information

The online version contains supplementary material available at <https://doi.org/10.1186/s12884-025-07261-4>.

Supplementary Material 1.

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Authors' contributions

V.E.: conceptualization and design; data acquisition; data analysis; interpretation of findings; primary draft of manuscript and critical revision of the manuscript. K.O.: conceptualization and design; data analysis; interpretation of findings; primary draft of manuscript and critical revision of the manuscript. N.G.: conceptualization and design; data acquisition; data analysis; interpretation of findings; primary draft of manuscript and critical revision of the manuscript. J.S.M.: conceptualization and design; data acquisition; interpretation of findings; critical revision of the manuscript. B.R.B.: conceptualization and design; interpretation of findings; critical revision of the manuscript. B.M.: data acquisition; interpretation of findings; critical revision of the manuscript. M.J.S.M.: conceptualization and design; data acquisition; interpretation of findings; critical revision of the manuscript. P.B.: conceptualization and design; data acquisition; interpretation of findings; critical revision of the manuscript. D.P.T.: conceptualization and design; data acquisition; interpretation of findings; critical revision of the manuscript. V.B.: conceptualization and design; data acquisition; interpretation of findings; critical revision of the manuscript.

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Data availability

The dataset used and/or analyzed during the current study is available from the corresponding author upon reasonable request. Partial data was submitted as supplementary information.

Declarations

Ethics approval and consent to participate

The study protocol, data collection tools, and informed consent procedure were approved by the Raghavendra Institute of Pharmaceutical Education Research (RIPER)—Institutional Review Board (RIPER/IRB/PP/2020/053). The study was conducted in accordance with the provisions of the Declaration of Helsinki regarding research with human subjects. All of the eligible participants were approached by a female researcher who could speak the Telugu and English. The researcher explained the study protocol and objectives to the eligible participants and received oral and written consent on a voluntary basis. For illiterate participants, informed consent was obtained from a legally authorized representative or local guardian. The participants were encouraged to share their thoughts and inquiries about the study openly and received clarifications from the principal investigator. All the participants had the complete right to withdraw from the study at any stage of the research process (consent, initiation, process, and completion). The study participants were not subjected to any harm, as the survey was conducted through interviews and did not involve any invasive procedures.

Consent for publication

Not applicable.

Competing interests

The authors declare no competing interests.

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