

RESEARCH ARTICLE

Open Access



Prevalence and factors associated with severe depressive symptoms in older west African people living with HIV

Charlotte Bernard^{1,2*}, H el ene Font^{1,2}, Z elica Diallo³, Richard Ahonon⁴, Judica el Malick Tine⁵, Franklin N'guessan Abouo³, Aristophane Tanon³, Eug ene Messou⁴, Moussa Seydi⁵, Fran ois Dabis^{1,2}, Nathalie de Rekeneire^{1,2} and the leDEA West Africa Cohort Collaboration

Abstract

Background: Depression is one of the most common psychiatric disorders in people living with HIV (PLHIV). Depression has a negative impact on both mental and physical health and is mainly associated with suboptimal HIV treatment outcomes. To encourage successful aging and the achievement of the 3 × 90 objectives in older PLHIV, the psychological domain must not be neglected. In this context and as data are scarce in West Africa, this study aimed to evaluate the prevalence and the factors associated with severe depressive symptoms in older PLHIV living in this region of the world.

Methods: Data from PLHIV aged ≥50 years and on ART since ≥6 months were collected in three clinics (two in C ote d'Ivoire, one in Senegal) participating in the West Africa International epidemiological Databases to Evaluate AIDS (leDEA) collaboration. The severity of depressive symptoms was measured using the Center for Epidemiological Studies Depression scale (CES-D), and associated factors were identified using logistic regressions.

Results: The median age of the 334 PLHIV included in the study was 56.7 (53.5–61.1), 57.8% were female, and 87.1% had an undetectable viral load. The prevalence of severe depressive symptoms was 17.9% [95% Confidence Interval (95% CI): 13.8–22.0]. PLHIV with severe depressive symptoms were more likely to be unemployed (adjusted Odd Ratio (aOR) = 2.8; 95% CI: 1.4–5.7), and to be current or former tobacco smokers (aOR = 2.6; 95% CI: 1.3–5.4) but were less likely to be overweight or obese (aOR = 0.4; 95% CI: 0.2–0.8).

Conclusions: The prevalence of severe depressive symptoms is high among older PLHIV living in West Africa. Unemployed PLHIV and tobacco smokers should be seen as vulnerable and in need of additional support. Further studies are needed to describe in more details the reality of the aging experience for PLHIV living in SSA. The integration of screening and management of depression in the standard of care of PLHIV is crucial.

Keywords: HIV, Aging, Depression, Sub-Saharan Africa

* Correspondence: charlotte.bernard@u-bordeaux.fr

¹Bordeaux Population Health Research Center, Univ. Bordeaux, Inserm, UMR 1219, F-33000 Bordeaux, France

²Bordeaux Population Health Research Center, Univ. Bordeaux, ISPED, UMR 1219, F-33000 Bordeaux, France

Full list of author information is available at the end of the article



  The Author(s). 2020 **Open Access** This article is licensed under a Creative Commons Attribution 4.0 International License, which permits use, sharing, adaptation, distribution and reproduction in any medium or format, as long as you give appropriate credit to the original author(s) and the source, provide a link to the Creative Commons licence, and indicate if changes were made. The images or other third party material in this article are included in the article's Creative Commons licence, unless indicated otherwise in a credit line to the material. If material is not included in the article's Creative Commons licence and your intended use is not permitted by statutory regulation or exceeds the permitted use, you will need to obtain permission directly from the copyright holder. To view a copy of this licence, visit <http://creativecommons.org/licenses/by/4.0/>. The Creative Commons Public Domain Dedication waiver (<http://creativecommons.org/publicdomain/zero/1.0/>) applies to the data made available in this article, unless otherwise stated in a credit line to the data.

Background

During the two last decades, a dramatic positive change has been observed worldwide in the demographics of people living with HIV (PLHIV) [1]. Increased access and use of HIV medical services and the improvement in antiretroviral therapy (ART) access are the two main reasons for this change. HIV infection is now considered a chronic disease in most settings, including in sub-Saharan Africa (SSA) [1]. PLHIV have a lifespan comparable to that observed in the general population and are getting older.

With aging, PLHIV experience more complications in the physiological domain. The compromised immune system with the involution of the thymus, ART side effects, and polypharmacy are a pathway to explain these complications [2]. Older patients receiving ART are at an increased risk of age-associated non-communicable comorbidities (AANCC), like cardiovascular diseases, renal diseases, diabetes, cancers, osteoporosis, and neuropsychological impairment [3, 4]. Among these AANCC, insufficient attention has been paid to mental health issues. However, to facilitate successful aging in the context of chronic diseases, such as HIV disease, the psychological and social domains must not be neglected [5]. In Young et al. model [5], psychological and social domains could be a way to compensate for physiological limitations (i.e., multiple chronic conditions) and allow, even in the context of disease and disability, to experience a good quality of life.

In PLHIV on ART, depression is among the most common psychiatric disorders [6] and has a high prevalence. In SSA, a recent meta-analysis reported a pooled prevalence of 13% for major depressive disorder and between 14 to 32% for severe depressive symptoms in those patients [7]. The consequences of depression on linkage to care and HIV response are crucial. First, depression has been shown to predict non-adherence to ART [8–11]. In South Africa, one study reported that, compared to adherent patients, non-adherent patients had a 3-fold higher risk of presenting moderate to severe depressive symptoms [12]. Second, depression is associated with poor health status overall [13–16], and poor HIV outcomes [17]: low CD4 progression [18–20], but also with faster progression to AIDS and increased mortality [6, 21]. As in the general population, depression is highly associated with suicide [22]. Third, depression impacts the quality of life in PLHIV [6]. Its occurrence leads to alteration of economic productivity, unemployment [20, 23], social isolation, stigmatization [24], disability [25], and also high sexual risk behaviors [26]. In western countries, untreated depression in PLHIV has also been related to increased cognitive complaints and negative consequences in multiple aspects of quality of life [27–29]. In addition to aging-related problems, these medical and psychological factors may be exacerbated in

older PLHIV [30]. In this context, depression could seriously compromise ART outcomes at individual and population levels and the achievement of the 3 × 90 objectives.

Despite depression substantially increasing over the past few years, data to document this significant dimension of the HIV epidemic in older PLHIV in SSA are scarce. While SSA is the part of the world that is the most affected by HIV/AIDS [6], depression often remains under-diagnosed [6, 31]. As depression in PLHIV emerges as a public health issue, the risk of a burden on the healthcare system and human resources is significant. Evaluating the prevalence of severe depressive symptoms and identifying associated factors will provide insights for clinical interventions. In this context, the present study aims to describe the prevalence and identify factors associated with severe depressive symptoms in PLHIV aged 50 years and above living in West Africa.

Methods

Study design

This study is a part of an ancillary study project within the West Africa network of the International epidemiological Databases to Evaluate AIDS (IeDEA) of the US National Institutes of Health (<https://www.iedea.org/regions/west-africa/>) [32]. This study was conducted in two different countries, in three urban clinics with a large caseload of PLHIV and selected by convenience: the infectious and tropical disease department of the Treichville University Hospital (Abidjan, Côte d'Ivoire), the public referral clinic (CePreF) in Yopougon Attié Hospital (Abidjan, Côte d'Ivoire) and the infectious and tropical disease department of the Fann University Hospital (Dakar, Senegal). The inclusion period of the study occurred between February 2016 to November 2017. We performed a cross-sectional analysis based on the baseline data of a 2-year longitudinal study evaluating different aspects of aging with HIV (cognition, physical function, and frailty), and the presence of severe depressive symptoms with a follow-up still ongoing.

Study population

Patients were recruited at the time of their usual HIV follow-up visit. Patients were eligible if they were living with type-1 HIV, 50 years old or older, and on ART for at least six months. We excluded patients having a psychiatric illness (including being under psychotropic treatment), a history of opportunistic cerebral infection, a neurological pathology (history of stroke or Parkinson disease), a current disabling opportunistic infection, meningitis, a sensitivo-motor paralysis, or cancer under treatment or respiratory or cardiac insufficiency.

Severity of depressive symptoms

The severity of depressive symptoms was evaluated with the Center for Epidemiological Studies Depression scale (CES-D), a 20-item self-report scale assessing the occurrence of depressive symptoms during the past week using a 4-point Likert scale [33]. Due to variability in patients' literacy level, each item was read aloud by a trained doctor or nurse. A translation of items in the national language other than French was used if necessary. Although CES-D does not provide a clinical diagnosis of depression, this scale has been reported as suitable in the context of epidemiological studies targeting French-speaking patients [34]. Even though this scale was not validated specifically in older PLHIV in West Africa, a recent meta-analysis reported a high pooled sensitivity and specificity for the CES-D, based on three African studies (Uganda, Zambia, South Africa) for threshold ranges between 16 and 22 (sensitivity 82% [95% CI, 73–87], specificity 73% [95% CI, 63–80]) [35]. It was also validated in Uganda, with scores > 16 having a good sensibility and specificity in predicting major depression disorders [36]. For the analyses, a total score ≥ 17 for men and ≥ 23 for women was used to define severe depressive symptoms [37].

Other covariates

Data were collected through essential questions and medical examination. Patients' sociodemographic characteristics as age, gender, level of education, marital status, and employment status were recorded.

Concerning HIV medical data, the initial clinical stage was defined using the Centers for Disease Control and Prevention (CDC) definition (A, B, or C). Baseline Nadir CD4 and more recent CD4 were presented in two categories (≤ 200 vs > 200 cells/ μl , and < 500 vs ≥ 500 cells/ μl , respectively). The composition of the initial and current ART treatment was presented through a categorical variable (TDF/3TC/EFV vs other combination). The duration of HIV disease was calculated as the delay in months between the first positive serology date and the study's inclusion date. Adherence to ART was defined as the percentage of tablets the patient declared to take over 7 days (in comparison to the prescribed total number of tablets over this period).

Substance use was evaluated through basic questions for tobacco and drugs (current, former, or never). Alcohol consumption was evaluated with the AUDIT-C. A score ≥ 3 for women or ≥ 4 for men was considered as hazardous drinking.

The Body Mass Index (BMI) was calculated as weight in kilograms/height in meters squared and considered in two categories: low or normal BMI (low when $< 18 \text{ kg/m}^2$, normal between 18 to 24 kg/m^2) and high when $\geq 25 \text{ kg/m}^2$. Patients were also asked if they had ever been diagnosed

with these comorbidities: hypertension, diabetes, hyperlipidemia, C or B hepatitis, tuberculosis, migraine, arthrosis, or other. A variable "comorbidities" was created with three categories: absence, only one, or more than one comorbidity. History of trauma and neurologic diseases was also documented.

Measures of functional status

Activities of the daily living (ADL) [38] and Instrumental activities with daily living (IADL) [39] scales were used to evaluate the autonomy of the patients. The final ADL and IADL scores range from 0 to 6 and 0 to 4, respectively (0, indicating the lowest degree of autonomy).

Statistical analysis

The study sample characteristics were described using median and interquartile range (IQR) for continuous variables, numbers, and proportions for categorical variables.

In order to describe the five most reported depressive symptoms among depressed PLHIV, we used the factorial structure described by Sheehan et al., [40] grouping the items 1, 2, 5, 7, 11, 13 and 20 as somatic symptoms, the items 3, 6, 14, 17 et 18 as depressive affects, the items 4, 8, 12 and 16 as negative affects, and the items 9, 10, 15 et 19 as interpersonal deficit. For this analysis, each item was recoded in two categories: the significant presence of the symptoms (≥ 3 days) or no (≤ 2 days). As the expression of depression could be different between females and males, we identified which symptoms were significantly most reported according to gender, using Chi-2 tests.

The prevalence of severe depressive symptoms was reported. Then, factors associated with the presence of severe depressive symptoms were evaluated using logistic regression analyses. Before conducting logistic regression analyses, a multivariable Random Forest imputation of missing data was performed. As no significant difference was observed between the two databases (with and without missing data), we used the database with imputed missing data for these analyses. In the multivariable regression model, we included all variables associated with the dependent variable with a p -value ≤ 0.2 in univariable analyses. The "inclusion centers" variable was included as a cofounder in each model. Unbalanced variables (85%/15%) were excluded from the multivariable analyses. The final model was obtained with a backward selection, and we considered significant associations at $p < 0.05$. The goodness of fit of the final model was evaluated with the Hosmer-Lemeshow test ($p > 0.05$). Statistical analyses were computed using R software.

Ethical consideration

Ethical clearance was obtained from the national ethics committee of each participating country (Senegal: Conseil

National d’Ethique de la Recherche en Santé (CNERES); Côte d’Ivoire: Comité National de l’Ethique et de la Recherche). All the patients gave their written consent before being included in the study. Participants’ right to refuse the participation was kept, and the confidentiality of the patient was maintained. To have a further assessment on their condition, patients with severe depressive symptoms were referred to a psychiatrist within the hospital.

Results

Characteristics of the sample

A total of 334 patients were included in our study. The median (IQR) age was 56.7 (53.5–61.1) years. Among them, 34.7% were aged 60 and older (only 11 were aged ≥ 70), 57.8% were female, and 50.6% had a primary level of education or less. Almost half of them lived in couple (46.4%) and were currently employed (53.6%) (Table 1).

A large majority of patients had an undetectable viral load (87.1%); half of them having $CD4 \geq 500$ (50.3%) and 60.8% a Nadir $CD4 < 200$. The median (Interquartile - IQR) duration of HIV infection was 108 months (68.9–141.0). Fourteen percent (14.4%) were on stage C at ART initiation. Concerning ART treatment, 25 and 52.7% received the standard combination for their initial and current treatment (according to the national treatment guidelines), respectively. Patients reported high adherence to ART (94.3%).

Few patients reported substance use (< 8%), except for tobacco (current/previous) (17.1%).

For other medical issues, 38% were overweight or obese, 35.3% reported one comorbidity in addition to their HIV disease, and 22.2% more than one.

In terms of the ADL and IADL instruments, 97.0 and 99.1% of the patients got the maximum score (6 or 4, respectively).

Prevalence of severe depressive symptoms

The prevalence of severe depressive symptoms was 17.9% [95% Confidence Interval (CI): 13.8–22.0]. Among PLHIV with severe depressive symptoms ($N = 60$), 80% reported somatic symptoms, 73.3% depressive affects, 71.7% negative affects and 40% interpersonal deficit. The five most reported symptoms (Fig. 1) were: “not enjoying life” (70%), “being unhappy” (66.7%), “being restless” (63.3%), “feeling depressed” (58.3%) and “sadness” (56.7%). Compared to males, females reported more frequently the following symptoms: “being restless” (78.6% vs 50%, $p = 0.02$), “crying spells” (42.9% vs 18.7%, $p = 0.03$), “sadness” (71.4% vs 43.7%, $p = 0.03$) and “not enjoying life” (82.1% vs 58.4%, $p = 0.05$). They also reported more frequently that their life is a failure (71.4% vs 40.6%, $p = 0.02$).

Factors associated with severe depressive symptoms

In univariate models (Table 2), having a longer duration of the disease ≥ 141 months (OR = 3.2; 95% CI: 1.3–7.6), being unemployed (OR = 1.9; CI95%: 1.0–3.8), a Nadir $CD4 \leq 200$ (OR = 2.1; CI95%: 1.1–4.2), a detectable viral load (OR = 3.1; 95% CI: 1.5–6.3) were significantly associated with the presence of severe depressive symptoms. PLHIV with severe depressive symptoms were also more likely to be current or former tobacco smokers (OR = 2.5; 95% CI: 1.3–4.9) but were less likely to be overweight or obese (OR = 0.4; 95% CI: 0.2–0.8).

In the multivariate model, being unemployed (adjusted OR (aOR) = 2.8; 95% CI: 1.4–5.7), being a current or former tobacco smokers (aOR = 2.6; 95% CI: 1.3–5.4) and being overweight or obese (aOR = 0.4; 95% CI: 0.2–0.8) remained associated with severe depressive symptoms (Goodness of Fit: $\chi^2 = 5.4$, $p = 0.71$).

Discussion

In the present study, in a large sample of PLHIV aged 50 years and above, severe depressive symptoms were observed in almost 18% of the patients. The severity of depressive symptoms seems to be more related to social (i.e., having no professional activity) and behavioral (i.e., being current or former tobacco) aspects. Unexpectedly, being overweight or obese seems to be a protective factor for the occurrence of depressive symptoms.

The prevalence of depressive symptoms is high and could not be neglected. In the context of the 3 \times 90 objectives, screening, and management of mental health disorders, including depression, has been listed as a research priority to improve timely diagnosis, ART initiation, retention, and viral suppression [41]. Recent data have also reported a 24% increased risk of mortality in older PLHIV who are depressed [42].

Recent publications from western countries reported variable results for the prevalence of severe depressive symptoms in older PLHIV. Among PLHIV aged 50 years or older living in Portugal, 23.9% presented chronic anxiety or depression [43]. In PLHIV aged between 56 to 65 living in the United States, the prevalence of severe depressive symptoms was 28.2% [27]. Data from SSA are scarce, presenting either the prevalence of a diagnosis of depression in PLHIV aged 50 years old or above or the age effects on depressive symptoms. In South Africa, the prevalence of major depressive disorders was 14.8% in PLHIV aged 50 years old or above on ART [44]. In rural South Africa, no significant difference was observed between age groups among PLHIV on ART but with a small sample size for the oldest (≥ 50 years) [45]. In other studies, younger age was associated with the presence of severe depressive symptoms but including a limited number of PLHIV aged above 50 years in Cameroun

Table 1 Characteristics of the study population according to the severity of depressive symptoms

Characteristics	No severe depressive symptoms		Severe depressive symptoms		p*	TOTAL	
	N	%	N	%		N	%
	274	(82.1)	60	(17.9)		334	(100.0)
Socio-demographic data							
Age					0.73		
50–59	180	(65.7)	38	(63.3)		218	(65.3)
60–69	94	(34.3)	22	(36.7)		116	(34.7)
Gender					0.05		
Male	109	(39.8)	32	(53.3)		141	(42.2)
Female	165	(60.2)	28	(46.7)		193	(57.8)
Education level					0.13		
No education	81	(29.6)	10	(16.7)		91	(27.2)
Primary school	61	(22.3)	17	(28.3)		78	(23.4)
Secondary school	100	(36.5)	28	(46.7)		128	(38.3)
University & Tertiary Education	32	(11.6)	5	(8.3)		37	(11.1)
Marital Status					0.36		
Married/Cohabiting	125	(45.6)	30	(50.0)		155	(46.4)
Widowed	93	(34.0)	14	(23.3)		107	(32.0)
Divorced	20	(7.3)	7	(11.7)		27	(8.1)
Never married	36	(13.1)	9	(15.0)		45	(13.5)
Employment status					0.08		
Currently employed	153	(55.8)	26	(43.3)		179	(53.6)
Unemployed	70	(25.5)	22	(36.7)		92	(27.5)
Retired	51	(18.6)	12	(20.0)		63	(18.9)
HIV Clinical data							
Clinical disease stage at ART initiation					0.42		
A	86	(31.4)	14	(23.3)		100	(29.9)
B	145	(52.9)	37	(61.7)		182	(54.5)
C - AIDS	39	(14.2)	9	(15.0)		48	(14.4)
Unknowm	4	(1.5)	.	.		4	(1.2)
Duration of infection (months)					0.08		
[6–69[	75	(27.4)	8	(13.3)		83	(24.9)
[69–108[	69	(25.2)	14	(23.3)		83	(24.9)
[108–141[	65	(23.7)	16	(26.7)		81	(24.3)
≥ 141	65	(23.7)	22	(36.7)		87	(26.0)
Nadir CD4					0.02		
> 200	106	(38.7)	14	(23.3)		120	(35.9)
≤ 200	158	(57.7)	45	(75.0)		203	(60.8)
Missing	10	(3.6)	1	(1.7)		11	(3.3)
Most recent CD4					0.38		
≥ 500	141	(51.5)	27	(45.0)		168	(50.3)
< 500	130	(47.4)	32	(53.3)		162	(48.5)
Missing	3	(1.1)	1	(1.7)		4	(1.2)
Detectable Viral load	27	(9.9)	16	(26.7)	< 0.001	43	(12.9)
Missing	47	(17.2)	9	(15.0)		56	(16.8)
Initial ART combinaison					0.11		
3TC + TDF + EFV	72	(26.3)	10	(16.7)		82	(24.6)
Other	200	(73.0)	50	(83.3)		250	(74.9)
Missing	2	(0.7)	.	.		2	(0.6)

Table 1 Characteristics of the study population according to the severity of depressive symptoms (Continued)

Characteristics	No severe depressive symptoms		Severe depressive symptoms		p*	TOTAL	
	N	%	N	%		N	%
	274	(82.1)	60	(17.9)		334	(100.0)
Actual ART combinaison					0.06		
3TC + TDF + EFV	151	(55.1)	25	(41.7)		176	(52.7)
Other	123	(44.9)	35	(58.3)		158	(47.3)
Adherence to ART (yes)	261	(95.3)	54	(90.0)	0.06†	315	(94.3)
Substance use							
Hazardous drinkers	18	(6.6)	7	(11.7)	0.18	25	(7.5)
Tobacco use (current/former)	39	(14.2)	18	(30.0)	0.004	57	(17.1)
Drug consumption	4	(1.5)	2	(3.3)	0.30†	6	(1.8)
Anthropometric and medical data							
Overweight/obesity	114	(41.6)	13	(21.7)	0.004	127	(38.0)
Comorbidities					0.61		
None	119	(43.4)	23	(38.3)		142	(42.5)
One	97	(35.4)	21	(35.0)		118	(35.3)
More than one	58	(21.2)	16	(26.7)		74	(22.2)
History of trauma (yes)	18	(6.6)	4	(6.7)	1.0	22	(6.6)
History of neurological disease (yes)	37	(13.5)	11	(18.3)	0.33	48	(14.4)
Inclusion centers							
CePREF, Abidjan	93	(33.9)	15	(25.0)		108	(32.3)
ITDD, Abidjan	140	(51.1)	37	(61.7)		177	(53.0)
ITDD, Dakar	41	(15.0)	8	(13.3)		49	(14.7)

Abbreviations: ART antiretroviral therapy, ITDD infectious and tropical disease department

* p-value associated with Chi-2 test

† p-value associated with Exact Fisher Test

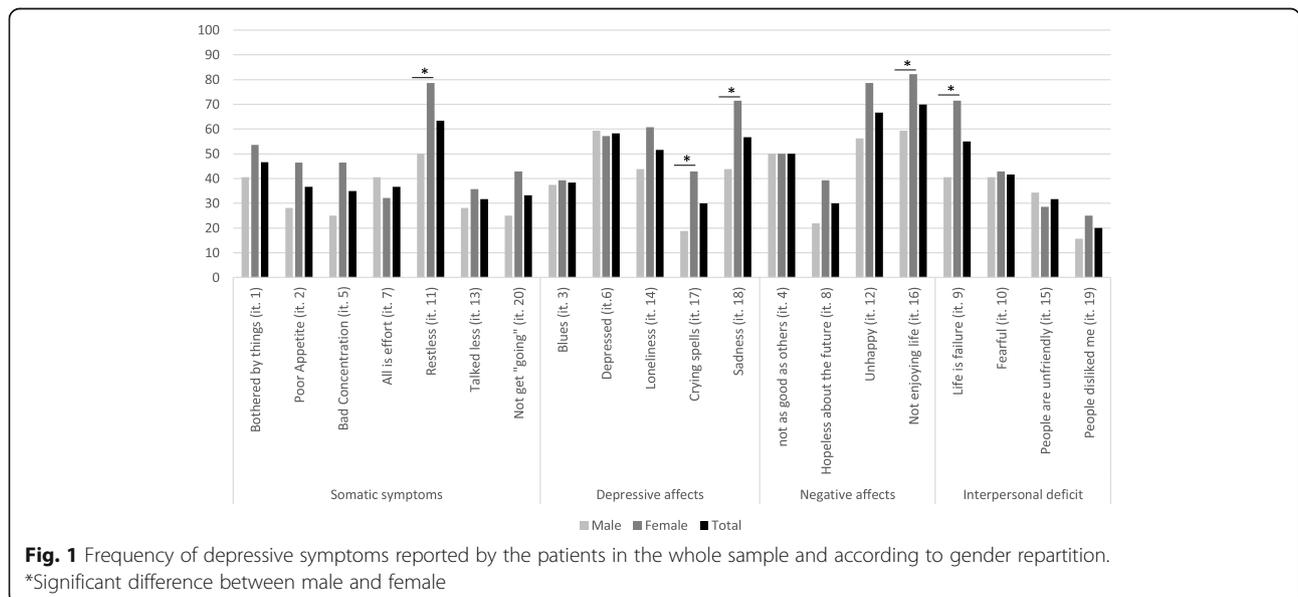


Table 2 Factors associated with severe depressive symptoms in the study population

Variables	% severe depressive symptoms ^a	Univariable models		Multivariable model	
		OR (95% CI)*	p-value	aOR (95% CI)*	p-value
Age			0.71		
50–59 years old	17.4	1			
≥ 60 years old	18.9	1.1 (0.6–2.0)			
Gender			0.09		
Men	22.7	1			
Women	14.5	0.6 (0.4–1.1)			
Education level					
No education	10.9	1			
Primary school	21.8	2.2 (0.9–5.2)	0.08		
Secondary school	21.9	2.1 (0.9–4.7)	0.07		
University & Tertiary Education	13.5	1.1 (0.3–3.6)	0.87		
Marital Status					
Married/Cohabiting	19.3	1			
Widowed	13.1	0.7 (0.3–1.3)	0.23		
Divorced	25.9	1.6 (0.6–4.2)	0.33		
Never married	20.0	1.0 (0.4–2.3)	0.99		
Employment status			0.11		0.01
Currently employed	14.5	1		1	
Unemployed	23.9	1.9 (1.0–3.8)	0.04	2.8 (1.4–5.7)	0.003
Retired	19.1	1.3 (0.6–2.8)	0.51	1.2 (0.5–2.6)	0.67
Duration of HIV infection					
[6–69[	9.6	1			
[69–108[	16.7	1.9 (0.8–4.8)	0.17		
[108–141[	19.7	2.3 (0.9–5.8)	0.07		
≥ 141	24.4	3.2 (1.3–7.6)	0.01		
Clinical disease stage					
A	14.0	1			
B	19.9	1.3 (0.6–2.7)	0.46		
C	18.7	1.2 (0.5–3.2)	0.67		
Nadir CD4			< 0.0001		
> 200	11.2	1			
≤ 200	22.0	2.1 (1.1–4.2)			
CD4			0.36		
≥ 500	15.9	1			
< 500	20.1	1.3 (0.7–2.3)			
Viral load			0.002		
Undetectable	15.1	1			
Detectable	37.2	3.1 (1.5–6.3)			
Initial ART combination			0.10		
3TC + TDF + EFV	12.2	1			
Other	19.8	1.8 (0.9–3.8)			
Actual ART combination			0.06		
3TC + TDF + EFV	14.2	1			

Table 2 Factors associated with severe depressive symptoms in the study population (Continued)

Variables	% severe depressive symptoms ^a	Univariable models		Multivariable model	
		OR (95% CI)*	p-value	aOR (95% CI)*	p-value
Other	22.1	1.7 (0.9–3.1)			
Non adherence to ART (ref.: adherent)	38.5	3.1 (0.9–9.9)	0.06		
Alcohol consumption (ref.: no) ^b	28.0	1.9 (0.7–4.8)	0.18		
Tobacco (current/former) (ref.: no)	31.6	2.5 (1.3–4.9)	0.01	2.6 (1.3–5.4)	0.01
Drug consumption (ref.: no)	33.3	1.9 (0.3–11.0)	0.45		
BMI			0.01		0.01
Normal / underweight	22.7	1		1	
Overweight/obesity	5.9	0.4 (0.2–0.8)		0.4 (0.2–0.8)	
Comorbidities					
No	16.2	1			
Only one	17.8	1.2 (0.6–2.3)	0.62		
More than one	21.6	1.7 (0.8–3.4)	0.18		
History of trauma (ref.: no)	18.2	0.9 (0.3–3.1)	0.99		
History of neurological disease (ref.: no)	22.9	2.3 (0.9–5.6)	0.07		

Abbreviations: aOR adjusted Odd Ratio, ART antiretroviral therapy, BMI Body Mass Index, CI Confident Interval, EFV Efavirenz, OR odd ratio, ref. Reference group, TDF Tenofovir, 3TC Lamivudine

*results considered as significant ($p < 0.05$) (bold text)

^aCalculated after imputation of missing data

^bref.: no: means that the OR is computed taking this category "absence of this medical problem" as the reference group

[46] or only middle-aged PLHIV in East Africa (mean age: 37.2 years) were included in those studies [14].

Compared to middle-aged PLHIV (median age < 45 years, 200 PLHIV included), and when using also the CES-D with the same cut-off as in our study, a prevalence of 18% was observed in Senegal [47]. In Nigeria and South Africa, using CES-D but with a cut off ≥ 16 , the prevalence of severe depressive symptoms in middle-aged PLHIV (mean age < 45 years) on ART for at least six months was similar or higher (21 to 62%) [23, 48, 49]. In this context, we cannot conclude that older PLHIV are more likely to have severe depressive symptoms than younger ones. However, the lived reality of older PLHIV might be different from the one of the youngest.

Indeed, based on western countries' studies, older PLHIV had to face different types of problems, including stigma [50] and specific concerns about disclosure due to age [51]. They also have some uncertainty about how aging, HIV, and long-term ART effects could interact and impact health [51]. The chronic aspect of the disease status and the increase of potential comorbidities with age could play an essential role in PLHIV related-depression, as observed in other chronic diseases [52]. Further studies are needed to better understand the reality of aging experience in PLHIV living in SSA.

Unemployment is commonly associated with depression or severe depressive symptoms in middle-aged PLHIV (mean age < 45 years) living in SSA [23, 31, 46, 53]. In

South Africa, it was shown that unemployed PLHIV could have a 3-fold risk to present severe depressive symptoms and more than a 2-fold risk to be non-adherent to ART [23]. Even if we did not document any income information, being unemployed is often indirectly related to a lack of income, and so poverty. Acting as a stressor, low income could lead to difficulties in supporting health expenses, particularly the one due to other comorbidities, which are more likely to be numerous when PLHIV are getting older. Concerning retirement, we did not collect information about pension, limiting our conclusions.

Prior studies have documented an association between current cigarette smoking or nicotine dependence and the presence of severe depressive symptoms in middle-aged PLHIV living in western countries [54–56] but also with a diagnosis of major depression in older PLHIV living in Brazil [57]. As older PLHIV living in SSA are more likely to be regular smokers, and as tobacco consumption is often under-estimated [58], it is essential to screen depression in those patients. Even though few data are available about previous smokers among older PLHIV, those individuals might also be vulnerable and should be screened for depression.

The association between BMI and severe depressive symptoms in PLHIV is not systematically explored and makes no consensus [25, 59–61]. A low BMI could be an indirect marker of loss of appetite, one of the most reported symptoms in HIV related-depression. A low

BMI could also be a marker of advanced disease, and in the social representation, HIV infection and mental illness are also often associated with thinness. Being overweight or obese could be in some ways protective against bad mood or stigmatization, but further investigations are needed to depict this point.

As observed in other studies conducted in SSA in middle-aged PLHIV, no effect of gender was observed [20, 24, 47]. However, the expression of depressive symptoms seems to be different in women and men, which is essential for clinicians to identify depressed patients.

In regard to HIV clinical data, a longer duration of the disease and a lower Nadir CD4 are associated in the univariate model with severe depressive symptoms. The impact of physical and emotional difficulties on the lived HIV experience should not be underestimated. In addition to the actual problem of living with HIV, long-time survivors might have to face different problems compared to those diagnosed more recently (i.e., confusion about surviving so far, a mourning of friends or family members lost to AIDS) [62]. The link with viral load could not be further investigated in our sample because of a significant proportion of missing data.

As depression has deleterious effects on PLHIV but is a modifiable condition, we encourage the screening and the management of depression in older PLHIV living in SSA. Promising results from a culturally-sensitive psychotherapeutic intervention [63] or a group-based counseling intervention [64] using task-shifting in middle-aged PLHIV living in SSA have already been reported. As older PLHIV are less likely to be engaged in behavioral health treatment for depression than younger PLHIV [65], it is essential to adapt psychotherapeutic interventions to the older PLHIV specific needs.

This study's major strength is the opportunity to describe the prevalence of severe depressive symptoms in a large sample of older PLHIV, included in 3 different sites in West Africa. However, the generalizability of the results and the comparison with other studies could be limited as we included PLHIV on ART for at least six months within hospital-based study sites from urban settings. Second, the presence of depressive symptoms has been evaluated in the literature with diverse tools with different psychometric validities, leading to substantial variability in the measurements [7], hence results may not be generalizable across tools. Third, considerable stress related to HIV (i.e., HIV-related stigma, disclosure concerns, ART, physical changes) are essential determinants of depression and should not be underestimated even in older PLHIV. Further studies are needed to depict this. Fourth, even high pooled sensitivity and specificity was observed for the CES-D scale in African studies [35], a full clinical evaluation was not included in our

scientific protocol to validate a major depressive disorder. As an interviewer-administered approach was used, and despite the staff's full training, social-desirability bias might not be completely avoided. Finally, the cross-sectional design of the present study cannot provide information on the causal direction.

Conclusions

The prevalence of severe depressive symptoms is high among older PLHIV living in West Africa, representing a severe problem for the organization of care and follow-up of PLHIV.

Unemployment and tobacco use were the main factors associated with severe depressive symptoms. Those patients should be considered as vulnerable and requiring additional support. Further studies in older PLHIV are needed to describe the phenomenon in more details and to better understand the reality of aging experience in PLHIV living in SSA. To guarantee the achievement of the 3 × 90 objectives, and encourage successful aging in PLHIV in West Africa, efforts are needed to integrate screening and management of depression in the standard of care. Finally, psychotherapeutic intervention adapted to older PLHIV specific needs should be developed.

Abbreviations

ADL: Activities of Daily Living; AIDS: *Acquired Immune Deficiency Syndrome*; aOR: Adjusted Odd Ratio; ART: Antiretroviral Therapy; BMI: Body Mass Index; CDC: Centers for Disease Control and Prevention; CES-D: Center for Epidemiological Studies Depression; CI: Confident Interval; HIV: Human Immunodeficiency Virus; IADL: Instrumental Activities of Daily Living; IeDEA: International epidemiological Databases to Evaluate AIDS; IQR: Interquartile Range; OR: Odds Ratio; PLHIV: People Living with HIV; SSA: Sub-Saharan Africa

Acknowledgements

The IeDEA West Africa region: Site investigators and cohorts: Adult cohorts: Marcel Djimon Zannou, CNHU, Cotonou, Benin; Armel Poda, CHU Sourou Sanou, Bobo Dioulasso, Burkina Faso; Fred Stephen Sarfo and Komfo Anokye Teaching Hospital, Kumasi, Ghana; Eugene Messou, ACONDA CePreF, Abidjan, Cote d'Ivoire; Henri Chenal, CIRBA, Abidjan, Cote d'Ivoire; Kla Albert Minga, CNTS, Abidjan, Cote d'Ivoire; Emmanuel Bissagnene, and Aristophane Tanon, CHU Treichville, Cote d'Ivoire; Moussa Seydi, CHU de Fann, Dakar, Senegal; Akessiwe Akouda Patassi, CHU Sylvanus Olympio, Lomé, Togo. Pediatric cohorts: Sikiratu Adouni Koumakpai-Adeothy, CNHU, Cotonou, Benin; Lorna Awo Renner, Korle Bu Hospital, Accra, Ghana; Sylvie Marie N'Gbeche, ACONDA CePreF, Abidjan, Ivory Coast; Clarisse Amani Bosse, ACONDA_MTCT+, Abidjan, Ivory Coast; Kouadio Kouakou, CIRBA, Abidjan, Cote d'Ivoire; Madeleine Amorissani Folquet, CHU de Cocody, Abidjan, Cote d'Ivoire; François Tanoh Eboua, CHU de Yopougon, Abidjan, Cote d'Ivoire; Fatoumata Dicko Traore, Hopital Gabriel Toure, Bamako, Mali; Elom Takassi, CHU Sylvanus Olympio, Lomé, Togo; Coordinators and data centers: François Dabis, Elise Arrive, Eric Balestre, Renaud Becquet, Charlotte Bernard, Shino Chassagne Arikawa, Alexandra Doring, Antoine Jaquet, Karen Malateste, Elodie Rabourdin, Thierry Tiendrebeogo, ADERA, Isped & INSERM U1219, Bordeaux, France. Sophie Desmonde, Julie Jesson, Valeriane Leroy, Inserm 1027, Toulouse, France. Didier Koumavi Ekouevi, Jean-Claude Azani, Patrick Coffie, Abdoulaye Cissé, Guy Gnepa, Apollinaire Horo, Christian Kouadio, Boris Tchounga, PACCI, CHU Treichville, Abidjan, Côte d'Ivoire.

Authors' contributions

CB, NdR and FD designed the study. CB coordinated the study, supervised the data management, conducted the statistical analyses and wrote the first draft. HF and NdR helped in the statistical methodology and analyses and also gave comments on the first draft. ZD, FNA, RA and JMT realized the inclusion of the patients and collected the data under the supervision of AT, EM and MS. All authors helped in the interpretation of the data, read and approved the final manuscript.

Funding

Supported by the National Institute of Mental Health (NIMH), National Cancer Institute (NCI), the Eunice Kennedy Shriver National Institute of Child Health & Human Development (NICHD) and the National Institute of Allergy and Infectious Diseases (NIAID) of the U.S. National Institutes of Health (NIH), as part of the International Epidemiologic Databases to Evaluate AIDS (IeDEA) under Award Number U01AI069919. The content is solely the responsibility of the authors and does not necessarily represent the official views of the National Institutes of Health.

Availability of data and materials

Complete data for this study cannot be posted in a supplemental file or a public repository at this current time because of scientific reasons here explained. This cross-sectional analysis is part of a 2-year longitudinal study evaluating different aspects of aging with HIV (cognition, physical function, and frailty) and the presence of severe depressive symptoms with a 2-year follow-up, which ended in December 2019. Cross-sectional analyses on cognition and frailty and longitudinal analyses on these topics, including depression, are currently in progress, and thus, data could not be posted at this time.

Ethics approval and consent to participate

Ethical clearance was obtained from the national ethics committee of each participating country (Senegal: Conseil National d'Ethique de la Recherche en Santé (CNERs); Côte d'Ivoire: Comité National de l'Ethique et de la Recherche). All the patients gave their written consent before being included in the study. Participants' right to refuse the participation was kept, and the confidentiality of the patient was maintained. To have a further assessment on their condition, patients with severe depressive symptoms were referred to a psychiatrist within the hospital.

Consent for publication

All the patients gave their written consent before being included in the study.

Competing interests

The authors have no conflicts of interest to disclose.

Author details

¹Bordeaux Population Health Research Center, Univ. Bordeaux, Inserm, UMR 1219, F-33000 Bordeaux, France. ²Bordeaux Population Health Research Center, Univ. Bordeaux, ISPED, UMR 1219, F-33000 Bordeaux, France. ³Service de maladies infectieuses et tropicales, CHU Treichville, Abidjan, Côte d'Ivoire. ⁴Centre de prise en charge de recherche et de formation (CePReF), Yopougon Attié Hospital, Abidjan, Côte d'Ivoire. ⁵Service de maladies infectieuses et tropicales, CRCF, CHNU de Fann, Dakar, Senegal.

Received: 20 February 2020 Accepted: 27 August 2020

Published online: 10 September 2020

References

- Deeks SG, Lewin SR, Havlir DV. The end of AIDS: HIV infection as a chronic disease. *Lancet Lond Engl*. 2013;382(9903):1525–33.
- Vance D, McGuinness T, Musgrove K, Orel NA, Fazeli P. Successful aging and the epidemiology of HIV. *Clin Interv Aging*. 2011;6:181.
- Bendavid E, Ford N, Mills EJ. HIV and Africa's elderly: the problems and possibilities. *AIDS Lond Engl*. 2012;26(Suppl 1):S85–91.
- Schouten J, Wit FW, Stolte IG, Kootstra NA, van der Valk M, Geerlings SE, et al. Cross-sectional Comparison of the Prevalence of Age-Associated Comorbidities and Their Risk Factors Between HIV-Infected and Uninfected Individuals: The AGEHIV Cohort Study. *Clin Infect Dis Off Publ Infect Dis Soc Am*. 2014;59(12):1787–97.
- Young Y, Frick KD, Phelan EA. Can successful aging and chronic illness coexist in the same individual? A Multidimensional Concept of Successful Aging. *J Am Med Dir Assoc*. 2009;10(2):87–92.
- Abas M, Ali G-C, Nakimuli-Mpungu E, Chibanda D. Depression in people living with HIV in sub-Saharan Africa: time to act. *Trop Med Int Health*. 2014;19(12):1392–6.
- Bernard C, Dabis F, de Rekeneire N. Prevalence and factors associated with depression in people living with HIV in sub-Saharan Africa: a systematic review and meta-analysis. *PLoS ONE*. 2017;12(8):e0181960.
- Memiah P, Shumba C, Etienne-Mesubi M, Agbor S, Hossain MB, Komba P, et al. The effect of depressive symptoms and CD4 count on adherence to highly active antiretroviral therapy in sub-Saharan Africa. *J Int Assoc Provid AIDS Care*. 2014;13(4):346–52.
- Wroe EB, Hedt-Gauthier BL, Franke MF, Nsanzimana S, Turinimana JB, Drobac P. Depression and patterns of self-reported adherence to antiretroviral therapy in Rwanda. *Int J STD AIDS*. 2015;26(4):257–61.
- Chibanda D, Benjamin L, Weiss HA, Abas M. Mental, neurological, and substance use disorders in people living with HIV/AIDS in low- and middle-income countries. *J Acquir Immune Defic Syndr*. 2014;67(Suppl 1):S54–67.
- Nakimuli-Mpungu E, Bass JK, Alexandre P, Mills EJ, Musisi S, Ram M, et al. Depression, alcohol use and adherence to antiretroviral therapy in sub-Saharan Africa: a systematic review. *AIDS Behav*. 2012;16(8):2101–18.
- Nel A, Kagee A. The relationship between depression, anxiety and medication adherence among patients receiving antiretroviral treatment in South Africa. *AIDS Care*. 2013;25(8):948–55.
- Kingori C, Haile ZT, Ngatia P. Depression symptoms, social support and overall health among HIV-positive individuals in Kenya. *Int J STD AIDS*. 2015;26(3):165–72.
- Seth P, Kidder D, Pals S, Parent J, Mbatia R, Chesang K, et al. Psychosocial functioning and depressive symptoms among HIV-positive persons receiving care and treatment in Kenya, Namibia, and Tanzania. *Prev Sci Jun*. 2014;15(3):318–28.
- Kaharuza FM, Bunnell R, Moss S, Purcell DW, Bikaako-Kajura W, Wamai N, et al. Depression and CD4 cell count among persons with HIV infection in Uganda. *AIDS Behav*. 2006;10(S1):105–11.
- Adeyuywa AO, Afolabi MO, Ola BA, Ogundele OA, Ajibare AO, Oladipo BF, et al. Relationship between depression and quality of life in persons with HIV infection in Nigeria. *Int J Psychiatry Med*. 2008;38(1):43–51.
- Ayano G, Solomon M, Abraha M. A systematic review and meta-analysis of epidemiology of depression in people living with HIV in East Africa. *BMC Psychiatry*. 2018;18(1):254.
- Akena D, Musisi S, Joska J, Stein DJ. The Association between Aids Related Stigma and Major Depressive Disorder among HIV-Positive Individuals in Uganda. *PLoS ONE*. 2012;7(11):e48671.
- L'akoa RM, Noubiap JJN, Fang Y, Ntone FE, Kuaban C. Prevalence and correlates of depressive symptoms in HIV-positive patients: a cross-sectional study among newly diagnosed patients in Yaoundé, Cameroon. *BMC Psychiatry*. 2013;13:228.
- Asangbeh SL, Sobngwi JL, Ekali GL, Eyoum C, Msellati P. Predictors of depression among patients on art in a rural health district in north West Cameroon. *AIDS Care*. 2016;28(2):205–8.
- Nakimuli-Mpungu E, Musisi S, Katabira E, Nachega J, Bass J. Prevalence and factors associated with depressive disorders in an HIV+ rural patient population in southern Uganda. *J Affect Disord*. 2011;135(1–3):160–7.
- Kinyanda E, Hoskins S, Nakku J, Nawaz S, Patel V. The prevalence and characteristics of suicidality in HIV/AIDS as seen in an African population in Entebbe district, Uganda. *BMC Psychiatry*. 2012;12:63.
- Kitshoff C, Campbell L, Naidoo S. The association between depression and adherence to antiretroviral therapy in HIV-positive patients, KwaZulu-Natal, South Africa. *Afr Fam Pr*. 2012;54(2):145–50.
- Endeshaw M, Walson J, Rawlins S, Dessie A, Alemu S, Andrews N, et al. Stigma in Ethiopia: association with depressive symptoms in people with HIV. *AIDS Care*. 2014;26(8):935–9.
- Myezwa H, Hancock JH. Investigating the Interaction between Disability and Depressive Symptoms in the Era of Widespread Access to ART. *J AIDS Clin Res*. 2016;7(7) [cité 31 janv 2020]. Disponible sur: <https://www.omicsonline.org/open-access/investigating-the-interaction-between-disability-and-depressive-symptoms-in-the-era-of-widespread-access-to-art-2155-6113-1000584.php?aid=74448>.
- Musisi S, Wagner GJ, Ghosh-Dastidar B, Nakasujja N, Dickens A, Okello E. Depression and sexual risk behaviour among clients about to start HIV antiretroviral therapy in Uganda. *Int J STD AIDS*. 2014;25(2):130–7.

27. Rooney AS, Moore RC, Paolillo EW, Gouaux B, Umlauf A, Letendre SL, et al. Depression and aging with HIV: associations with health-related quality of life and positive psychological factors. *J Affect Disord.* 2019;251:1–7.
28. Coleman CL. Health related quality of life and depressive symptoms among seropositive African Americans. *Appl Nurs Res.* 2017;33:138–41.
29. Leserman J. Role of Depression, Stress, and Trauma in HIV Disease Progression. *Psychosom Med.* 2008;70(5):539–45.
30. Grov C, Golub S, Parsons J, Brennan M, Karpiak S. Loneliness and HIV-related stigma explain depression among older HIV-positive adults. *AIDS Care.* 2010; 22(5):630–9.
31. Berhe H, Bayray A. A: prevalence of depression and associated factors among people living with HIV/AIDS in Tigray, North Ethiopia: a cross sectional hospital based study. *Int J Pharm Sci Res.* 2013;4(2):765–75.
32. Egger M, Ekouevi DK, Williams C, Lyamuya RE, Mukumbi H, Braitstein P, et al. Cohort profile: the international epidemiological databases to evaluate AIDS (IeDEA) in sub-Saharan Africa. *Int J Epidemiol.* 2012;41(5):1256–64.
33. Radloff LS. The CES-D scale: a self-report depression scale for research in the general population. *Appl Psychol Measure.* 1977;1:385–401.
34. Morin AUS, Moule G, Maïano C, Layet L, Just J-L, Ninot G. Psychometric properties of the Center for Epidemiologic Studies Depression Scale (CES-D) in French clinical and nonclinical adults. *Rev Épidémiologie Santé Publique.* 2011;59(5):327–40.
35. Tsai AC. Reliability and validity of depression assessment among persons with HIV in sub-Saharan Africa: systematic review and meta-analysis. *JAIDS J Acquir Immune Defic Syndr.* 2014;66(5):503–11.
36. Akena D, Joska J, Obuku EA, Stein DJ. Sensitivity and specificity of clinician administered screening instruments in detecting depression among HIV-positive individuals in Uganda. *AIDS Care.* 2013;25(10):1245–52.
37. Fuhrer R, Rouillon F. The french version of the Center for Epidemiologic Studies. *Depression Scale.* 1989;4(3):163–6 [cité 13 sept 2012]. Disponible sur: <http://www.ncbi.nlm.nih.gov/pubmed/?term=Fuhrer%20rouillon%201989>.
38. Katz S, Ford AB, Moskowitz RW, Jackson BA, Jaffe MW. STUDIES OF ILLNESS IN THE AGED. THE INDEX OF ADL: A STANDARDIZED MEASURE OF BIOLOGICAL AND PSYCHOSOCIAL FUNCTION. *JAMA.* 1963;185:914–9.
39. Lawton MP, Brody EM. Assessment of older people: self-maintaining and instrumental activities of daily living. *Gerontologist.* 1969;9(3):179–86.
40. Sheehan TJ, Fifield J, Reisine S, Tennen H. The measurement structure of the Center for Epidemiologic Studies Depression Scale. *J Pers Assess.* 1995;64(3): 507–21.
41. Yotebieng M, Brazier E, Addison D, Kimmel AD, Cornell M, Keiser O, et al. Research priorities to inform “Treat All” policy implementation for people living with HIV in sub-Saharan Africa: a consensus statement from the International epidemiology Databases to Evaluate AIDS (IeDEA). *J Int AIDS Soc.* 2019;22(1):e25218.
42. So-Armah K, Gupta S, Kundu S, Stewart J, Goulet J, Butt A, et al. Depression and all-cause mortality risk in HIV-infected and HIV-uninfected US veterans: a cohort study. *HIV Med.* 2019;20(5):317–29.
43. Serrão R, Piñero C, Velez J, Coutinho D, Maltez F, Lino S, et al. Non-AIDS-related comorbidities in people living with HIV-1 aged 50 years and older: the AGING POSITIVE study. *Int J Infect Dis.* 2019;79:94–100.
44. Nyirenda M, Chatterji S, Rochat T, Mutevedzi P, Newell M-L. Prevalence and correlates of depression among HIV-infected and -affected older people in rural South Africa. *J Affect Disord.* 2013;151(1):31–8.
45. Bongongo T, Tumbo J, Govender I. Depressive features among adult patients receiving antiretroviral therapy for HIV in Rustenburg district, SA. *South Afr J Psychiatry.* 2013;19(2):31.
46. 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):103–14.
47. Poupard M, Ngom Gueye NF, Thiam D, Ndiaye B, Girard PM, Delaporte E, et al. Quality of life and depression among HIV-infected patients receiving efavirenz- or protease inhibitor-based therapy in Senegal. *HIV Med.* 2007;8(2):92–5.
48. Olisah VO, Bajyewu O, Sheikh TL. Adherence to highly active antiretroviral therapy in depressed patients with HIV/AIDS attending a Nigerian university teaching hospital clinic. *Afr J Psychiatry.* 2010;13(4):275–9.
49. Nakasujja N, Skolasky RL, Musisi S, Allebeck P, Robertson K, Ronald A, et al. Depression symptoms and cognitive function among individuals with advanced HIV infection initiating HAART in Uganda. *BMC Psychiatry.* 2010;10:44.
50. Emler CA, Brennan DJ, Brennenstuhl S, Rueda S, Hart TA, Rourke SB. The impact of HIV-related stigma on older and younger adults living with HIV disease: does age matter? *AIDS Care.* 2015;27(4):520–8.
51. Rosenfeld D, Ridge D, Catalan J, Delpech V. Age and life course location as interpretive resources for decisions regarding disclosure of HIV to parents and children: findings from the HIV and later life study. *J Aging Stud.* 2016; 38:81–91.
52. Clarke DM, Currie KC. Depression, anxiety and their relationship with chronic diseases: a review of the epidemiology, risk and treatment evidence. *Med J Aust.* 2009;190(7 Suppl):S54–60.
53. Akena DH, Musisi S, Kinyanda E. A comparison of the clinical features of depression in HIV-positive and HIV-negative patients in Uganda. *Afr J Psychiatry.* 2010;13(1):43–51.
54. Benard A, Bonnet F, Tessier J-F, Fossoux H, Dupon M, Mercie P, et al. Tobacco addiction and HIV infection: toward the implementation of cessation programs. ANRS CO3 Aquitaine Cohort. *AIDS Patient Care STDs.* 2007;21(7):458–68.
55. Webb MS, Vanable PA, Carey MP, Blair DC. Cigarette smoking among HIV+ men and women: examining health, substance use, and psychosocial correlates across the smoking spectrum. *J Behav Med.* 2007;30(5):371–83.
56. Cropsey KL, Willig JH, Mugavero MJ, Crane HM, McCullumsmith C, Lawrence S, et al. Cigarette smokers are less likely to have undetectable viral loads: results from four HIV clinics. *J Addict Med.* 2016;10(1):13–9.
57. Carmo Filho AD, Fakoury MK, Eyer-Silva WD, Neves-Motta R, Kalil RS, Ferry FR. Factors associated with a diagnosis of major depression among HIV-infected elderly patients. *Rev Soc Bras Med Trop.* 2013;46(3):352–4.
58. Jaquet A, Ekouevi DK, Aboubakrine M, Bashi J, Messou E, Maiga M, et al. Tobacco use and its determinants in HIV-infected patients on antiretroviral therapy in west African countries. *Int J Tuberc Lung Dis Off J Int Union Tuberc Lung Dis.* 2009;13(11):1433–9.
59. Kinyanda E, Hoskins S, Nakku J, Nawaz S, Patel V. Prevalence and risk factors of major depressive disorder in HIV/AIDS as seen in semi-urban Entebbe district, Uganda. *BMC Psychiatry.* 2011;11:205.
60. Zoungrana J, Dembélé JP, Sako FB, Siranyan S, Traore J, Sawadogo A, et al. Depression and HIV: epidemiological and clinical aspects at the Bamako University hospital (Mali). *Médecine Santé Trop.* 2017;27(2):186–9.
61. Nyongesa MK, Mwangi P, Wanjala SW, Mutua AM, Newton CRJC, Abubakar A. Prevalence and correlates of depressive symptoms among adults living with HIV in rural Kilifi, Kenya. *BMC Psychiatry.* 2019;19(1):333.
62. Owen G, Catalan J. ‘We never expected this to happen’: narratives of ageing with HIV among gay men living in London, UK. *Ceult Health Sex.* 2012;14(1):59–72.
63. Nakimuli-Mpungu E, Wamala K, Okello J, Alderman S, Odokonyero R, Mojtabai R, et al. Group support psychotherapy for depression treatment in people with HIV/AIDS in northern Uganda: a single-Centre randomised controlled trial. *Lancet HIV.* 2015;2(5):e190–9.
64. Petersen I, Hanass Hancock J, Bhana A, Govender K. A group-based counselling intervention for depression comorbid with HIV/AIDS using a task shifting approach in South Africa: a randomized controlled pilot study. *J Affect Disord.* 2014;158:78–84.
65. Moore RC, Marquine MJ, Straus E, Depp CA, Moore DJ, Schiehser DM, et al. Predictors and Barriers to Mental Health Treatment Utilization Among Older Veterans Living With HIV. *Prim Care Companion CNS Disord.* 2017;19(01) [cité 30 août 2019]. Disponible sur: <http://www.psychiatrist.com/PCC/article/Pages/2017/v19n01/16m02059.aspx>.

Publisher’s Note

Springer Nature remains neutral with regard to jurisdictional claims in published maps and institutional affiliations.