Original Article

Sociodemographic Factors Associated with Depression among People Living with Human Immunodeficiency Virus on Antiretroviral Therapy at a University Teaching Hospital in a Nigerian Cosmopolitan City

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Abstract

Background and objectives: Depression can lead to poor outcomes during antiretroviral therapy, and current evidence suggests high rates of depression among people living with human immunodeficiency virus (PLHIV), especially in low-and middle-income countries. This study was designed to investigate the sociodemographic factors associated with depression among PLHIV on antiretroviral therapy in a Nigerian cosmopolitan city.

Methods: A hospital-based, cross-sectional study was conducted among 592 consenting, randomly selected adult PLHIV receiving treatment at a university teaching hospital in Jos, Nigeria, in 2022, using the PHQ-9 questionnaire and an interviewer-administered sociodemographic questionnaire. Associated variables in univariate analysis were used in multivariable binary logistic regression to obtain adjusted odds ratios (AOR) with a significance level set at $\alpha = 0.05$.

Results: Depression was found to be highly prevalent among study participants, with 44.9% of them affected. Findings revealed that being male [AOR = 0.62; 95% confidence interval (CI): 0.42–0.92], being employed (AOR = 0.55; 95% CI: 0.31–0.97), and earning a monthly income of ₦50,000–100,000 ($65–130) (AOR = 0.49; 95% CI: 0.27–0.91) and >₦100,000–200,000(>$130–260) (AOR = 0.33; 95% CI: 0.13–0.77) were significantly associated with reduced odds of depression.

Conclusions: The significant association of being male, having formal employment, and earning a moderate monthly income with reduced odds of depression may have implications for policy and strategies for managing mental health issues among PLHIV in cosmopolitan areas like Jos, which face peculiar challenges such as cultural tensions, traffic congestion, and gentrification. PLHIV categories with a relatively higher likelihood of depression may benefit from targeted mental health support systems, in addition to other mental health management strategies generally available to PLHIV.

Introduction

The widespread availability of antiretroviral therapy (ART) has led to considerable strides in the management of human immunodeficiency virus (HIV)/acquired immunodeficiency syndrome in recent years. ART has not only increased the life expectancy of people living with HIV (PLHIV) but has also improved their overall quality of life.[1,2] Despite these developments, the prevalence of

mental health disorders among PLHIV continues to be a significant concern.[3] Over 300 million people worldwide suffer from depression, making it one of the major causes of disability-adjusted life years and a major contributor to the burden of mental health disorders.[4,5] Depression can lead to chronic feelings of sadness, loss of interest or desire for normal activities, changes in appetite, disruption in sleep patterns, fatigue, and reduced ability to concentrate or make decisions. These symptoms can significantly impede a person's ability to work, perform daily tasks, and maintain social relationships.[4,6]

Depression has been reported to occur at high rates among individuals with chronic medical conditions, such as HIV.[3,7] Among PLHIV, depressive symptoms may be exacerbated by the intricate interaction of the psychosocial impacts of HIV diagnosis, the stigma associated with HIV infection, and the neuropathological effects of the virus. Depression may also lead to poor medication adherence among PLHIV, which could potentially result in virologic failure and an increased risk of HIV transmission.[7] Analyzing the demographics of PLHIV may provide a better understanding of and improved management for depression.[8,9] It also helps healthcare providers, researchers, and policymakers develop more targeted interventions and efficient support systems for this group.[10] In recent years, Plateau State has consistently been among the fifteen states with the highest HIV prevalence in the country.[11] This study was designed to investigate the socio-demographic factors associated with depression in Jos, the cosmopolitan administrative capital of Plateau State, Nigeria.

Materials and methods

Study area

This study was conducted among PLHIV receiving care at the ART clinic of Bingham University Teaching Hospital, a tertiary health institution in Jos, Plateau State, North-Central Nigeria. The state has an estimated HIV prevalence of 1.5% and has been consistently listed among Nigerian states with the highest HIV prevalence in recent years.[11] Compared to other major cities in Nigeria, Jos has a temperate climate that contributes to its cosmopolitan nature, with average monthly temperatures ranging from 21°C to 25°C. The city is surrounded by several smaller agrarian communities that produce and supply a wide variety of fruits, vegetables, and crops, making Jos a hub of commercial agricultural activities, not only for Plateau State residents but also for people from neighboring states in North-Central Nigeria.[12]

Study design and source population

A cross-sectional, hospital-based study design was used for this study. The source population comprised adult PLHIV (defined in this study as PLHIV aged ≥18 years) accessing healthcare at the ART clinic of Bingham University Teaching Hospital, Jos, Nigeria, from September to December 2022, which included approximately 4,500 patients.

Study population

The study population comprised adult PLHIV accessing healthcare at the ART clinic of Bingham University Teaching Hospital, Jos, Nigeria, who had been on ART for at least six months with adequate follow-up. In this study, adequate follow-up refers to ongoing medical care and support to ensure effective management of HIV, which includes adherence counseling and support, as well as assessment of clinical, immunological, and virological responses to treatment.

Inclusion and exclusion criteria

All adult PLHIV receiving treatment at the ART clinic of Bingham University Teaching Hospital, who had been on ART for at least six months with follow-up, and who consented to the study, were included. The first six months after initiation of ART are critical for a patient's physical and mental well-being. Patients who did not consent to the study and those who were critically ill or pregnant were excluded.

Variables

The dependent variable was depression, while the independent variables were socio-demographic factors, which included gender, age, marital status, employment status, income level, and educational status. Socio-demographic factors were assessed based on different categories. For instance, marital status was categorized as divorced, widowed, married, and single (i.e., not previously or currently married). Categories of other independent variables are listed in Table 1.

Operational definition of depression

Study participants who scored ≥5 on the Patient Health Questionnaire-9 (PHQ-9) were considered depressed, while those who scored <5 were considered not depressed.[13,14]

Sampling technique and sample size determination

Face-to-face interviews with PLHIV who visited the ART clinic during the study period were conducted by experienced ART clinic nurses, and eligible patients were recruited. The sample size was estimated using the Leslie-Kish formula for calculating sample size for cross-sectional studies, $n = Z^2 P(1-P)/d^2$, where n represents the minimum sample size.[15] For this study, Z (*z*-score) and d (margin of error) were taken as 1.96 at a 95% confidence level and 0.05, respectively, while P (prevalence rate) was set at 50.0% based on previous studies in Nigeria and other parts of Africa.[6,16,17] A minimum sample size of 384 was calculated, which was increased to 600 to boost the power of the study, with 592 individuals completing the questionnaire, giving a response rate of 98.7%. Study participants were chosen using a simple random sampling procedure. On ART clinic days, adult PLHIV were assigned numbers and a raffle of 35 to 40 numbers was drawn to select respondents. Selected respondents who provided consent were enrolled in the study. This process continued until the required sample size was attained.

Ethical statement

Ethical approval for this study was obtained from the Health Research Ethics Committee (HREC) of Bingham University Teaching Hospital, Jos, Nigeria, under approval number NHREC/21/05/2005/00950. Informed written consent was obtained from the participants before recruitment into the study. The study was conducted in accordance with the principles of the Declaration of Helsinki.

Data collection tools and procedure

The Patient Health Questionnaire-9 (PHQ-9) tool was used to assess depression. The PHQ-9 is a standardized and sensitive questionnaire that is commonly used among healthcare professionals to assess depression in patients.[13,14] It is a nine-item depression screening tool that focuses on the Diagnostic and Statistical Manual of Mental Disorders, 4th edition for major depressive disorder. The PHQ-9 has been used to provide valuable insights into the prevalence of depression. The questionnaire assesses how often

Table 1. Demographics of study participants

Characteristics	Category	Frequency (%)
Gender		
	Male	171 (28.9)
	Female	421 (71.1)
	Total	592 (100.0)
Age (years)		
	18–35	96 (16.2)
	36–45	221 (37.3)
	46–55	159 (26.9)
	56–65	92 (15.5)
	≥66	24 (4.1)
	Total	592 (100.0)
Marital status		
	Single	91 (15.4)
	Married	341 (57.6)
	Widowed	119 (20.1)
	Divorced	36 (6.1)
	No response	5 (0.8)
	Total	592 (100.0)
Employment status		
	Unemployed	47 (7.9)
	Self-employed	303 (51.2)
	Employed	167 (28.2)
	Retired	71 (12.0)
	No response	4 (0.7)
	Total	592 (100.0)
Income level (Naira/month)		
	<50,000	339 (57.3)
	50,000–100,000	74 (12.5)
	>100,000–200,000	33 (5.6)
	>200,000	126 (21.3)
	No response	20 (3.4)
	Total	592 (100.0)
Educational status		
	No education	49 (8.3)
	Quranic	19 (3.2)
	Primary	141 (23.8)
	Secondary	186 (31.4)
	Tertiary	194 (32.8)
	No response	3 (0.5)
	Total	592 (100.0)

the subjects had been disturbed by any of the nine items during the immediately preceding two weeks.[18] Responses to each item were scored on a scale of zero to three, giving a total score ranging from zero to 27. While higher scores indicate greater depression severity, with 5, 10, 15, and 20 used as cut-offs for mild, moderate, moderately severe, and severe depression, respectively,[18–20] a single cut-off score of ≥5 was used in this study. Study participants with a PHQ-9 score ≥5 were considered "depressed", and those who scored <5 were considered "not depressed". The PHQ-9 questionnaire was combined with a pretested sociodemographic questionnaire administered by experienced nurses and other trained personnel at the ART clinic.

Data quality control

Data collectors were trained in the use of data collection tools and the sampling technique. Data collection was duly supervised, and the collected data were regularly checked for accuracy and consistency.

Data management and analysis procedure

SPSS version 26 was used for cleaning and comprehensive analysis of the data collected. Categorical variables were measured using frequencies and percentages. The Chi-square test of association was used for preliminary assessment of the association between depression status and the demographics of study participants at α = 0.05. Univariate logistic regression analysis was used to obtain crude odds ratios (CORs) for the initial assessment of factors associated with depression. Variables with *p*-values less than 0.25 in the univariate logistic regression analysis were selected for multivariable binary logistic regression analysis.[9,14,17]

A stepwise, backward elimination procedure was used to remove non-significant variables from the model. Variables with *p*-values of less than 0.05 were considered statistically significant. Adjusted odds ratio (AOR) and 95% confidence interval (CI) were calculated to determine associated factors. The multiple imputation method was used to account for missing data, which were found to be random. Results obtained after five iterations were pooled into one and used to complete missing data before statistical analyses. The variance inflation factor was used to check for multicollinearity, and none was found. The Hosmer–Lemeshow goodness-of-fit test was applied.[9,14]

Results

Socio-demographic characteristics of study participants and prevalence of depression

Five hundred and ninety-two participants were recruited. Most were aged 36–45 years (37.3%), males (71.1%), married (57.6%), and self-employed (51.2%). While about 80.0% had some type of employment, only about 27.0% were earning above ₦100,000 (about $130) monthly. More than 90.0% of the study participants also had some level of education.

Preliminary assessment of the association between sociodemographic factors and depression

Depression was more prevalent among PLHIV who were previously married (i.e., either "divorced" or "widowed") than among those who were "married" or "single", but it was less prevalent among participants with tertiary and secondary education compared to those with no education or with only primary education. A preliminary assessment of the association between depression

Table 2. Preliminary assessment of association between depression status and demographics of study participants

Characteristics and categories	Depression status among PLHIV		Chi-square	p-value
	Not depressed (%)	Depressed (%)		
Gender			4.66	0.03*
Male (n = 171)	106 (62.0)	65 (38.0)		
Female (n = 421)	220 (52.3)	201 (47.7)		
Total (N = 592)	326	266		
Age (years)			7.39	0.12
18–35 (n = 96)	51 (53.1)	45 (46.9)		
36–45 (n = 221)	116 (52.5)	105 (47.5)		
46–55 (n = 159)	101 (63.5)	58 (36.5)		
56–65 (n = 92)	48 (52.2)	44 (47.8)		
≥66 (n = 24)	10 (41.7)	14 (58.3)		
Total (N = 592)	326	266		
Marital status			6.99	0.07
Single (n = 92)	51 (55.4)	41 (44.6)		
Married (n = 344)	202 (58.7)	142 (41.3)		
Widowed (n = 120)	58 (48.3)	62 (51.7)		
Divorced (n = 36)	15 (41.7)	21 (58.3)		
Total (N = 592)	326	266		
Employmentstatus			9.21	0.03*
Employed (n = 168)	107 (63.7)	61 (36.3)		
Self-employed (n = 305)	154 (50.5)	151 (49.5)		
Unemployed (n = 47)	29 (61.7)	18 (38.3)		
Retired (n = 72)	36 (50.0)	36 (50.0)		
Total (N = 592)	326	266		
Income level (Naira/month)			15.00	0.00*
<50,000 (n = 350)	183 (52.3)	167 (47.7)		
50,000–100,000 (n = 77)	52 (67.5)	25 (32.5)		
>100,000–200,000 (n = 34)	26 (76.5)	8 (23.5)		
>200,000 (n = 131)	65 (49.6)	66 (50.4)		
Total (N = 592)	326	266		
Educational status			14.02	0.01*
No education (n = 49)	23 (46.9)	26 (53.1)		
Quranic (n = 19)	14 (73.7)	5 (26.3)		
Primary (n = 142)	66 (46.5)	76 (53.5)		
Secondary (n = 187)	99 (52.9)	88 (47.1)		
Tertiary (n = 195	124 (63.6)	71 (36.4)		
Total (N = 592)	326	266		

*p-value < 0.05; PLHIV, people living with HIV.

status and the demographics of study participants using the chi-square test of association revealed that gender ($\chi^2 = 4.66$, $p = 0.03$), employment status ($\chi^2 = 9.21$, $p = 0.03$), income level ($\chi^2 = 15.00$, $p = 0.00$), and educational status ($\chi^2 = 14.02$, $p = 0.01$) were significantly associated with depression at $\alpha = 0.05$. These results are shown in Table 2.

Table 3. Univariate logistic regression analysis for initial assessment of socio-demographic factors associated with depression among study participants

Characteristics and categories	Depression status among PLHIV		COR (95% CI)	p-value
	Not depressed (n = 326)	Depressed (n = 266)		
Gender				
Male	106	65	0.67 (0.47–0.96)	0.03*
Female	220	201	I	
Age (years)				
18–35	51	45	0.63 (0.26–1.56)	0.32
36–45	116	105	0.65 (0.28–1.52)	0.32
46–55	101	58	0.41 (0.17–0.98)	0.05*
56–65	48	44	0.66 (0.26–1.63)	0.36
≥66	10	14	I	
Marital status				
Single	51	41	0.57 (0.26–1.24)	0.16*
Married	202	142	0.50 (0.25–1.01)	0.05*
Widowed	58	62	0.77 (0.36–1.64)	0.50
Divorced	15	21	I	
Employment status				
Employed	107	61	0.58 (0.33–1.01)	0.05*
Self-employed	154	151	0.99 (0.59–1.66)	0.96
Unemployed	29	18	0.62 (0.29–1.31)	0.21*
Retired	36	36	I	
Income level (Naira/month)				
<50,000	183	167	0.91 (0.60–1.35)	0.62
50,000–100,000	52	25	0.47 (0.25–0.85)	0.01*
>100,000–200,000	26	8	0.32 (0.14–0.77)	0.01*
>200,000	65	66	I	
Educational status				
No education	23	26	0.34 (0.11–1.09)	0.07*
Quranic	14	5	1.00 (0.52–1.92)	0.99
Primary	66	76	0.79 (0.42–1.49)	0.47
Secondary	99	88	0.51 (0.27–0.96)	0.04*
Tertiary	124	71	I	

*p-value < 0.25; CI, confidence interval; COR, crude odds ratio; I, reference; PLHIV, people living with HIV.

Associated factors of depression among people living with HIV during the study

Univariate logistic regression analysis revealed that at least 50.0% of the categories under five of the six predictor variables were significantly associated with depression compared to their respective reference categories. The significantly associated categories were "male" (COR = 0.67; 95%CI: 0.47–0.96) under "gender"; "single" (COR = 0.57; 95%CI: 0.26–1.24) and "married" (COR = 0.50; 95%CI: 0.25–1.01) under "marital status"; "employed" (COR = 0.58; 95%CI: 0.33–1.01) and "unemployed" (COR = 0.62; 95%CI: 0.29–1.31) under "employment status"; "₦50,000–100,000" (COR = 0.47; 95%CI: 0.25–0.85) and ">₦100,000–200,000" (COR =

0.32; 95%CI: 0.14–0.77) under "income level"; and "no education" (COR = 0.34; 95%CI: 0.11–1.09) and "secondary" (COR = 0.51; 95%CI: 0.27–0.96) under "educational status". The association between the gender category "male" (AOR = 0.62; 95%CI: 0.42–0.92) and the income level categories "₦50,000–100,000" ($65–130) (AOR = 0.49; 95% CI: 0.27–0.91) and ">₦100,000–200,000"(>$130–260) (AOR = 0.33; 95% CI: 0.13–0.77) with depression remained significant after adjusting for age, employment status, and educational status using multivariable binary logistic regression analysis. These results are shown in Tables 3 and 4. Male participants were 38% less likely to be depressed than female participants, while those who earned a monthly income from

Table 4. Binary logistic regression analysis for associated factors of depression among PLWH assessing ART at Bingham University Teaching Hospital, Jos, Nigeria

Characteristics and categories	Depression status among PLHIV		COR (95% CI)	AOR (95% CI)	*p*-value
	Not depressed (*n* = 326)	Depressed (*n* = 266)			
Gender					
Male (n = 171)	106 (62.0)	65 (38.0)	0.67 (0.47–0.96)	0.62 (0.42–0.92)	0.02*
Female (n = 421)	220 (52.3)	201 (47.7)	I	I	
Employment status					
Employed (n = 168)	107 (63.7)	61 (36.3)	0.58 (0.33–1.01)	0.55 (0.31–0.97)	0.04*
Self-employed (n = 305)	154 (50.5)	151 (49.5)	0.99 (0.59–1.66)	0.92 (0.54–1.55)	0.74
Unemployed (n = 47)	29 (61.7)	18 (38.3)	0.62 (0.29–1.31)	0.57 (0.27–1.21)	0.14
Retired (n = 72)	36 (50.0)	36 (50.0)	I		
Income level (Naira/month)					
<50,000 (n = 350)	183 (52.3)	167 (47.7)	0.91 (0.60–1.35)	0.89 (0.59–1.34)	0.60
50,000–100,000 (n = 77)	52 (67.5)	25 (32.5)	0.47 (0.25–0.85)	0.49 (0.27–0.91)	0.02*
>100,000–200,000 (n = 34)	26 (76.5)	8 (23.5)	0.32 (0.14–0.77)	0.33 (0.13–0.77)	0.01*
>200,000 (n = 131)	65 (49.6)	66 (50.4)	I		

*p-value < 0.05; AOR, adjusted odds ratio; CI, confidence interval; COR, crude odds ratio; I, reference; PLHIV, people living with HIV.
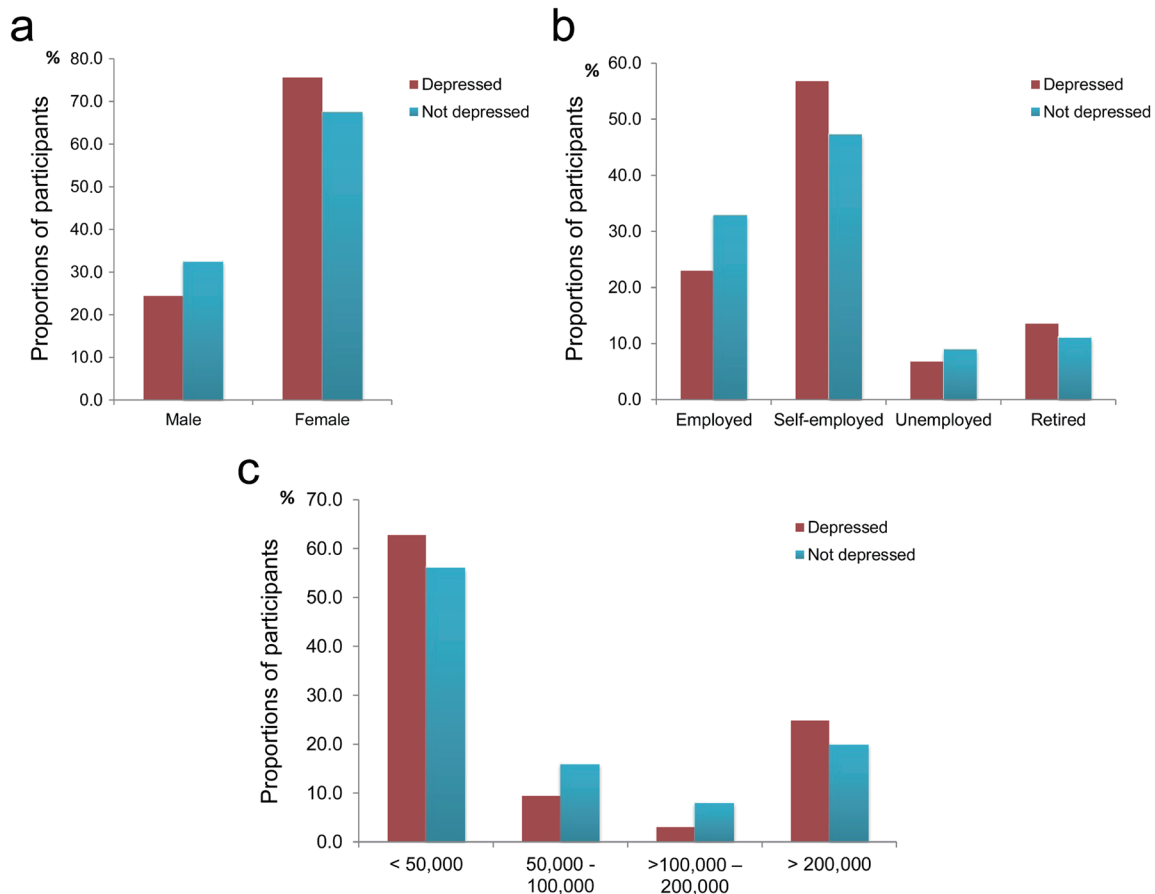

Fig. 1. Charts showing proportions of participants that were depressed (n = 266) and not depressed (n = 326) categorized by gender (a), employment status (b), and income level (c).

₦50,000 to ₦200,000 ($65–260) also had significantly reduced odds of experiencing depression at α = 0.05 compared to those with a monthly income of >₦200,000 (>$260). Figure 1 depicts the patterns of depression among participants based on the three sociodemographic variables associated with depression during this study. It reveals that depression occurred more among females, self-employed and retired categories, and PLHIV with income below ₦50,000 ($65) and above ₦200,000 ($260).

Discussion

The focus of this study was to analyze and identify sociodemographic factors associated with depression among PLHIV on ART in the study area. The high prevalence of depression [44.9%] found in this study is similar to findings from related studies among PLHIV in different parts of Africa,[14,16,21,22] as well as in other parts of the world.[9] In view of the 34.17% global average prevalence of depressive symptoms reported in a recent systematic review,[23] the prevalence of 44.9% obtained in this study is considered considerably high. A recent study also reported a very high prevalence of depression (80.0%) among PLHIV in the Asia–Pacific region.[24] While the estimation of depression prevalence may have been influenced by factors such as sampling technique, sample size, and data collection tools, and while some studies have reported relatively lower prevalence rates of depression among PLHIV,[6,25] the widespread high prevalence of depression among adult PLHIV in recent years highlights the need for improved diagnosis and better management of mental health issues in this vulnerable population.

In this study, gender was found to be a significant factor associated with depression. The AOR of 0.62 for males implies that, after controlling for other covariates, male participants had 0.62 times the odds of having depression compared to female participants. This indicates that gender was significantly associated with depression among the study participants at α = 0.05, with males (AOR = 0.62, p = 0.03) being 38% less likely to have depression compared to females. This result contrasts with a report from Ethiopia, where male PLHIV had higher odds of depression,[14] but it aligns with findings from other studies where being female was more associated with depression among PLHIV.[9,16,26] Factors such as differences in culture and ethnicity may influence how depressive tendencies vary by gender. However, while this study was conducted in a cosmopolitan area and included participants from different cultural backgrounds, an important limitation was that ethnicity was not included as a covariate in our model. Future studies could explore the interaction between depression and gender more thoroughly by including ethnicity or race as a predictor variable.

Age, marital status, and educational attainment have been linked to depression in PLHIV in some earlier studies.[6,9] However, these variables did not significantly affect depressive tendencies in the present study, which is similar to some reports, such as that by Obadeji and colleagues, where marital status was not associated with depression among PLHIV.[26] While unemployment was previously reported to be associated with depression among PLHIV in Nigeria,[16] in the present study, being unemployed or self-employed was not found to be significantly associated with depression. However, our results revealed that PLHIV who were formally employed, either by the government or the private sector, had significantly lower odds of depression (AOR = 0.55, p = 0.04) at α = 0.05 compared to the "retired" group. In other words, study participants who had formal employment had 0.55 times lower odds of experiencing depression compared to those who were re-

tired, making them 45% less likely to experience depression than the retired group. This finding is similar to that of Ware and colleagues, where being employed was associated with lower odds of depression among PLHIV.[27]

Jos is home to various ethnic groups and people of different religious backgrounds and is considered one of the major cosmopolitan cities in Nigeria. It shares common challenges with other cosmopolitan areas globally, such as cultural tensions, high cost of living, traffic congestion, gentrification leading to overcrowding in low-cost areas, high crime rates, and poor social integration and inclusivity.[28,29] In the present study, results indicated that individuals with a monthly income of ₦50,000–100,000 ($65–130) (AOR = 0.49) and >₦100,000–200,000 (>$130–260) (AOR = 0.33) had statistically significant reduced odds of depression at α = 0.05 compared to the reference category (monthly income of >₦200,000 (about $260). However, the category with a monthly income of <₦50,000 ($65) did not have statistically significant odds of depression compared to the reference category at α = 0.05.

These results suggest that study participants with a monthly income below ₦50,000 (<$65) did not have a statistically significant difference in their likelihood of depression compared to those with a monthly income above ₦200,000 (>$260) (the reference group with an odds ratio = 1). This finding is similar to a previous study in Nigeria where low income was associated with depressive symptoms among PLHIV.[16] However, study participants earning a moderate income [₦50,000–100,000 ($65–130) per month] to moderately high income [₦100,000–200,000 (>$130–260) per month] had a significantly reduced risk of depression at α = 0.05 compared to those with a monthly income >₦200,000 (>$260). The odds of depression for these income categories suggest that a moderate to moderately high monthly income was associated with a lower likelihood of depression. The observed reduced odds of depression among these two income categories in the cosmopolitan city of Jos may have been influenced by factors such as lower financial responsibility, better job satisfaction, job security, and lifestyle differences. These factors could be included as covariates in future studies to obtain more robust findings. Additionally, the impact of internalized HIV stigma—which involves the acceptance of negative societal attitudes about HIV, leading to self-disparagement, derogatory self-evaluations, and feelings of rejection—could be explored in future longitudinal studies to assess its role in the occurrence of depressive symptoms in the study area.[30,31]

Study limitations

Limitations of the study include its inability to confirm causality, as it was designed as a cross-sectional study. The findings only highlight associations between certain socio-demographic variables and depression among PLHIV in the study area. Depression can also be influenced by factors not accounted for in the model used for this study, such as social support, job satisfaction, and lifestyle differences. Interviewer-administered questionnaires, while advantageous, can also be susceptible to various biases. Despite efforts to minimize such biases through interviewer training, the use of standardized survey tools, and data quality checks, we acknowledge that some biases may not have been completely eliminated. Additionally, the relatively small sample sizes in some categories of predictor variables might have introduced bias and limited the generalizability of our findings. Further research with larger and more diverse samples is recommended to validate these results and enhance their applicability.

Future directions

Future research should include longitudinal studies to determine causal relationships between sociodemographic factors and depression among this vulnerable population. Studies may also incorporate factors such as social support, access to healthcare, lifestyle differences, job satisfaction, job security, and ethnicity as predictor variables. Given the recognized role of internalized HIV stigma as a significant risk factor for depression among PLHIV, future studies should explore its development and impact on depressive symptoms across different age, gender, educational, and occupational categories of PLHIV, especially in low- and middle-income countries, using various network analysis models. Additionally, considering the potential emergence and re-emergence of infectious diseases, predictive models could be developed to assess the impacts of future epidemics and pandemics on the occurrence of depressive symptoms among PLHIV.

Conclusions

The findings revealed a high prevalence of depression, indicating a need for improved management of mental health issues among PLHIV on ART in the study area. Being male, officially employed, and earning a moderate monthly income of ₦50,000–200,000 (>$65–260) were significantly associated with reduced odds of depression. These findings may inform policy and intervention strategies for addressing mental health issues among PLHIV on ART. PLHIV categories used as reference groups in the present study, as well as other categories with comparable odds for depression, may benefit from targeted mental health support systems. Promoting mental health and well-being for everyone is crucial, regardless of their specific mental health condition, as prevention and early intervention can reduce suffering and improve overall quality of life.

Acknowledgments

Funding

Conflict of interest

The authors have no conflict of interest related to this publication.

Author contributions

Study design and supervision (JO, OAA, PE, AAGC), data collection (JO, PE, GOS, AE, AAGC), literature search (OAA, GOS, AE), analysis and interpretation of data (OAA, AAGC), and preparation of original and revised manuscripts (OAA). All authors have made significant contributions to this study and have approved the final manuscript.

Data sharing statement

The data used to support the findings of this study are available upon reasonable request from the corresponding author at phamo2@yahoo.co.nz.

Ethical statement

Ethical approval for this study was obtained from the Health Research Ethics Committee (HREC) of Bingham University Teaching Hospital, Jos, Nigeria, under approval number NHREC/21/05/2005/00950. Informed written consent was obtained from the participants before recruitment into the study. The study was conducted in accordance with the principles of the Declaration of Helsinki.

References

[1] Du X, Zhang Q, Hao J, Gong X, Liu J, Chen J. Global trends in depression among patients living with HIV: A bibliometric analysis. Front Psychol 2023;14:1125300. doi:10.3389/fpsyg.2023.1125300, PMID:36968702.

[2] Maggiolo F, Bandera A, Bonora S, Borderi M, Calcagno A, Cattelan A, *et al*. Enhancing care for people living with HIV: current and future monitoring approaches. Expert Rev Anti Infect Ther 2021;19(4):443–456. doi:10.1080/14787210.2021.1823217, PMID:33054479.

[3] Hoare J, Sevenoaks T, Mtukushe B, Williams T, Heany S, Phillips N. Global Systematic Review of Common Mental Health Disorders in Adults Living with HIV. Curr HIV/AIDS Rep 2021;18(6):569–580. doi:10.1007/s11904-021-00583-w, PMID:34792706.

[4] Liu J, Liu Y, Ma W, Tong Y, Zheng J. Temporal and spatial trend analysis of all-cause depression burden based on Global Burden of Disease (GBD) 2019 study. Sci Rep 2024;14(1):12346. doi:10.1038/s41598-024-62381-9, PMID:38811645.

[5] COVID-19 Mental Disorders Collaborators. Global prevalence and burden of depressive and anxiety disorders in 204 countries and territories in 2020 due to the COVID-19 pandemic. Lancet 2021;398(10312):1700–1712. doi:10.1016/S0140-6736(21)02143-7, PMID:34634250.

[6] Duko B, Geja E, Zewude M, Mekonen S. Prevalence and associated factors of depression among patients with HIV/AIDS in Hawassa, Ethiopia, cross-sectional study. Ann Gen Psychiatry 2018;17:45. doi:10.1186/s12991-018-0215-1, PMID:30386408.

[7] Manea L, Gilbody S, McMillan D. Optimal cut-off score for diagnosing depression with the Patient Health Questionnaire (PHQ-9): a meta-analysis. CMAJ 2012;184(3):E191–E196. doi:10.1503/cmaj.110829, PMID:22184363.

[8] Shittu RO, Issa BA, Olanrewaju GT, *et al*. Prevalence and correlates of depressive disorders among people living with HIV/AIDS, in North Central Nigeria. J AIDS Clin Res 2013;4:251. doi:10.4172/21556113.1000251.

[9] Deshmukh NN, Borkar AM, Deshmukh JS. Depression and its associated factors among people living with HIV/AIDS: Can it affect their quality of life? J Family Med Prim Care 2017;6(3):549–553. doi:10.4103/2249-4863.222016, PMID:29417006.

[10] Remien RH, Stirratt MJ, Nguyen N, Robbins RN, Pala AN, Mellins CA. Mental health and HIV/AIDS: the need for an integrated response. AIDS 2019;33(9):1411–1420. doi:10.1097/QAD.0000000000002227, PMID:30950883.

[11] Onovo AA, Adeyemi A, Onime D, Kalnoky M, Kagniniwa B, Dessie M, *et al*. Estimation of HIV prevalence and burden in Nigeria: a Bayesian predictive modelling study. EClinicalMedicine 2023;62:102098. doi:10.1016/j.eclinm.2023.102098, PMID:37538543.

[12] Nadabo C, Ramyil SC, Bello CS, Adeola OA, Ike R, Ogundeko TO, *et al*. Parasitic Contamination of Commonly Consumed and Locally Cultivated Leafy Vegetables in Jos, North-Central Nigeria. J Hum Environ Health Promot 2022;8(1):1–9. doi:10.52547/jhehp.8.1.1.

[13] Siniscalchi KA, Broome ME, Fish J, Ventimiglia J, Thompson J, Roy P, *et al*. Depression Screening and Measurement-Based Care in Primary Care. J Prim Care Community Health 2020;11:2150132720931261. doi:10.1177/2150132720931261, PMID:33185122.

[14] Beyamo A, Bashe T, Facha W, Moshago T. Depression and Associated Factors Among Adult HIV/AIDS Patients Attending Antiretroviral Therapy at Wolaita Sodo University Teaching and Referral Hospital, Southern Ethiopia. HIV AIDS (Auckl) 2020;12:707–715. doi:10.2147/HIV.S278794, PMID:33192101.

[15] Pourhoseingholi MA, Vahedi M, Rahimzadeh M. Sample size calculation in medical studies. Gastroenterol Hepatol Bed Bench 2013;6(1):14–17. PMID:24834239.

[16] Adeoti AO, Dada MU, Fadare JO. Prevalence of Depression and Anxiety Disorders in People Living with HIV/AIDS in a Tertiary Hospital in South Western Nigeria. Med Rep Case Studies 2018;3:1. doi:10.4172/2572-5130.1000150.

[17] Hankebo M, Fikru C, Lemma L, Aregago G. Depression and Associated Factors among People Living with Human Immunodeficiency Virus Attending Antiretroviral Therapy in Public Health Facilities, Hosanna Town, Southern Ethiopia. Depress Res Treat 2023;2023:7665247. doi:10.1155/2023/7665247, PMID:37534229.

[18] Spitzer RL, Williams JB, Kroenke K. Test-review-patient-health-questionnaire-9 (PHQ-9). RehabilCouns Bull 2014;57(4):246–248.

[19] Sun Y, Fu Z, Bo Q, Mao Z, Ma X, Wang Z. The reliability and validity of PHQ-9 in patients with major depressive disorder in psychiatric hospital. BMC Psychiatry 2020;20:474. doi:10.1186/s12888-020-02885-6.

[20] Negeri ZF, Levis B, Sun Y, He C, Krishnan A, Wu Y, *et al*. Accuracy of the Patient Health Questionnaire-9 for screening to detect major depression: updated systematic review and individual participant data meta-analysis. BMJ 2021;375:n2183. doi:10.1136/bmj.n2183, PMID:34610915.

[21] Oyapero A, Erinoso O, Osoba M, Ebuka A, Olasunkanmi O, Ekerin O, Oyapero O, Omotoye I. Prevalence and predictors of depression and oral health related quality of life among patients living with HIV/AIDS in Nigeria: modifying influence of tobacco use. PAMJ-One Health 2023;11:5. doi:10.11604/pamj-oh.2023.11.5.39401.

[22] Abdisa E, Tolesa T, Abadiga M. Prevalence of Depressive Symptoms and Its Associated Factors among People Living with HIV Attending Public Hospitals of Nekemte Town, Western Ethiopia, 2021. Behav Neurol 2021;2021:8854791. doi:10.1155/2021/8854791, PMID:34306251.

[23] Necho M, Zenebe Y, Tiruneh C, Ayano G, Yimam B. The Global Landscape of the Burden of Depressive Symptoms/Major Depression in Individuals Living With HIV/AIDs and Its Effect on Antiretroviral Medication Adherence: An Umbrella Review. Front Psychiatry 2022;13:814360. doi:10.3389/fpsyt.2022.814360, PMID:35633778.

[24] Ross JL, Jiamsakul A, Avihingsanon A, Lee MP, Ditangco R, Choi JY, *et al*. Substance use, Stigma, Depression and Disability (S2D2) study group of IeDEA Asia-Pacific. Prevalence and Risks of Depression and Substance Use Among Adults Living with HIV in the Asia-Pacific Region. AIDS Behav 2022;26(12):3862–3877. doi:10.1007/s10461-022-03714-5.

[25] Ngum PA, Fon PN, Ngu RC, Verla VS, Luma HN. Depression Among HIV/AIDS Patients on Highly Active Antiretroviral Therapy in the Southwest Regional Hospitals of Cameroon: A Cross-Sectional Study. Neurol Ther 2017;6(1):103–114. doi:10.1007/s40120-017-0065-9, PMID:28316064.

[26] Obadeji A, Ogunlesi AO, Adebowale TO. Prevalence and Predictors of Depression in People living with HIV/AIDS Attending an Outpatient Clinic in Nigeria. Iran J Psychiatry Behav Sci 2014;8(1):26–31. PMID:24995027.

[27] Ware D, Rueda S, Plankey M, Surkan P, Okafor CN, Teplin L, *et al*. The longitudinal impact of employment, retirement and disability status on depressive symptoms among men living with HIV in the Multicenter AIDS Cohort Study. PLoS One 2020;15(10):e0239291. doi:10.1371/journal.pone.0239291, PMID:33007781.

[28] Onazi O, Swomen HE. The radio: a tool for violence prevention in Jos, Nigeria. Med ConflSurviv 2011;27(1):5–8. doi:10.1080/13623699.2011.562391, PMID:21721341.

[29] Oladosu RO, Abdulkadir M, Haruna A. Urban Development Profile of Jos Tin City, Nigeria. Int. J. Res. Sci. Innov. Appl. Sci 2023;7(6):656–667.

[30] Turan B, Rice WS, Crockett KB, Johnson M, Neilands TB, Ross SN, *et al*. Longitudinal association between internalized HIV stigma and antiretroviral therapy adherence for women living with HIV: the mediating role of depression. AIDS 2019;33(3):571–576. doi:10.1097/QAD.0000000000002071, PMID:30702521.

[31] Yuan GF, Qiao S, Li X. Bridging internalized HIV stigma and depressive symptoms among people living with HIV in China during the COVID-19 pandemic: a network analysis. Front Public Health 2023;11:1306414. doi:10.3389/fpubh.2023.1306414, PMID:38249397.