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Prevalence and predictors of depression and oral health related quality of life among patients living with HIV/AIDS in Nigeria: modifying influence of tobacco use

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Abstract

Introduction: *tobacco use remains a global health burden, and studies in developed countries have found a significantly higher prevalence amongst persons living with HIV/AIDS (PLWHA) compared to the whole populace. PLWHA who smoke have a higher predisposition to oral, respiratory and mental health illnesses, thereby worsening their Health-Related Quality of Life (HRQOL). We assessed the prevalence of self-reported depression and tobacco smoking, as well as their relationship with the oral health related quality of life (OHRQOL) among PLWHA in Lagos, Nigeria.* ***Methods:*** *using a descriptive design, 370 HIV-positive adults in Lagos State, Nigeria were interviewed to obtain socio-demographic and HIV related clinical information as well as history of tobacco use. The Patient Health Questionnaire-9 (PHQ-9) and the Generalized Anxiety Disorder - 7 (GAD-7) and susceptibility to smoking cigarettes were also determined. Bivariate and multivariate logistic regression analysis was done to identify factors significantly associated with self-reported depression and impacts on OHRQOL. Statistical significance was inferred at p values < 0.05.* ***Results:*** *participants were mainly in the age group of 31 - 40 years and were predominantly female (58.7%). The highest proportion of the participants (119; 32.1%) had been HIV positive for ≥16 years; 26.6% had mild depression, 7.5% had Moderate/moderately severe depression while 3.4% had severe depression. Majority of the respondents (54.3%) had low impacts on their OHRQOL while 22.7% had high impacts. There was a significant association (p<0.05) between being male (female -aOR: 0.490; CI: 0.286-0.841), and smoking cigarettes (non-smokers -aOR: 0.206; CI: 0.090-0.472) with having poor OHRQOL. There was also a significant association (p<0.05) between alcohol use (non-drinkers -aOR: 0.441; CI: 0.236-0.823), and smoking cigarettes (non-smokers -aOR: 0.110; CI: 0.110-0.492) with depression amongst respondents. While those who drank alcohol, had a primary level of education, who do not use HAART, aged 21-30 years, and those who had been HIV positive for >16 years, had increased odds of poor OHRQOL, the association was not significant.* ***Conclusion:*** *our findings suggest a relatively high level of depression amongst PLWHA in Lagos, while almost a quarter had high impacts on their OHRQOL. Being male and combustible cigarette smoking was significantly related with poor OHRQOL while smoking and alcohol consumption was significantly associated with depression. Electronic cigarette use was not associated with poorer OHRQOL, as observed amongst those using cigarettes, shisha and marijuana. Health promotion and regulatory policies should target smoking cessation amongst PLWHA.*

Introduction

The Acquired Immune-Deficiency Syndrome resulting from Human Immune-deficiency Virus (HIV/AIDS) is a public health problem globally and especially in sub-Saharan Africa (SSA). Even though sub-Saharan Africa represents less than one-eight of the world´s population, over two thirds of the estimated 35.3 million people living with HIV/AIDS worldwide live in the sub-Saharan region [1-3]. In addition, this region had two thirds of the 2.1 million new infections and 70% of 1.1 million global mortality associated with this disease [2]. Furthermore, of all PLWHA in the world, 9% of them live in Nigeria (UNAIDS) [4]. In the year 2020, the adult HIV prevalence in Nigeria was 1.3%, with 86,000 newly recorded HIV infections and about 50,000 deaths [5]. In the country, 1.5 million out of 1.7 million of PLHHA were on antiretroviral

treatment [5]. Nigeria is a multiethnic, multireligious and multicultural society which is often polarized along political lines, often making HIV prevention programs challenging. Other factors related to the spread of HIV in Nigeria include practices like polygamy and multiple sexual partners, poverty, taboos, a low level of literacy, low acceptance of condoms, a high prevalence of untreated sexually transmitted infections (STIs), discrimination against women, stigmatization and the use of addictive substances and drugs [6].

Alcohol abuse, tobacco smoking, and drug addiction among PLWHA have been associated with poor compliance with and reduced effectiveness of highly active antiretroviral therapy (HAART), resulting in viral proliferation, disease progression, as well as increased morbidity and mortality [7]. Moreover, the prevalence of cigarette smoking is exceedingly high in PLWHA. While the prevalence of smoking among the general population is approximately 20% [8], the prevalence is between 40-70% among PLWHA [9,10]. Smokers are more susceptible to bacterial and viral induced inflammatory neuro-pathologies [11]. Moreover, in addition to a weakened host immunity [12] and reduced HAART function [13], persons living with HIV/AIDS who smokes have a higher prevalence of pneumonia, hairy leukoplakia, oral candidiasis, and oral malignancies, which worsen their Health Related Quality of Life (HRQOL) [14]. In addition to the immunocompromised state of PLWHA, discrimination, poverty, social stigma, unemployment, relationship problems, and other untoward circumstances reduce the HRQOL in HIV-positive people. These health-related outcomes have also been observed, to contribute to a higher frequency of chronic comorbidities, [15] such as depression and depressive symptoms [16]. The assessment of the health-related quality is a desirable method for documenting disease burden [17], and it has become an integral part of HIV/AIDS patients´ follow-up. In addition to systemic effects of HIV infection, risk factors for oral diseases, tobacco use, alcohol abuse, obliviousness about the need for improved nutrition and oral hygiene, and poor access to oral care can worsen oral health among PLWHA [18,19]. These oral problems negatively impact the Oral Health Related Quality of Life (OHRQoL) through increased discomfort, pain, altered taste and other physical and psychological impacts [20].

Mental health is often shaped by the wide-ranging inequalities in the social, economic and physical environments in which people live. HIV diagnosis is associated with psychological distress and depression is three times more common among PLWHA compared to the global of 15-22% [21-23]. Furthermore, 20% to 50% of PLWHA in Sub-Saharan Africa have mild-to-moderate depressive symptoms [24,25]. Individual and interpersonal factors such as social rejection, discrimination and isolation, as well as other specific societal factors such as insecurity and famine can heighten the risk of depression [26]. Correspondingly, PLWHA have higher rates of smoking and psychoactive substances abuse and co-comorbid psychiatric conditions like depression, which also directly impacts on their quality of life [27]. Inadequate attention has been given to the impact of tobacco use on the mental health and oral health related quality of life of PLWHA in Nigeria. This research aimed to answer questions related to the modifying influence of tobacco use on depressive symptoms in PLWHA and also its impact on their OHRQOL. We hypothesized that tobacco use among PLWHA may be associated with depression and poorer OHRQOL. This study thus aimed to assess the prevalence of self-reported depression and tobacco smoking, as well as their relationship with the OHRQOL among PLWHA in Lagos, Nigeria.

Methods

Study design and settings: a descriptive study of PLWHA, aged 18-year-old and above, conducted between November 2021 and April 2022 in Lagos State, Nigeria. Lagos State, is a densely populated

and highly industrialized cosmopolitan region with a population of about 20 million people who engage mainly in commercial activities. The Lagos State AIDS Control Agency (LSACA) supervises about 167 HIV facility centers and organizations which provide HIV/AIDS-related services and care [28].

Ethical aspects: ethical approval for the study was recieved from the Health Research and Ethics Committee of the Lagos State University Teaching Hospital (Approval number: LREC/06/10/1844). Informed consent was also obtained from study participants with assurance of their confidentiality being guaranteed.

Study participants and sampling method: data was collected using randomly selected sample of HIV positive patients aged between 18 years and above. A multi-stage random sampling method was utilized to enlist the study participants. A simple random technique by balloting method was used to select 2 LGAs (Ikeja and Alimosho) in the first stage. At the second stage, a simple random sampling method was utilized to select the Lagos State University Teaching Hospital and the Alimosho General Hospital out of the HIV facility centers and organizations providing HIV/AIDS-related services in each LGA. The third stage involved selection of eligible consenting participants that were registered for care at each of these centers through the local state clinical mentors who utilized the nominal roll in each center to enlist participants.

Sample size calculation: the minimum sample size was obtained using the formula for cross-sectional studies below:

$$n = \frac{Z^2 pq}{d^2}$$

Where: n= minimum sample size for the study; Z= 1.96 at 95% confidence level and p= proportion of adolescents who were exposed to SHS; q= 1-p; and d= acceptable margin of error of 5% precision. Using a prevalence of 20% for depression among HIV+ patients in a previous Nigerian study by Bankole *et al*. 2017 [29], a sample size of 246 was made. Provision for incomplete responses of 20% gave a final minimum sample size of 295 respondents.

Inclusion criteria: HIV status, based on documented results of blood tests conducted with biomarkers and categorized HIV status as HIV-positive, including those who tested positive for either HIV-1 or HIV-2 and a signed informed consent form.

Exclusion criteria: those that were HIV-negative; those who withheld their consent; physically, mentally or medically challenged patients, as well as those who were hospitalized were excluded from the study.

Data collection tool: a validated interviewer administered questionnaire partly adapted from the Global Adult Tobacco Survey (GYTS) version was used. The survey had five sections: sociodemographic and HIV related clinical information, history of tobacco use, the Patient Health Questionnaire-9 (PHQ-9) and the Generalized Anxiety Disorder - 7 (GAD-7) and Susceptibility to smoking cigarettes. Section A determined the sociodemographic and HIV-related clinical information of the participants, including duration of infection, use of HAART and alcohol consumption. Section B enquired about cigarette smoking, e-cigarette use, poly-tobacco use (e.g., shisha use), other substance such (e.g. marijuana use), and quit attempts. In Section C, the OHIP-14, a 14-question QOL assessment that measures seven aspects of impact (functional limitation, pain, psychological discomfort, physical disability, psychological disability, social disability and handicap) on OHRQOL was used. For each of the OHIP-14 questions subjects rated how frequently they had experienced an impact in the preceding months, on a 5-point Likert scale indicating if the problem had been experienced “very often” (code 4), “fairly often” (code 3), “sometimes” (code 2), “hardly ever” (code 1), or “never” (code 0). To calculate the OHIP-14 impact scores for

individual domains, the mean of the subjects´ scores was obtained to give a maximum score of 4. For individual sub-domain scores 0, 1 and 2 were classified as low impact while scores 3 and 4 were classified as high impact. To determine the overall OHIP-14 total impact score, item response codes were summed to give the final scores (Maximum obtainable impact score =56). The OHIP-14 final impact scores were classified as low (0-18.9), moderate (19-37.9) and high (38-56) to describe the impact level in the study population.

The Patient Health Questionnaire 9 (PHQ-9) was used to determine depressive symptoms and severity in Section D. The PHQ-9 questionnaire was scored from 0 to 27, with higher scores indicating more severe depressive symptoms. In Section E, Susceptibility to smoking cigarettes, defined by the absence of a firm decision not to smoke which was assessed among non-smoking respondents using a composite index of three questions: a) If one of your friends offered you a cigarette, would you smoke it? b) Do you think you will smoke a cigarette at any time during the next year? and c) What is the likelihood that 'you will be smoking cigarettes soon? Participants who answered anything other than 'definitely not' to any of the three items were classified as susceptible.

Statistical analysis: statistical analysis was done using SPSS version 26.0 software (Version 26.0. Armonk, NY: IBM Corp). The characteristics of the study subjects and the OHRQOL measured with OHIP-14 were reported in the univariate analysis. For continuous variables, the mean and standard deviation were calculated, and bivariate associations between socio-demographic characteristics and tobacco use with self-reported depression and OHRQOL were assessed using T test and Anova tests. To measure the association between tobacco use as the predictor variable and self-reported depression and OHRQoL as the outcome variables, multi-variate binary logistic regression was done with adjustment for Sex, Age, Alcohol use, Education, Use of HAART and duration of HAART use. Adjusted odds ratio (AOR) and Confidence Intervals ((5% CI) for each variable was calculated by considering adjustment for all of the other independent variables. P values < 0.05 were considered significant.

Results

The characteristics of participants in regard to HIV diagnosis period, HAART use, Depression Severity, OHRQOL impact severity and susceptibility to smoking among non-smoking participants are presented in Table 1. Of the 370 respondents surveyed, the highest proportion (119; 32.1%) had been HIV positive for ≥16 years; 26.6% had mild depression, 7.5% had moderate/moderately severe depression while 3.4% had severe depression. Majority of the respondents (54.3%) had low impacts on their OHRQOL while 22.7% had high impacts. The highest proportion of respondents (113;30.5%) had been on HAART for over 16 years. The highest OHRQOL (mean OHIP-14) scores were observed in the subdomains of Altered Taste (1.73±1.46), self-consciousness (1.64±1.55), pain (1.25±1.39) and being tense (1.23±1.42). More than 20% of the subjects reported high impacts on their quality of life in these sub-domains as well as in the subdomain of discomfort in the mouth. The highest mean impact score (1.73) was observed in the subdomain of altered taste. The lowest impact scores were obtained in the handicap (Table 2).

Bivariate association between socio-demographic characteristics, with self-reported depressive symptoms and OHRQOL among the study participants shows that non-binary respondents (6.40±4.90), those aged 21-30 years (5.57±4.93), current alcohol drinkers (6.16±4.51) current cigarette smokers (12.50±3.53) and smokers who had never made a cessation attempt (7.88±5.03) had a higher prevalence of self-reported depression. (Mean PHQ-9 scores). Worse OHRQOL (Higher mean OHIP-14 scores) was also significantly higher among non-binary respondents (31.14±16.21), those aged 21-30 years (27.00±18.81), University educated respondents

(27.00±18.81), current cigarette smokers (38.76±14.25), current alcohol drinkers (29.84±18.68) and smokers who were unsuccessful at a cessation attempt (39.38±15.50) (Table 3). In regression analysis showing adjusted odds ratio and confidence intervals for association between respondents´ characteristics and poor OHRQOL and depression, there was a significant association ($p<0.05$) between being male (female -aOR: 0.490; CI: 0.286-0.841), and smoking cigarettes (non-smokers -aOR: 0.206; CI: 0.090-0.472) with having poor OHRQOL. There were also increased odds of poor OHRQOL among those who drink alcohol, had a primary level of education, who do not use HAART, those aged 21-30 years and those who had been HIV positive for >16 years, although, the association was not significant. In addition, there was a significant association ($p<0.05$) between alcohol use (non-drinkers -aOR: 0.441; CI: 0.236-0.823), and smoking cigarettes (non-smokers -aOR: 0.110; CI: 0.110-0.492) with depression among respondents. There were also increased odds of depression among females, those that had a university level of education, those who do not use HAART, those aged 21-30 years and those who had been HIV positive for >16 years, although, the association was not significant (Table 4).

Discussion

The prevalence of alcohol use among the respondents was 37.3% while 23.6% of the study participants were smokers. Recent multicounty studies based on the Demographic and Health Survey (DHS) like that by Murphy *et al*. [30,31], from DHS data from 25 countries in SSA observed that PLWHA were more likely to use cigarettes and smokeless tobacco (SLT) compared to the general population [30]. Likewise, Mdege *et al*. observed a higher prevalence of tobacco use among PLWHA compared to those living without HIV [31]. Majority of the respondents had low impacts on their OHRQOL while 22.7% had high impacts. The highest impacts on OHRQOL were observed in the subdomains of altered taste self-consciousness, pain, being tense and discomfort with about 20% of study participants having high impacts in these subdomains. The lowest impact scores were however obtained in the handicap domain. This was in agreement with previous research that also found that the most affected OHRQOL category in PLWHA in Malaysia was psychological discomfort [32]. Parish *et al*. [33] similarly found that the highest impact on OHRQOL was in painful aching in the mouth and discomfort while eating. Oral health problems and unmet dental needs are common among PLWHA. In addition to periodontitis, other HIV-related oral lesions, such as ulcers, candidiasis and other opportunistic infections occur in over a third of PLWHA [34,35]. Additionally, PLWHA take HAART and other medications that diminish salivary flow, consequently affecting mastication, swallowing, speech and other oral functions [36]. Hence, the oral manifestations of HIV can make routine activities such as the ability to chew and swallow food comfortably, speak, and interact socially difficult, thus negatively impacting OHRQOL [32,33].

A key finding in the present study is that electronic cigarette use was not associated with poorer OHRQOL as observed among those using cigarettes, shisha and marijuana. This association should be further explored and if validated could support the use of e-cigarettes as a cessation tool among PLWHA who are unwilling to cease smoking. There were however, increased odds of poor OHRQOL among those who drink alcohol. Substantial alcohol consumption by PLWHA has been associated with increased viral loads, and more rapid disease progression, possibly due to the association between inebriation and poor attendance at follow-up clinic sessions [37]. Alcohol is also known to reduce the levels of neurotransmitters associated with mood stability such as serotonin, resulting in depressed mood. Worse, OHRQOL was also significantly higher among current cigarette smokers. Previous researchers have also reported that smoking status had a negative impact on OHRQOL [38]. A relationship has previously been established

between cigarette smoking to AIDS-related mortality [39]. This is possibly related to the oral morbidity independently associated with smoking, which is compounded by HIV status. Cigarette smoking and HIV infection are independent as well as synergistic risk factors for cardiovascular disease, chronic obstructive pulmonary disease (COPD), human papillomavirus (HPV), and malignancies [39]. Tobacco smoking is also associated with elevated inflammatory biomarkers, such as C-reactive protein, which is associated with increased risk of morbidity and mortality among PLWHA [40]. In addition, smoking has been implicated in reducing the effectiveness of HAART medication [41]. Therefore, PLWH who smoke tobacco should be assisted to quit tobacco use. The prevalence of depression among PLWHA in the present study was 38.5% and this ranged from 26.6% for those with mild depression, 7.5% for moderate or moderately severe depression and 3.4% for severe depression. This prevalence level corroborates that previously obtained in a study among PLWHA in Nigeria [42]. The findings also correlate with that from several global studies which reported that the prevalence of depressive disorders an among PLWHA ranges from 9 to 45% [20,43]. Furthermore, the discrimination and stigma associated with the condition also predisposes PLWHA to depression [44]. The association between HIV and depression has also been attributed toother factors, such as poor physical functioning, health-induced anxiety, a sense of helplessness, and social isolation [45,46].

Moreover, there was a significant association between alcohol use and smoking cigarettes with depression among respondents, and those who had never made a cessation attempt had a higher prevalence of self-reported depression. The relationship between smoking and depression among PLWHA may be bi-directional. They may resort to smoking to alleviate symptoms of depression and anxiety while smoking itself may lead to depression or anxiety, through its effects on the nervous system, that increases susceptibility to environmental stressors [47] There were also increased odds of depression among those who do not use HAART. The widespread availability and use of HAART reduces viral replication and improves immune status, with attendant reduction in mortality from opportunistic infections [48]. However, tobacco smoking enhances the susceptibility and risk for several comorbidities, while the rates of decline in CD4 counts is higher in smokers. Thus, the successes associated with increased HAART uptake may be hampered by other factors, such as tobacco smoking [49]. There were also increased odds of depression among females, those aged 21-30 years and those that had a university level of education. Some researchers observed that females and older PLWHA are more prone to depression, [50] while other researchers found no such association [51,52]. Bhatia *et al*. found observed that females who were newly diagnosed with HIV were more prone to depression [53]. Aljassem *et al*. similarly observed elevated odds of depressive symptoms among female Ontario residents [54]. It is noteworthy that females living with HIV from SSA could be at a higher risk of depression due to other traumatic events such as sexual abuse and intimate partner violence, which could have even predisposed them to the infection [55,56]. This study has some limitations. First, since the questionnaire was based on self-report and interviewer-administered, the data may be subject to recall and social desirability biases. Secondly, due to the descriptive nature of the study design, causal inferences cannot be made about the direction of the associations. Moreover, the role of additional health indicators, such as domestic violence, maternal health and social support, which may also be associated with HIV infection, alcohol consumption or tobacco use was not explored.

Conclusion

Our findings suggest a 38.5% prevalence of depression amongst a representative sample of people living with HIV/AIDS in Lagos, Nigeria, while almost a quarter had high impacts on their

OHRQOL. This study corroborated previous research that oral health problems are common amongst PLWHA and worse OHRQOL are significantly higher amongst current smokers. Of note, we found that electronic cigarette use was not associated with poorer OHRQOL, as observed among those using cigarettes, shisha and marijuana. Being male and smoking cigarettes were significantly associated with having poor OHRQOL, while alcohol use and smoking cigarettes were significantly associated with depression among respondents. The findings from this study can inform public health interventions aimed at smoking cessation amongst PLWHA given the modifying effect of cigarette smoking on depression and poor OHRQOL. The association between electronic cigarette (e-cigarette) use, OHRQOL and depression should be further investigated as there may be a potential for e-cigarettes to be used as a cessation tool among PLWHA who are unwilling to quit cigarette smoking.

What is known about this topic

- *Even though sub-Saharan Africa represents less than one-eight of the world´s population, over two thirds of the estimated 35.3 million people living with HIV/AIDS worldwide live in the sub-Saharan region; in addition, this region had two thirds of the 2.1 million new infections and 70% of 1.1 million global mortality associated with this disease;*
- *Alcohol abuse, tobacco smoking, and drug addiction among PLWHA have been associated with poor compliance with and reduced effectiveness of highly active antiretroviral therapy (HAART), resulting in viral proliferation, disease progression, as well as increased morbidity and mortality. PLWHA who smoke also have a higher predisposition to oral, respiratory and mental health illnesses, thereby worsening their Health-Related Quality of Life (HRQOL).*

What this study adds

- *The prevalence of depression among PLWHA in the present study was 38.5% and this ranged from 26.6% for those with mild depression, 7.5% for moderate or moderately severe depression and 3.4% for severe depression. There was a significant association between alcohol use and smoking cigarettes with depression among respondents, and those who had never made a cessation attempt had a higher prevalence of self-reported depression;*
- *Majority of the respondents had low impacts on their OHRQOL while 22.7% had high impacts. The highest impacts on OHRQOL were observed in the subdomains of altered taste self-consciousness, pain, being tense and discomfort with about 20% of study participants having high impacts in these subdomains. The lowest impact scores were however obtained in the handicap domain;*
- *Electronic cigarette use was not associated with poorer OHRQOL as observed among those using cigarettes, shisha and marijuana. This association should be further explored and if validated could support the use of e-cigarettes as a cessation tool among PLWHA who are unwilling to cease smoking.*

Competing interests

The authors declare no competing interests.

Authors' contributions

All the authors have read and agreed to the final manuscript.

Tables

Table 1: HIV diagnosis period, HAART use, Depression Severity, OHRQOL impact severity and Susceptibility to smoking among study participants

Table 2: oral Health-related quality of life among study participants

Table 3: bivariate association between socio-demographic characteristics of patients, with self-reported depressive symptoms and OHRQOL

Table 4: regression analysis showing adjusted odds ratio and confidence Intervals for association between respondents´ characteristics and poor OHRQOL and depression

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Table 1: HIV diagnosis period, HAART use, depression severity, OHRQOL impact severity and susceptibility to smoking among study participants			
		Frequency	**Percentage**
Duration since HIV diagnosis	0-5 years	93	25.0
	6-10 years	79	21.4
	11-15 years	79	21.4
	≥16 years	119	32.1
Depression (PHQ-9 score categories)	None-minimal depression (score 0-4)	231	62.5
	Mild depression (score 5-9),	98	26.6
	Moderate/moderately severe depression (score 10-19)	28	7.5
	Severe depression (score 20-27).	13	3.4
OHIP-14 impact severity	Low impact (0- 18.9)	201	54.3
	Moderate impact (19- 37.9)	85	23.0
	High Impact (38- 56)	84	22.7
Duration on HAART	Not on HAART	32	8.6
	0-5 years	80	21.7
	6-10 years	65	17.4
	11-15 years	80	21.7
	≥16 years	113	30.5
Susceptibility to smoking among non-smokers n= 283	Susceptible	81	28.6
	Not susceptible	202	71.4
Overall total		370	100
HAART: highly active antiretroviral therapy; OHRQOL: oral health related quality of life; PHQ-9: patient health questionnaire 9			

Table 2: oral health-related quality of life among study participants						
OHIP domains	**OHIP-14 Sub-domains**	**Low impact Band-0, 1 and 2.**		**High Impact Band 3 and 4**		**Mean OHIP-14 impact score**
		N	**%**	**N%**		
Functional limitation						
	Speech/sore mouth	303	81.5	67	18.5	1.12±1.26
	Altered taste	258	69.3	112	30.7	1.73±1.46
Physical pain						
	Pain	254	76.5	86	23.5	1.25±1.39
	Discomfort	294	79.2	76	20.1	1.18±1.37
Psychological discomfort						
	Self-consciousness	247	66.4	123	33.6	1.64±1.55
	Tense	259	77.9	81	22.1	1.23±1.42
Physical disability						
	Change in diet	303	81.5	67	18.5	1.15±1.34
	Interrupt meals	315	84.9	55	15.1	1.09±1.27
Psychological disability						
	Not relaxed	324	87.4	46	12.6	0.87±1.19
	Embarrassed	312	84.2	58	16.8	1.00±1.28
Social disability						
	Irritable	324	87.4	46	12.6	0.89±1.17
	Job/less tolerant	320	86.4	50	13.6	0.89±1.21
Handicap						
	Life less satisfying	321	86.5	49	13.5	0.87±1.20
	Inability to function	324	87.4	46	12.6	0.85±1.87
OHIP-14: oral health impact profile-14						

Table 3: bivariate association between socio-demographic characteristics of patients, with self-reported depressive symptoms and OHRQOL

Variables		n	%	Mean PHQ-9	Anova/p **	Mean OHIP-14	Anova/p**
Gender	Female	217	58.7	3.13±4.36	4.642/0.003*	15.39±16.12	12.383/0.000*
	Male	131	35.4	4.68±4.58		27.63±18.93	
	Non-binary	22	6.0	6.40±4.90		31.14±16.21	
Age categories	18-20	15	4.1	2.90±4.86	8.992/0.000*	22.84±13.15	7.774/ 0.000*
	21-30	125	33.8	5.57±4.93		27.00±18.81	
	31-40	94	25.4	4.17±4.26		21.77±19.01	
	41-50	84	22.7	2.05±3.33		16.37±16.02	
	>50	28	7.6	1.38±3.68		9.54±11.01	
Education	Post-graduate	27	7.3	2.05±2.62	1.619/0.185	9.57±10.47	11.905/0.000*
	Primary school	14	3.8	2.65±4.59		10.57±13.07	
	Secondary school	136	36.8	3.77±4.70		16.95±16.64	
	University	193	52.2	4.15±4.41		25.79±18.90	
Duration of HIV diagnosis (years)	0-5	93	25.0	4.50±4.67	2.186/ 0.130	23.33±9.64	2.019/ 0.142
	6-10	79	21.4	3.25±3.50		13.17±6.58	
	11-15	79	21.4	4.25±3.86		11.00±7.71	
	>16	119	32.1	7.33±5.27		30.14±27.07	
ART drug use	No	32	8.6	2.09±5.50	1.872/ 0.146	14.64±21.17	1.531/0.218
	Yes	338	91.4	3.92±4.54		21.25±18.49	
Duration of HAART use (years)	Not on HAART	32	8.6	5.68±4.88	0.452/0.720	31.24±9.87	0.869/0.475
	0-5	80	21.7	5.60±4.83		30.20±23.67	
	6-10	65	17.4	2.00±3.46		15.25±7.37	
	11-15	80	21.7	5.66±3.21		12.60±7.50	
	>16	113	30.5	5.71±5.91		26.00±26.40	
Alcohol use	No	232	62.7	2.56±3.97	49.053/0.000*	15.15±15.51	63.631/0.000*
	Yes	138	37.3	6.16±4.51		29.84±18.68	
Current tobacco use	No	283	76.4	2.95±4.11	25.886/0.000*	16.12±15.53	58.280/0.000*
	Yes	87	23.6	7.59±4.00		39.00±16.17	
Cigarette	No	299	80.8	3.73±4.43	45.774/0.000	16.79±17.95	46.861/0.000
	Yes	71	19.2	12.50±3.53		38.76±14.25	
Shisha*	No	307	91.7	2.11±3.47	49.653/0.000*	17.22±15.28	87.202/0.000*
	Yes	63	8.3	9.16±3.82		43.30±13.21	
Marijuana	No	337	91.1	2.47±3.91	20.967/0.000*	16.77±17.55	29.792/0.000*
	Yes	33	8.9	8.04±3.77		42.45±11.32	
E-cigarettes	No	289	78.1	3.72±4.43	1.861/ 0.051	10.39±17.55	1.744/0.053
	Yes	81	21.9	6.33±3.53		30.00±18.78	
Dual users	No	322	87.0	3.24±4.12	4.126/0.000*	17.09±15.33	10.053/0.000*
	Yes	48	13.0	7.93±4.41		42.50±22.19	
Smoking cessation (n=135)	Successful	48	36.0	1.58±2.77	20.191/0.000*	20.50±17.44	37.398/0.000*
	Unsuccessful	53	39.0	7.74±4.14		39.38±15.50	
	Never tried	34	25.0	7.88±5.03		36.96±16.07	
	Overall total	370	100.0				

*Significant **ANOVA test for association between sociodemographic, clinical and behavioural factors with depressive symptoms and OHRQOL; OHIP-14: oral health impact profile-14; OHRQOL: oral health related quality of life; PHQ-9: patient health questionnaire 9

Table 4: regression analysis showing adjusted odds ratio and confidence intervals for association between respondents characteristics and poor OHRQOL and depression					
OHRQOL		**aOR**	**95% C.I.**		**p value**
			Lower	Upper	
Sex	Male	1 (ref)			
	Female	0.490	0.286	0.841	0.010*
Alcohol use	Yes	1 (ref)			
	No	0.584	0.329	1.038	0.067
Education	University	1 (ref)			
	Primary	1.345	0.937	1.931	0.108
Use of HAART	No	1 (ref)			
	Yes	0.693	0.264	1.820	0.456
Cigarette smoking	Yes	1 (ref)			
	No	0.206	0.090	0.472	0.000*
Age	21-30	1 (ref)			
	>50	0.564	0.218	1.461	0.239
Duration of HAART use (years)	Not on HAART	1 (ref)			
	6-10 years	0.820	0.366	1.834	0.629
Duration since HIV diagnosis	0-5	1 (ref)			
	>16	1.404	0.386	1.439	0.382
Depression					
Sex	Male	1 (ref)			
	Female	1.291	0.687	2.428	0.427
Alcohol use	Yes	1 (ref)			
	No	0.441	0.236	0.823	0.010*
Education	University	1 (ref)			
	Primary	0.937	0.635	1.383	0.744
Use of HAART	No	1 (ref)			
	Yes	0.446	0.126	1.584	0.212
Cigarette smoking	Yes	1 (ref)			
	No	0.232	0.110	0.492	0.000*
Age	21-30	1 (ref)			
	>50	0.451	0.158	1.285	0.136
Duration of HAART use (years)	6-10 years	1 (ref)			
	Not on HAART	1.312	0.572	3.007	0.521
Duration since HIV diagnosis	0-5	1 (ref)			
	>16	1.404	0.708	2.783	0.382
*Significant OHRQOL: oral Health related quality of life; aOR: adjusted odds ratio; 95% C.I.: 95% confidence interval					