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Depression among people with HIV/AIDS in Northwest Ethiopia: A comparative cross-sectional study

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Abstract

Objectives: The objective of this study was to compare depression among people with HIV/AIDS and the general population sample. We also assessed the factors associated with depression in both HIV/AIDS and the general population sample.

Design: A comparative cross-sectional study was conducted.

Settings: Antiretroviral therapy clinics in three primary healthcare facilities and semi-urban area in Northwest Ethiopia.

Participants: A total of 1115 participants (558 for HIV-positive sample and 557 for general population comparison group) aged 18 years and above were recruited. From the total sample size, 1,026 participants (530 from the HIV-positive sample and 496 from the general population comparison group) completed the interview. Individuals with known HIV-positive status were excluded from the general population comparison group.

Outcome measure: Patient Health Questionnaire (PHQ-9) was used to assess depression. The proportion of depression was compared between samples of the general population and people living with HIV/AIDS using chi-squared statistics. Multivariable logistic regression analysis was done to examine the associated factors.

Results: The overall proportion of depression was 13.3% (11.2 – 15.4%). The proportion was significantly higher in people living with HIV/AIDS, 16.6% (13.4 – 19.8%) compared to the community sample, 9.7% (7.1 – 12.3%), p = 0.001. The difference was significant in the multivariable logistic regression where the odds of depression in people with HIV/AIDS was 1.7 times more than the community sample. Variables significantly associated with depression for the overall sample were older age, being single, divorced/widowed, and poor social support.

Conclusions: Depression was higher in people with HIV/AIDS compared to the general population. It is necessary to include mental healthcare and screening for depression in routine HIV/AIDS care.

Keywords: Depression, HIV/AIDS, Comparative study; Co-morbidity; Ethiopia

Strengths and limitations of this study

- This study provides evidence comparing depression among people with HIV/AIDS and the general population.
- Matching of variables between the study and comparison group was not employed.
- We were not able to exclude those who are HIV positive but who did not know their status in the comparison group.
- Due to the cross-sectional nature of the study, we cannot report causal relationships.

1. Introduction

HIV/AIDS continues to be a global public health threat with more than 75 million infections and 32 million AIDS-related deaths since the start of the epidemic.[1 2] On the other hand, depression is also a major public health issue and has been considered as a global crisis because of its high contribution to the disease burden, high comorbidities with other medical conditions, and associated disabilities.[3 4] The comorbidity of depression and HIV/AIDS is common that ranged between 12% - 63%.[5-7] This was more pronounced in low resource settings, particularly in Sub-Saharan Africa.[8 9] A global systematic review and meta-analysis also reported 31% of depression in people with HIV/AIDS.[10] The prevalence of depression in people with HIV/AIDS has been reported as at least twice that of the general population. [5 11] This comorbidity between depression and HIV/AIDS have significant consequences in reducing in antiretroviral therapy (ART) responses, interfering in daily life, and leading to poor quality of life.[12-14]

The magnitude of depression among HIV/AIDS patients is disproportionately high and its effect is mostly associated with poor disease progress and poor quality of life. This comorbidity is

associated with multiple factors including sociodemographic, psychosocial, and clinical factors.[15-18] For instance, people living with HIV who received ART without HIV counseling and testing services are more likely to develop depression.[19] Female gender and recent negative life events are also known contributors to depression in HIV/AIDS patients.[20] However, depression remains underdiagnosed in people with HIV/AIDS.[21]

Depression can be prevented and treated with available resources at the primary care level if detected early and the important factors are identified. To prevent and manage depression in HIV/AIDS, the most important contributing factors need to be explored. Despite the high prevalence and negative consequences of depression among HIV-positive individuals, there is substandard care for depression in most low-income countries HIV care programs.[22-24]

In Ethiopia, the prevalence of depression was reported 14.6 – 48.6% among people living with HIV/AIDS[25-27] and 9.1% in the general population.[16] However, there was no study found that compares depression in HIV-positive people. It is important to see if there is any significant difference in prevalence and possible modifiable factors of depression between HIV-positive people and the general population. Therefore, the objectives of this study were:

1. To assess the level of depression among HIV-positive individuals in the ART clinic compared to the general population.
2. To identify factors associated with depression in HIV-positive people and the general population.

2. Methods and materials

2.1. Study design and setting

A comparative cross-sectional study was conducted in Mecha Demographic Surveillance and Field Research Center (MDSFRC). The site is in Mecha district, Northwest Ethiopia which is 540 kilometers away from Addis Ababa. MDSFRC is one of the newly established research centers in Bahir Dar University. We recruited people with HIV/AIDS from the adult ART clinics in the district and the comparisons from the general population.

2.2. Participants

HIV-positive individuals aged 18 years and above (69.8% Female) in the adult ART clinics of the district were included in the study group. For the general population comparison group, adult residents of Merawi town (a town in Mecha district) aged 18 years and above (48.4% Female) who resided for at least six months were included. In the comparison group, individuals with known HIV-positive status were excluded.

2.3. Data collection and procedures

Data collection was through face-to-face interviews by trained data collectors in March 2018. Clinical data were retrieved from the participants' medical records. Participants were assured of confidentiality and the anonymity of the questionnaire was maintained. Supervisors and data collectors counterchecked the questionnaire every day for its completeness. Sample size was calculated using Epi-Info by considering 80% power, 95% confidence interval, 9.1% depression in the general population,[16] 14.9% depression in HIV positive people,[28] 10% non-response rate, and 1:1 ratio of the study and comparative groups to detect 1.7 odds of depression in the study

group. The final sample size was 1115 (558 for HIV positive sample and 557 general population comparison group).

In the community comparison group, we selected administrative villages from Merawi town by multi-stage sampling method. We randomly selected the households from the administrative villages using the registration of MDSFRC. We selected one participant using lottery method for those households with more than one eligible participant. For the study group, around 1200 individuals were estimated to attend their ART follow up during the data collection period. We used a systematic random sampling method to select participants in every two individuals based on their appointment from the ART clinic registration logbook.

2.4. Variables and Measurements

We measured depression by Patient Health Questionnaire-9 (PHQ-9). PHQ-9 is a tool with nine items and validated in the Ethiopian population with good psychometric properties (86% sensitivity and 67% specificity with 10 cut-off point)[29]. Severity of depressive symptoms were also described based on PHQ-9 score (0 – 4 = no depressive symptoms, 5 – 9 = mild depressive symptoms, 10 – 14 = moderate depressive symptoms, 15 – 19 = moderately severe symptoms, and 20+ = severe depressive symptoms).[30] The tool also had good reliability in the current study (Cronbach's Alpha = 0.79).

The independent variables were:

Socio-demographic variables: sex, age, marital status, educational status, perceived relative income

Psychosocial variables: social support, alcohol abuse, and khat chewing

HIV related variables: CD4 level, duration of HIV-positive status and ART use, ART regimen, and presence of opportunistic infections

Social support was assessed using Oslo Social Support Scale (OSSS-3), three items scale, has a sum score ranges from 3 – 14 (poor social support = 3 – 8, intermediate social support = 9 – 11, and strong social support = 12 – 14).[31] Perceived general quality of life was assessed by asking the participants to rate their quality of life, adapted from the World Health Organization's quality of life assessment tool.[32] Relative wealth of the participants was assessed by asking them what they perceived about their wealth in relation to others in their neighborhood.[33] Problematic alcohol use was assessed by Alcohol Use Disorder Identification Test-Consumption (AUDIT – C) which is a 3-items scale with 72% specificity and 86% sensitivity for men, and 94% specificity and 66% sensitivity for women.[34 35]

2.5. Analysis

Data entry was done with Epi info version 7(double entry) and analysis was done with SPSS-21. Chi-squared test was used to compare simple frequencies in between groups. We run univariate logistic regression for each variable to select variables (p-value < 0.2) for the final model[36]. Multivariable logistic regression analysis was done to identify the associated variables. The strength of associations was indicated by OR (odds ratio) with a 95% confidence interval. Variables with p-values < 0.05 were considered as statistically significant.

2.6. Patient and public involvement

The participants were not involved in the design, conduct, reporting, or dissemination plans of this research.

3. Results

3.1. Socio-demographic characteristics of the participants

From the total of 1,115 participants, 1026(496 from the general population and 530 from the ART clinics) agreed to participate in the study. The reasons for non-response were lack of time to

complete the interview (n = 47), no interest to participate (n = 23), and withdraw the interview without giving reason (n = 19). The mean age of participants was 38.85 years (SD ± 10.72) and most of them were in the age group of 25 – 44 years. The overall divorce and widow rates were 22.9% and 7.6% respectively. This is significantly higher in the HIV positive sample (18.3% and 11.3%) as compared with the community sample (4.6% and 3.6%), $p < 0.001$. (Table 1)

Table 1: Socio-demographic characteristics of the respondents (N = 1026)

Variables		Sample type		Overall	
		Community n(%)	HIV n(%)	N(%)	p-value(χ^2)
Sex	Male	256(51.6)	160(30.2)	416(40.5)	< 0.001
	Female	240(48.4)	370(69.8)	610(59.5)	
Age	< 25 years	109(22)	22(4.2)	131(12.8)	
	25 – 44 years	305(61.5)	382(72.1)	687(67)	< 0.001
	Above 44 years	82(16.5)	126(23.8)	208(20.3)	
Family size	One (alone)	100(20.2)	124(23.4)	224(21.8)	
	Two to five	352(71)	369(69.6)	721(70.3)	0.29
	More than five	44(8.9)	37(7)	81(7.9)	
Family income compared to others	Better	20(4)	13(2.5)	33(3.2)	
	Average	257(51.8)	138(26)	395(38.5)	< 0.001
	Poor	219(44.2)	379(71.5)	598(58.3)	
Marital status	Married	276(55.6)	235(44.3)	511(49.8)	
	Single	155(31.3)	47(9.5)	202(19.7	< 0.001
	Divorced	47(4.6)	188(18.3)	235(22.9)	
	Widowed	18(3.6)	60(11.3)	78(7.6)	
Education	Unable to read & write	138(27.8)	165(31.1)	303(29.5)	0.2
	Informal education	61(12.3)	79(14.9)	140(13.6)	
	Elementary school	99(20)	103(19.4)	202(19.7)	
	Secondary school	126(25.4)	106(20)	232(22.6)	
	College and above	72(15.5)	77(14.5)	149(14.5)	

3.2. Psychosocial and related characteristics

Khat (Catha edulis, evergreen, psychoactive leaf which is commonly cultivated in East Africa) was chewed by 6% of participants (9.5% in the community sample and 2.8% in the HIV sample); $p < 0.001$. The HIV positive participants reported relatively good social support as compared to the community participants. (Table 2)

Table 2: Psychosocial factors of the participants (N = 1026)

Variables		Sample type		Overall	
		Community n(%)	HIV n(%)	N(%)	p-value(χ^2)
Khat chewing	Never	449(90.5)	515(97.2)	964(94)	< 0.001
	Yes	47(9.5)	15(2.8)	62(6)	
Problematic alcohol	No	427(86.1)	501(94.5)	928(90.4)	< 0.001
use	Yes	69(13.9)	29(5.5)	98(9.6)	
Social support	Poor support	259(52.2)	215(40.6)	474(46.2)	< 0.001
	Intermediate support	201(40.5)	246(46.4)	447(43.6)	
	Strong support	36(7.3)	69(13)	105(10.2)	
Depressive symptoms	None	287(57.9)	313(59.1)	600(58.5)	<0.001
	Mild	161(32.5)	129(24.3)	290(28.3)	
	Moderate	23(4.6)	62(11.7)	85(8.3)	
	Moderately severe	21(4.2)	24(4.5)	45(4.4)	
	Severe	4(0.8)	2(0.4)	6(0.6)	

3.3. HIV and other related characteristics of HIV positive participants

The mean duration since HIV status determined was 79.9 months (SD ± 35.9 months) with a minimum of 2 months and a maximum of 159 months. The mean duration since ART started was 66.4 months (SD ± 35.9 months) with a minimum of 1 month and a maximum of 144 months. The commonly prescribed ART regimens were 1e and 1c, and opportunistic infections in the last one month prior to the data collection time were reported by 12(2.3%) of participants. (Table 3)

Table 3: HIV related factors of the ART clinic participants (n = 530)

Variables		Depression		
		No n(%)	Yes n(%)	p-value(χ^2)
Duration since knowing HIV status	Less than 5 years	132(24.9)	19(3.6)	0.1
	5 years and above	310(58.5)	69(13)	
Duration of ART	Less than 5 years	191(36)	33 (6.2)	0.3
	5 years and above	251(47.4)	55(10.4)	
ART drug regimen	1c	166(31.3)	35(6.6)	0.8
	1d	54(10.2)	13(2.5)	
	1e	197(37.2)	36(6.8)	
	1f	25(4.7)	4(0.8)	
Opportunistic infections	Yes	4(0.8)	8(1.5)	<0.001
	No	438(82.6)	80(15.1)	
CD4 level	Less than 500	228(43)	61(11.5)	0.002
	500 and above	214(40.4)	27(5.1)	

1c = Zidovudine (AZT) + Lamivudine (3TC) + Nevirapine (NVP); 1d = AZT + 3TC + Efavirenz (EFV); 1e = Tenofovir (TDF) + 3TC+EFV; 1f = TDF+3TC+NVP

3.4. Prevalence and associated factors of depression

The overall prevalence of depression was 13.3% (11.2 – 15.4%). The prevalence was significantly higher in people with HIV/AIDS, 16.6% (13.4 – 19.8%) as compared to the community sample, 9.7% (7.1 – 12.3%), p = 0.001. Variables significantly associated with depression were older age [AOR = 2.3, 95% CI: 1.1, 5.1], HIV positive sample [AOR = 1.7, 95% CI: 1.1, 2.6], being single [AOR = 1.9, 95% CI: 1.1, 3.5], divorced/widowed [AOR = 2.3, 95% CI: 1.5, 3.5], poor social support [AOR = 3.9, 95% CI: 1.7, 9.8]. (Table 4)

Table 4: Factors associated with depression (N=1026)

Variables		Depression		AOR (95% CI)	p-value
		No	Yes		
Sample type	Community sample	448	48	1	
	ART clinic sample	442	88	**1.7(1.1 – 2.6)**	0.01
Sex	Male	370	46	1	
	Female	520	90	0.9(0.6 – 1.5)	0.84
Age	Less than 25 years	117	14	1	
	25 – 44 years	609	78	1.1(0.5 – 2.1)	0.87
	45 years and above	164	44	**2.3(1.1 – 5.1)**	0.03
Khat chewing	Never	835	129	1	
	Yes	55	7	0.9(0.4 – 2.1)	0.84
Marital status	Married	467	44	1	
	Single	177	25	**1.9(1.1 – 3.5)**	0.03
	Divorced/widowed	246	67	**2.3(1.5 – 3.5)**	< 0.001
Problematic alcohol use	No	805	123	1	
	Yes	85	13	1.2(0.6 – 2.3)	0.59
Social support	Poor support	393	81	**3.9(1.7 – 9.6)**	0.002
	Intermediate support	398	49	2.4(0.96– 5.7)	0.06
	High support	99	6	1	
Perceived quality of	Poor	443	90	1.4(0.8 – 2.4)	0.19
compared to others	Not good – not bad	13	21	1.8(0.9 – 3.3)	0.08
	Good	316	25	1	

4. Discussion

This study reported that the prevalence of depression is significantly higher in HIV-positive participants (16.6%) compared to the general population sample (9.7%). This variation was also indicated in the multivariable logistic regression analysis where the odds of depression in people with HIV/AIDS was 1.7 times higher than the community sample. The additional burdens in HIV-positive participants including opportunistic infections, ART drug side effects, and lowered level of CD4 count (54.5% of HIV-positive participants have less than 500 CD4) may contribute to this increased prevalence of depression in the HIV-positive sample. The finding is in-line with Chinese study 18.33%,[37] higher than Ugandan 8.1% and USA 12.2%[38 39] studies, and lower than the Cameroon study 26.7% and other sub-Saharan countries 26 – 28%.[40-42]

Multiple conditions including HIV-related stigma,[43-45] poor adherence to antiretroviral therapy,[46-48], and the direct effect of the virus itself[49] are possible reasons for the excess odds of depression in HIV-positive individuals. New perspectives towards non-medical services and resource allocation,[50] and interventions focusing on reduction of risk behavior and social stigma would decrease the prevalence of depression in HIV-positive individuals.[51] The advancements in HIV prevention and treatment are becoming promising in ending the HIV epidemic. However, this may be difficult to achieve without addressing depression and other mental health issues in HIV/AIDS care.

Marital status, age, and social support were important factors associated with depression in the overall sample of our study. The odds of depression in single and divorced/widowed participants was nearly twofold as compared to their married counterparts. Marital tragedies are the most stressful events[52] that can lead to lead to a sense of insecurity and hopelessness. The odds of having

depression at the age of 45 years and above was more than twofold as compared to those with younger age (25 years and below). Poor social support is also strongly and positively associated with depression in which participants with poor social support were about 4 times more likely to have depression as compared with high social support. Social interaction between family members and the family's ability to react positively to life changes are important to reassuring individuals and maintaining social cohesion.[53] On the other hand, if this social connectedness gets loose, the individual might feel lonely and depressed. This finding is supported by the study in Ethiopia and other sub-Saharan countries [41 54].

In general, this study provided evidence about depression in HIV/AIDS patients by comparing it with the general population. In the current study, gender, perceived quality of life, and substance use (khat chewing and alcohol, do not involve intravenous administration) were not statistically significant. However, recent finding indicates HIV-positive individuals with drug injection were more likely to have depression [55].

4.1. Limitations

The study has some limitations to take into consideration in interpretations of the result. The first limitation is with matching. It would have been better if we did a matching of important variables for depression such as sex and age in both groups. The other potential limitation is that we did not conduct HIV testing in the general population comparison group to exclude those with positive HIV test results. Though we excluded those who reported their HIV positive status in the comparison group, we were not able to exclude those who are HIV positive but who did not know their status.

5. Conclusions

Depression is significantly higher in people with HIV/AIDS compared to the general population. The higher prevalence of depression in people with HIV/AIDS is an important public health issue to consider incorporating mental health care and screening in routine HIV/AIDS care.

Declarations

Ethics approval and consent to participate

Ethical clearance was obtained from the College of Medicine and Health Sciences ethical review committee of Bahir Dar University. Formal permission letter was obtained from the University and local administration. Participants were informed about the purpose of the study, confidentiality, and their rights to withdraw from the interview at any time they want. Informed consent was obtained from each participant. To maintain confidentiality, the questionnaire was anonymous, and the data were kept in a secure place.

Availability of data and material

The data related to this research will be available upon reasonable request.

Competing Interests

The authors declare that they have no competing interests.

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Author Contributions

All authors (TM, HB, and WF) equally contributed from the conception to the completion of this project.

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Depression among people with HIV/AIDS in Northwest Ethiopia: A comparative cross-sectional study

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STROBE 2007 (v4) Statement—Checklist of items that should be included in reports of *cross-sectional studies*

Section/Topic	Item #	Recommendation	Reported on page #
Title and abstract	1	(*a*) Indicate the study's design with a commonly used term in the title or the abstract	1
		(*b*) Provide in the abstract an informative and balanced summary of what was done and what was found	2
Introduction			
Background/rationale	2	Explain the scientific background and rationale for the investigation being reported	3 & 4
Objectives	3	State specific objectives, including any prespecified hypotheses	4
Methods			
Study design	4	Present key elements of study design early in the paper	5
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection	5
Participants	6	(*a*) Give the eligibility criteria, and the sources and methods of selection of participants	5
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable	6
Data sources/ measurement	8	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group	6 & 7
Bias	9	Describe any efforts to address potential sources of bias	*5, 6 & 7*
Study size	10	Explain how the study size was arrived at	5 & 6
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why	7
Statistical methods	12	(*a*) Describe all statistical methods, including those used to control for confounding	7

		(*b*) Describe any methods used to examine subgroups and interactions	N/A
		(*c*) Explain how missing data were addressed	N/A
		(*d*) If applicable, describe analytical methods taking account of sampling strategy	N/A
		(*e*) Describe any sensitivity analyses	N/A
Results			
Participants	13	(a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed	7
		(b) Give reasons for non-participation at each stage	7
		(c) Consider use of a flow diagram	N/A
Descriptive data	14*	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders	7 – 10
		(b) Indicate number of participants with missing data for each variable of interest	N/A
Outcome data	15	Report numbers of outcome events or summary measures	11
Main results	16	(*a*) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included	11
		(*b*) Report category boundaries when continuous variables were categorized	11
		(*c*) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period	N/A
Other analyses	17	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses	N/A
Discussion			
Key results	18	Summarise key results with reference to study objectives	12
Limitations	19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias	13
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence	12 – 14
Generalisability	21	Discuss the generalisability (external validity) of the study results	12 – 14
Other information			
Funding	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based	14

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Depressive symptoms among people with HIV/AIDS in Northwest Ethiopia: Comparative study

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Abstract

Objectives: The objective of this study was to compare depressive symptoms among people with HIV/AIDS and the general population sample. We also assessed the factors associated with depressive symptoms.

Design: A comparative cross-sectional study was conducted.

Settings: Antiretroviral therapy clinics in three primary healthcare facilities and semi-urban area in Northwest Ethiopia.

Participants: A total of 1115 participants (558 people with HIV/AIDS and 557 comparison group) aged 18 years and above were recruited. A total of 1,026 participants (530 people with HIV/AIDS and 496 comparison group) completed the interview. We excluded people with known HIV-positive status from the general comparison group.

Outcome measure: Patient Health Questionnaire (PHQ-9) was used to assess depressive symptoms. The proportion of depressive symptoms was compared between samples of the general population and people living with HIV/AIDS using chi-squared statistics. Multivariable logistic regression analysis was done to examine the associated factors.

Results: The overall prevalence of depressive symptoms was 13.3% (11.2 – 15.4%). The prevalence was significantly higher in people living with HIV/AIDS compared to the community sample (16.6% Vs 12,3%), p = 0.001. The difference was also significant in the multivariable logistic regression (odds ratio = 1.7). For the overall sample, depressive symptoms were significantly associated with older age, being single, marital status, and poor social support.

Conclusions: Depressive symptoms were higher in people with HIV/AIDS compared to the general population. It is necessary to include mental healthcare and screening for depression in routine HIV/AIDS care.

Keywords: Depression, HIV/AIDS, Comparative study; Co-morbidity; Ethiopia

Strengths and limitations of this study

- Having a comparison group is one of the strengths of this study.
- Matching of variables between the study and comparison group was not employed.
- We were not able to exclude those who are HIV positive but who did not know their status in the comparison group.
- Due to the cross-sectional nature of the study, we cannot report causal relationships.

1. Introduction

HIV/AIDS continues to be a global public health threat with more than 75 million infections and 32 million AIDS-related deaths since the start of the epidemic.[1 2] On the other hand, depression is also a major public health issue and has been considered as a global crisis because of its high contribution to the disease burden, high comorbidities with other medical conditions, and associated disabilities.[3 4] The comorbidity of depression and HIV/AIDS is common that ranged between 12% - 63%.[5-7] This was more pronounced in low resource settings, particularly in Sub-Saharan Africa.[8 9] A global systematic review and meta-analysis also reported that 31% of people with HIV/AIDS had depression.[10] The prevalence of depression in people with HIV/AIDS has been reported as at least twice that of the general population. [5 11] The comorbidity between depression and HIV/AIDS has significant consequences in reducing antiretroviral therapy (ART) response that leads to poor quality of life.[12-14]

The magnitude of depression among HIV/AIDS patients is disproportionately high and its effect is mostly associated with poor disease progress and poor quality of life. This comorbidity is associated with multiple factors including sociodemographic, psychosocial, and clinical factors.[15-

[18] For instance, people living with HIV who received ART without HIV counseling and testing services are more likely to develop depression.[19] Female gender and recent negative life events are also known contributors to depression in HIV/AIDS patients.[20] However, depression remains underdiagnosed in people with HIV/AIDS.[21]

Depression can be prevented and treated with available resources at the primary care level. This can be achieved by early detection of depression and identifying important factors associated with depression. To prevent and manage depression in HIV/AIDS, the most important contributing factors need to be explored. Despite the high prevalence and negative consequences of depression among HIV-positive individuals, there is substandard care for depression in most low-income countries HIV care programs.[22-24]

In Ethiopia, the prevalence of depression was reported 14.6 – 48.6% among people living with HIV/AIDS[25-27] and 9.1% in the general population.[16] However, there was no study that compares depression in HIV-positive people and general population. It is important to see if there is any significant difference in prevalence and possible modifiable factors of depressive symptoms between HIV-positive people and the general population. Therefore, the objectives of this study were:

1. To assess the level of depressive symptoms among HIV-positive individuals in the ART clinic compared to the general population.
2. To identify factors associated with depressive symptoms in HIV-positive people and the general population.

2. Methods and materials

2.1. Study design and setting

A comparative cross-sectional study was conducted in Mecha Demographic Surveillance and Field Research Center (MDSFRC). The site is located in Mecha district, Northwest Ethiopia, which is 540 kilometers away from Addis Ababa. MDSFRC is one of the newly established research centers in Bahir Dar University. We recruited people with HIV/AIDS from the adult ART clinics in the district and the comparisons from the general population.

2.2. Participants

People living with HIV/AIDS aged 18 years and above (69.8% Female) in the adult ART clinics of the district were included in the study group. For the general population comparison group, adult residents of Merawi town (a town in Mecha district) aged 18 years and above (48.4% Female) who resided for at least six months were included. In the comparison group, individuals with known HIV-positive status were excluded.

2.3. Data collection and procedures

Data collection was conducted through face-to-face interviews by trained data collectors in March 2018. Clinical data were retrieved from the participants' medical records. Participants were assured of confidentiality and the anonymity of the questionnaire. Supervisors and data collectors counterchecked the questionnaire every day for its completeness. Sample size was calculated using Epi-Info by considering 80% power, 95% confidence interval, 9.1% depression in the general population,[16] 14.9% depression in HIV positive people,[28] 10% non-response rate, and 1:1 ratio of the study and comparative groups to detect 1.7 odds of depression in the study group. The final sample size was 1115 (558 people with HIV/AIDS and 557 comparison group).

In the community comparison group, we selected administrative villages from Merawi town by multi-stage sampling method. We randomly selected the households from the administrative villages using the registration of MDSFRC. We selected one participant using lottery method for those households with more than one eligible participant. For the study group, around 1200 individuals were estimated to attend their ART follow up during the data collection period. We used a systematic random sampling method to select participants in every two individuals based on their appointment from the ART clinic registration logbook.

2.4. Variables and Measurements

We measured depressive symptoms by Patient Health Questionnaire-9 (PHQ-9). PHQ-9 is a tool with nine items and validated in the Ethiopian population with good psychometric properties (86% sensitivity and 67% specificity with 10 cut-off point)[29]. Severity of depressive symptoms were also described based on PHQ-9 score (0 – 4 = no depressive symptoms, 5 – 9 = mild depressive symptoms, 10 – 14 = moderate depressive symptoms, 15 – 19 = moderately severe symptoms, and 20+ = severe depressive symptoms).[30] The tool also had good reliability in the current study (Cronbach's Alpha = 0.79). We have used PHQ-9 at cut off score of 10 to identify depressive symptoms that require clinical intervention (moderate to severe depressive symptoms).

The independent variables were:

Socio-demographic variables: sex, age, marital status, educational status, perceived relative income

Psychosocial variables: social support, alcohol abuse, and khat chewing

HIV related variables: CD4 level, duration of HIV-positive status and ART use, ART regimen, and presence of opportunistic infections

Social support was assessed using Oslo Social Support Scale (OSSS-3), three items scale, has a sum score ranges from 3 – 14 (poor social support = 3 – 8, intermediate social support = 9 – 11, and strong social support = 12 – 14).[31] Perceived general quality of life was assessed by asking the participants to rate their quality of life, adapted from the World Health Organization's quality of life assessment tool.[32] Relative wealth of the participants was assessed by asking what they perceived about their wealth in relation to others in their neighborhood.[33] Problematic alcohol use was assessed by Alcohol Use Disorder Identification Test-Consumption (AUDIT – C) which is a 3-items scale with 72% specificity and 86% sensitivity for men, and 94% specificity and 66% sensitivity for women.[34 35]

2.5. Analysis

Data entry was done with Epi info version 7(double entry) and analysis was done with SPSS-21. Chi-squared test was used to compare simple frequencies in between groups. We ran univariate logistic regression for each variable to select variables (p-value < 0.2) for the final model[36]. Multivariable logistic regression analysis was done to identify the associated variables. The strength of associations was indicated by OR (odds ratio) with a 95% confidence interval. Variables with p-values < 0.05 were considered as statistically significant.

2.6. Patient and public involvement

The participants were not involved in the design, conduct, reporting, or dissemination plans of this research.

3. Results

3.1. Socio-demographic characteristics of the participants

From the total of 1,115 participants, 1026(496 from the general population and 530 from the ART clinics) agreed to participate in the study. The reasons for non-response were lack of time to

complete the interview (n = 47), no interest to participate (n = 23), and withdraw the interview without giving reason (n = 19). The mean age of participants was 38.85 years (SD ± 10.72) and most of them were in the age group of 25 – 44 years. The overall divorce and widow rates were 22.9% and 7.6% respectively. This is significantly higher in the HIV positive sample (18.3% and 11.3%) as compared with the community sample (4.6% and 3.6%), $p < 0.001$. (Table 1)

Table 1: Socio-demographic characteristics of the respondents (N = 1026)

Variables		Sample type		Overall	
		Community n(%)	HIV n(%)	N(%)	p-value(χ^2)
Sex	Male	256(51.6)	160(30.2)	416(40.5)	< 0.001
	Female	240(48.4)	370(69.8)	610(59.5)	
Age	< 25 years	109(22)	22(4.2)	131(12.8)	
	25 – 44 years	305(61.5)	382(72.1)	687(67)	< 0.001
	Above 44 years	82(16.5)	126(23.8)	208(20.3)	
Family size	One (alone)	100(20.2)	124(23.4)	224(21.8)	
	Two to five	352(71)	369(69.6)	721(70.3)	0.29
	More than five	44(8.9)	37(7)	81(7.9)	
Family income compared to others	Better	20(4)	13(2.5)	33(3.2)	
	Average	257(51.8)	138(26)	395(38.5)	< 0.001
	Poor	219(44.2)	379(71.5)	598(58.3)	
Marital status	Married	276(55.6)	235(44.3)	511(49.8)	
	Single	155(31.3)	47(9.5)	202(19.7	< 0.001
	Divorced	47(4.6)	188(18.3)	235(22.9)	
	Widowed	18(3.6)	60(11.3)	78(7.6)	
Education	Unable to read & write	138(27.8)	165(31.1)	303(29.5)	0.2
	Informal education	61(12.3)	79(14.9)	140(13.6)	
	Elementary school	99(20)	103(19.4)	202(19.7)	
	Secondary school	126(25.4)	106(20)	232(22.6)	
	College and above	72(15.5)	77(14.5)	149(14.5)	

3.2. Psychosocial and related characteristics

Khat (Catha edulis, evergreen, psychoactive leaf which is commonly cultivated in East Africa) was chewed by 6% of participants (9.5% in the community sample and 2.8% in the HIV sample); $p < 0.001$. The HIV positive participants reported relatively good social support as compared to the community participants. (Table 2)

Table 2: Psychosocial factors of the participants (N = 1026)

Variables		Sample type		Overall	
		Community n(%)	HIV n(%)	N(%)	p-value(χ^2)
Khat chewing	Never	449(90.5)	515(97.2)	964(94)	< 0.001
	Yes	47(9.5)	15(2.8)	62(6)	
Problematic alcohol use	No	427(86.1)	501(94.5)	928(90.4)	< 0.001
	Yes	69(13.9)	29(5.5)	98(9.6)	
Social support	Poor support	259(52.2)	215(40.6)	474(46.2)	< 0.001
	Intermediate support	201(40.5)	246(46.4)	447(43.6)	
	Strong support	36(7.3)	69(13)	105(10.2)	
Depressive symptoms	None/mild	448(90.3)	442(83.4)	890(86.7)	0.001
	Moderate	23(4.6)	62(11.7)	85(8.3)	
	Moderately severe	21(4.2)	24(4.5)	45(4.4)	
	Severe	4(0.8)	2(0.4)	6(0.6)	

3.3. HIV and other related characteristics of HIV positive participants

The median duration since HIV status determined was 84 months (interquartile range = 60 months) with a minimum of 2 months and a maximum of 159 months. The median duration since ART started was 60 months (interquartile range = 60 months) with a minimum of 1 month and a maximum of 144 months. The commonly prescribed ART regimens were 1e and 1c, and opportunistic infections in the last one month prior to the data collection time were reported by 12(2.3%) of participants. (Table 3)

Table 3: HIV related factors of the ART clinic participants (n = 530)

Variables		Depressive symptoms		
		No n(%)	Yes n(%)	p-value(χ^2)
Duration since knowing HIV status	Less than 5 years	132(24.9)	19(3.6)	0.1
	5 years and above	310(58.5)	69(13)	
Duration of ART	Less than 5 years	191(36)	33 (6.2)	0.3
	5 years and above	251(47.4)	55(10.4)	
ART drug regimen	1c	166(31.3)	35(6.6)	0.8
	1d	54(10.2)	13(2.5)	
	1e	197(37.2)	36(6.8)	
	1f	25(4.7)	4(0.8)	
Opportunistic infections	Yes	4(0.8)	8(1.5)	<0.001
	No	438(82.6)	80(15.1)	
CD4 level	Less than 500	228(43)	61(11.5)	0.002
	500 and above	214(40.4)	27(5.1)	

1c = Zidovudine (AZT) + Lamivudine (3TC) + Nevirapine (NVP); 1d = AZT + 3TC + Efavirenz (EFV); 1e = Tenofovir (TDF) + 3TC+EFV; 1f = TDF+3TC+NVP

3.4. Prevalence and associated factors of depressive symptoms

The overall prevalence of depressive symptoms was 13.3% (11.2 – 15.4%). The prevalence was significantly higher in people with HIV/AIDS, 16.6% (13.4 – 19.8%) as compared to the community sample, 9.7% (7.1 – 12.3%), p = 0.001. Variables significantly associated with depressive symptoms were older age [AOR = 2.3, 95% CI: 1.1, 5.1], HIV positive sample [AOR = 1.7, 95% CI: 1.1, 2.6], being single [AOR = 1.9, 95% CI: 1.1, 3.5], divorced/widowed [AOR = 2.3, 95% CI: 1.5, 3.5], poor social support [AOR = 3.9, 95% CI: 1.7, 9.8]. (Table 4)

Table 4: Factors associated with depressive symptoms (N=1026)

Variables		Depressive symptoms		AOR (95% CI)	p-value
		No	Yes		
Sample type	Community sample	448	48	1	
	ART clinic sample	442	88	**1.7(1.1 – 2.6)**	0.01
Sex	Male	370	46	1	
	Female	520	90	0.9(0.6 – 1.5)	0.84
Age	Less than 25 years	117	14	1	
	25 – 44 years	609	78	1.1(0.5 – 2.1)	0.87
	45 years and above	164	44	**2.3(1.1 – 5.1)**	0.03
Khat chewing	Never	835	129	1	
	Yes	55	7	0.9(0.4 – 2.1)	0.84
Marital status	Married	467	44	1	
	Single	177	25	**1.9(1.1 – 3.5)**	0.03
	Divorced/widowed	246	67	**2.3(1.5 – 3.5)**	< 0.001
Problematic alcohol use	No	805	123	1	
	Yes	85	13	1.2(0.6 – 2.3)	0.59
Social support	Poor support	393	81	**3.9(1.7 – 9.6)**	0.002
	Intermediate support	398	49	2.4(0.96– 5.7)	0.06
	High support	99	6	1	
Perceived quality of life	Poor	443	90	1.4(0.8 – 2.4)	0.19
compared to others	Not good – not bad	13	21	1.8(0.9 – 3.3)	0.08
	Good	316	25	1	

4. Discussion

This study reported that the prevalence of moderate to severe depressive symptoms is significantly higher in HIV-positive participants (16.6%) compared to the general population sample (9.7%). This variation was also indicated in the multivariable logistic regression analysis where the odds of depressive symptoms in people with HIV/AIDS was 1.7 times higher than the community sample. The additional burdens in HIV-positive participants including opportunistic infections, ART drug side effects, and lowered level of CD4 count (54.5% of HIV-positive participants have less than 500 CD4) may contribute to this increased prevalence of depressive symptoms in the HIV-positive sample. The finding is in-line with Chinese study (18.33%),[37] higher than Ugandan (8.1%) and USA (12.2%)[38 39] studies, and lower than the Cameroon study (26.7%) and other sub-Saharan countries (26 – 28%).[40-42]

Multiple conditions including HIV-related stigma,[43-45] poor adherence to antiretroviral therapy,[46-48], and the direct effect of the virus[49] are possible reasons for the excess odds of depressive symptoms in HIV-positive individuals. New perspectives towards non-medical services and resource allocation,[50] and interventions focusing on reduction of risk behavior and social stigma would decrease the prevalence of depressive symptoms in HIV-positive individuals.[51] The advancements in HIV prevention and treatment are becoming promising in ending the HIV epidemic. However, this might be difficult to achieve without addressing depression and other mental health issues in HIV/AIDS care.

Marital status, age, and social support were important factors associated with depressive symptoms in the overall sample of this study. The odds of depressive symptoms in single and divorced/widowed participants was nearly twofold as compared to their married counterparts.

Marital tragedies are the most stressful events[52] that can lead to a sense of insecurity and hopelessness. The odds of having depressive symptoms at the age of 45 years and above was more than twofold as compared to those with younger age (25 years and below). Poor social support is also strongly and positively associated with depressive symptoms in which participants with poor social support were about 4 times more likely to have depressive symptoms compared to participants with high social support. Social interaction between family members and the family's ability to react positively to life changes are important to reassuring individuals and maintaining social cohesion.[53] On the other hand, if this social connectedness gets loose, the individual might feel lonely and depressed. This finding is supported by the study in Ethiopia and other sub-Saharan countries [41 54].

In general, this study provided evidence about depressive symptoms in HIV/AIDS patients by comparing it with the general population. In the current study, gender, perceived quality of life compared to others, and substance use (khat chewing and alcohol, do not involve intravenous administration) were not statistically significant. However, recent finding indicates HIV-positive individuals with drug injection were more likely to have depression [55].

4.1. Limitations

The study has some limitations to take into consideration in interpretations of the result. The first limitation is with matching. It would have been better if we did a matching of important variables for depression such as sex and age in both groups. The other potential limitation is that we did not conduct HIV testing in the general population comparison group to exclude those with positive HIV test results. Though we excluded those who reported their HIV positive status in the comparison group, we were not able to exclude those who are HIV positive but who did not know their status.

5. Conclusions

Depressive symptoms are significantly higher in people with HIV/AIDS compared to the general population. The higher prevalence of depressive symptoms in people with HIV/AIDS is an important public health issue that urges the incorporation of mental health care and depression screening in routine HIV/AIDS care.

Declarations

Ethics approval and consent to participate

Ethical clearance was obtained from the College of Medicine and Health Sciences ethical review committee of Bahir Dar University. Formal permission letter was obtained from the University and local administration. Participants were informed about the purpose of the study, confidentiality, and their rights to withdraw from the interview at any time they want. Informed consent was obtained from each participant. To maintain confidentiality, the questionnaire was anonymous, and the data were kept in a secure place.

Availability of data and material

The data related to this research will be available upon reasonable request.

Competing Interests

The authors declare that they have no competing interests.

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Author Contributions

All authors (TM, HB, and WF) equally contributed from the conception to the completion of this project.

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Depression among people with HIV/AIDS in Northwest Ethiopia: A comparative cross-sectional study

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STROBE 2007 (v4) Statement—Checklist of items that should be included in reports of *cross-sectional studies*

Section/Topic	Item #	Recommendation	Reported on page #
Title and abstract	1	(*a*) Indicate the study's design with a commonly used term in the title or the abstract	1
		(*b*) Provide in the abstract an informative and balanced summary of what was done and what was found	2
Introduction			
Background/rationale	2	Explain the scientific background and rationale for the investigation being reported	3 & 4
Objectives	3	State specific objectives, including any prespecified hypotheses	4
Methods			
Study design	4	Present key elements of study design early in the paper	5
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection	5
Participants	6	(*a*) Give the eligibility criteria, and the sources and methods of selection of participants	5
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable	6
Data sources/ measurement	8	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group	6 & 7
Bias	9	Describe any efforts to address potential sources of bias	*5, 6 & 7*
Study size	10	Explain how the study size was arrived at	5 & 6
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why	5 – 7
Statistical methods	12	(*a*) Describe all statistical methods, including those used to control for confounding	7

		(*b*) Describe any methods used to examine subgroups and interactions	N/A
		(*c*) Explain how missing data were addressed	N/A
		(*d*) If applicable, describe analytical methods taking account of sampling strategy	N/A
		(*e*) Describe any sensitivity analyses	N/A
Results			
Participants	13	(a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed	5
		(b) Give reasons for non-participation at each stage	7
		(c) Consider use of a flow diagram	N/A
Descriptive data	14*	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders	8 – 10
		(b) Indicate number of participants with missing data for each variable of interest	N/A
Outcome data	15	Report numbers of outcome events or summary measures	12
Main results	16	(*a*) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included	12
		(*b*) Report category boundaries when continuous variables were categorized	8, 10, 12
		(*c*) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period	N/A
Other analyses	17	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses	N/A
Discussion			
Key results	18	Summarise key results with reference to study objectives	13
Limitations	19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias	14
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence	12 – 15
Generalisability	21	Discuss the generalisability (external validity) of the study results	12 – 15
Other information			
Funding	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based	15