ORIGINAL RESEARCH

Rates and predictors of adherence and retention for antiretroviral therapy among HIV-positive adults in Enugu, Nigeria

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Abstract

Background

HIV infection and AIDS are majorpublic health challenges in Nigeria, a country with one of the highest rates of new infection in sub-Saharan Africa and the second largest HIV epidemic in the world.Non-adherence to medication and defaulting from treatment are the two major challenges faced by anti-retroviral therapy (ART) programs in resource-constrained settings. This study was undertaken to determine the rate and predictors of adherence to medication and retention among people living with HIVin Enugu State, Nigeria.

Methods

This was a cross-sectionalretrospective study conducted among adults living with HIV(PLHIV) receiving ARTs in eightcomprehensive health facilities in Enugu, Nigeria. We used self-reported adherence and recorded clinic visits to assess adherence and retention, respectively. Descriptive statistics (frequencies, proportions, mean and standard deviation) and regression analysis were then conducted to identify the association between adherence, retention and demographic and health-related factors.

Results

The mean age of respondents was 38.5±9.8 years. Predictors of good adherence to medication includedbeing male(adjusted odds ratio [AOR]:2.08; 95% confidence interval [CI]:1.12–3.85), having been on anti-retroviral medications for more than 5 years (AOR:1.92; 95% CI: 1.17–3.16), the non-consumption of alcohol(AOR: 3.67; 95% CI: 2.01–6.70),not usingtraditional medicine (AOR: 2.76; 95% CI:1.33–5.73) and having a baseline CD4count exceeding 500 cells/µl (AOR: 5.67; 95% CI: 1.32–24.32).Adequate retention was predicted by being resident in the urban area (AOR: 1.90; 95% CI: 1.17–3.06). Being away from home (41.8%) and forgetfulness (35.0%) were reported as the major reasons for missing medication.

Conclusion

The rates of adherence and retention found in this study were similar to those reported forother resource-limited settings. Health education and behavioural modification interventions should be intensified to reduce the consumption of alcohol and the use of traditional medicine by people living with HIV. Identifying other factors may help to design effective strategies to ensure that people living with HIV adhere to their medications and remain in care.

Key Words

Adherence, retention, predictors, PLHIV, Enugu State, Nigeria

Introduction

Sub-Saharan Africa, home to over 10% of the world's population, remains the worst HIV-affected region in the world. In fact, this geographical area is home to approximately 70% of all people living with HIV (PLHIV) globally[1]. While the number of people newly diagnosed with HIV is falling, both HIV and AIDS remain major public health challenges in Nigeria, the country with the second largest HIV epidemic in the world[2]. Findings from the 2014 HIV National Sentinel Survey showed that Nigeria, Africa's most populous nation with a population of 186 million, had an HIV prevalence of 3.0%.ranging from 0.9% to 15.4% across different zones[2,3]. Furthermore, thissurvey showed that 1.6 million women were living with HIV compared with 1.4 million men[2,3]. The magnitude of the HIV epidemic, and the complexity of its chronicity, however, represent major challenges to healthcare delivery systems in both resource-rich and resource-constrained settings[4]. In resource-constrained settings,in which healthcare services are not well developed, there are two major challenges faced by anti-retroviral therapy (ART) programs:poor adherence to treatment and defaulting from treatment[5].

Adherence has been difficult to sustain for patients receiving highly active anti-retroviral therapy (HAART) across the globe[6]. The meanrate of adherence to ART is approximately 70%, despite the fact that long-term viral suppression requires near-perfect adherence[7]. On the other hand, poor adherence compromises the efficacy of treatment, making this a critical public health issue[8]. As one of the major predictors of progression to AIDS and death after CD4 count, poor adherence is also associated with the development of drug-resistant viral strains and virological failure[7,9,10].The results of a 2006 meta-analysis of ART adherence showed that, on average, 23% of patients in studies from sub-Saharan Africa did not achieve adequate adherence, with the proportion of non-adherent patients ranging from 2% to 70%[11].

Despite the widely acknowledge scale-up in the use of ARTs, retaining patients in care remains a well-documented global challenge and has undermined efforts to enhance treatment outcomes[12,13]. Patient retention is a function of attrition which includes deaths, patients who are lost-to-follow-up (LTFU) and those who stop treatment.LTFU is the most common cause of attrition, followed by death[12]. Furthermore, LTFU has been shown to contribute to poorer health outcomes for patients, constitutes a serious form of resource wastage, and can promoteHIV drug resistance[14]. In 2007, a meta-analysis of ART programs in Africa showed a retention of approximately 60% and 76% of patients on ART at the end of 2 years and 3 years, respectively[15]. Similar findings were reported in an updated meta-analysis of 39 cohorts from sub-Saharan Africa in 2011[12].

Many barriers to adherence are common to both developed and developing settings, such as fear of disclosure. Other barriers are unique to studies conducted in the developing world, such as financial constraints (cost of drugs and/or transport) and others, such as stigma, a feeling of being healthy and forgetfulness[5,16,17]. Other factors can also make it more difficult for patients to adhere to treatment, includingmental illness, the complexity of drug regimes, the side effects of medication, active alcohol use, substance abuse and the non-disclosure of HIV status[6,18,19]. Factors such as increased duration on ART, male gender, an age of less than 15 years and a World Health Organization (WHO) classification of stage III and IV have been shown to be significantly associated with retention[20]. Based on a study population in south-eastern Nigeria, Onoka et al. reported that being male, having a CD4 countless than 200/µl and being treated by a public hospitalwere good predictors of retention-in-care[20]. In another study, Eguzo et al. found that baseline CD4 count, the year of enrolment and drug combination were significant predictors of retention[14]. With the positive strides already gained in the fight against AIDS over recent years, the paradigm of HIV care has now shifted to theestablishment of a continuum of care among PLHIV. Although research has shown that adequate ART adherence rates can be achieved in resource-poor settings[11], there are concerns that adherence to ART in such settings may decline as access to treatment increases[10]. The present studycollaborated with several healthcare facilities within Enungu State Nigeria and aimed to investigate adherence to medication and retention among PLHIV. Findings from this study will aid the planning and implementation of intervention programs so that we can scale-up ART adherence and retention of PLHIV in Enugu State Nigeria.

Methods

Study setting

Enugu state is one of the five states in south-eastern Nigeria, with a population of 3,257,298 people[22], three senatorial zones and 17 local government areas (which serve as administrative units for the state). The ART program was introduced into this state in 2004 and first began to provide free drugs to patients in 2006. In Enugu state, ART services are now offered in 21 comprehensive ART sites, in both public and private health institutions. This study was conducted in eight comprehensive health facilities in Enugu state: Mother of Christ Specialist Hospital, University of Nigeria Teaching Hospital, Annunciation Specialist Hospital, Enugu State University Teaching Hospital, Nsukka District Hospital, Bishop Shanahan Hospital, Udi District Hospital and General Hospital Nsukka.

Study design, population and sampling

This study combined both cross-sectional and retrospective study designs involving PLHIV who accessed care in comprehensive health facilities in Enugu state. We included all PLHIV that were over 18 years of age and had been onHAART for at least 1 year prior to the study commencing. We excluded patients who refused to provide consent, whose records were incomplete or missing, or who were in HIV clinical stage III or IV and in a generally poor clinical state at presentation, usually with complicated AIDS-defining illness. The minimum sample size for the study was determined based on the expected proportion of adherence to ART among PLHIV in a previous study (75%)[5]; the calculations involved the use of Fisher's statistical formula[23]. However, in order to increase the validity of the study, a sample size of 840 was used, with a relative precision of 5% and a confidence interval of 95%. We then compiled a list of patients attending ART clinics using files from the medical records department of the eight selected health facilities. We used this data to then determine the sampling frame for the study.Theeight facilities were selected proportionately from the three senatorial zones. The sample size was proportionally allocated to the facilities based on their patient load. A systematic sampling technique was then used to select the study participants as they presented for their routine clinic visits.

Data collection

The study lasted for 6 weeks (August to September 2016). Data was collected from study participants using two approaches; a pre-tested semi-structured interviewer-administered questionnaire designed by the principal researcher, and medical records. The questionnaire contained a section relating to socio-demographic information and another section on self-reported adherence. Additional questions were developed to acquire responses peculiar to this study such as disclosure, social habitsand theHIV status of partner.We reviewed the medical records of each participant to ascertain retention over a period of 1 year prior to the study. Routine health data were extracted from medical records, includingthe year of HIV diagnosis, the duration on HAART, the type of regimen, dosing frequency and the regularity of routine clinic visits. The questionnaire was pretested among 42 randomly selected PLHIV from a health facility in Agbani district, which was not selected for the main study. Ambiguities or deficiencies in the study instruments were then revised. Ethical approval was obtained from the Health Research and Ethics Committee of Enugu State University Teaching Hospital, Enugu. The study was also approved by theState Ministry of Health and the Heads of the health facilities involved. Written consent was secured from each participant and anonymity was assured.

Measurement of variables

We used the pharmacy records, regimen type and dosing frequency to estimate the total number of doses expected and delivered within a 1-month period. In order to determine self-reported adherence, we asked our participants the following question:'How many pills were you unable to take in the past 28 days?' Self-reported adherence was then ascertained by calculating the proportion (%) of medication (pills) taken over 28 days divided by the number of pills prescribed within the same period. In this study, adherence

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was classified as either good or poor. Good adherence was scored as '1' while poor adherence was scored as '0'. Participants who achieved an adherenceof less than 95% were classified as having poor adherence, while those withan adherence of 95% and abovewere classified as having good adherence; these classifications were based on established WHO definitions[24].

Retention was assessed using the medical records of each participantover a period of 1 year prior to the study commencing. Participants who were absent from treatment for at least 90 days (3 months) from the last given refill or appointment date were considered LTFU and scored as '0'

Table 1. Socio-demographic characteristics of respondents (N=840)

Variable	Frequency	Percentage
Age of respondents		
Mean ±(SD)	38.5±9.8	
Age in groups		
<30 years	136	16.2
30 – 39 years	353	42.0
40 – 49 years	228	27.1
≥50 years	123	14.6
Gender		
Male	199	23.7
Female	641	76.3
Level of Education		
No formal education	44	5.2
Primary education	312	37.1
Secondary education	362	43.1
Tertiary education	122	14.5
Employment status		
Self employed	623	74.2
Salary earners	119	14.2
Unemployed/Student	98	11.7
Area of Residence		
Rural	553	65.8
Urban	287	34.2
Socio-Economic Status		
Low socio-economic status	425	50.6
High socio-economic status	415	49.4
HIV Status of partner	n=742	
Unknown	241	32.5
Negative	235	31.7
Positive	266	35.8
Mode of transport		
Taxi/Bus	630	75.0
Tricycle/Okada	170	20.2
Personal car	26	3.1
Walk	14	1.7
Approximate cost of transport to health facility (Naira)		
Mean ± SD	601.3±691.4	
Median	400	
Minimum	80	
Maximum	5000	
Estimated time to reach the facility (Minutes)		
Mean ± SD	69±45	
Median	60	
Minimum	10	
Maximum	240	
Alcohol intake		
No	751	89.4
Yes	89	10.6

while those that reported at least once within 3 months were scored as '1'20. The quarterly visits (four visits annually) were summated over the year. For the purpose of this study, retention was categorizedas either adequate or inadequate. Adequate retention was scored as'1' while inadequatewas scored as'0'. Participants with a total of four visits were categorized as having adequate retention while those who made less than fourvisits were categorized as having inadequate retention.To avoid recall bias, we extracted this information from thehospital records of each participant.

Data analysis

Data cleaning and editing were performed manually and were designed todetect omissions and ensure uniform coding. Data entry and analysis were performed using the Statistical Package for Social Sciences (SPSS) version 22. Frequencies and proportions were derived for categorical variables and analysed using the chi-square test and Student's t-test. Multivariate analysis, using binary logistic regression,was also used to predict the probability of occurrence for each outcome variable. Results are reported asodds ratios and95% confidence intervals; the level of significance was set to 0.05. Variables showing a P-value <0.2 in the bivariate analysis were subsequently entered into a multivariate binary logistic regression model to determine predictors of medication adherence and retention.

In addition, we also determined the socio-economic status (SES) index for each patient usingprincipal component analysis (PCA) and Stata statistical software version 10. The indicator variables used for PCA were (1) estimated monthly household incomeand (2) ownership of ten household modern assets, including radio, plasma television, refrigerator, cable television, electric fan, air conditioner, motor vehicle,

Table 1 Cont..

Cigarette intake		
No	823	98
Yes	17	2
Herbal medication intake		
No	792	94.3
Yes	48	5.7
Number of years on HAART		
Mean ±(SD)	4.2±2.9	
1 - 4	497	59.2
>4	343	40.8
Type of Regimen		
First line regimen	675	80.4
Second line regimen	165	19.6
Dosing frequency		
Once daily (24 hourly)	281	33.5
Twice daily (12 hourly)	559	66.5
Monthly pill count		
Mean ±(SD)	67.8±43.1	
30 pills	281	33.5
60 pills	394	46.8
150 pills	162	19.3
180 pills	3	0.4
Baseline CD4 staging (cells/µl)		
Mean±(SD)	253.3±185.2	
0 - 199	361	43.0
200 - 349	293	34.9
350 - 499	119	14.2
≥ 500	67	8.0

Table 2. Adherence and retention rates of PLHIV in Enugu

Variable	Frequency	Percentage
Adherence ≥95%	752	89.5
Adequate Retention	732	87.1

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Table 3. Predictors of adherence to ART among PLHIV in Enugu

Variable	Adherence Yes	Adherence No	p-value*	AOR[95%CI]**
Age in groups				
<30 years	120 (16.0)	16 (18.2)	0.356	NA
30 – 39 years	311 (41.4)	42 (47.7)		
40 – 49 years	206 (27.4)	22 (25.0)		
≥50 years	115 (15.3)	8 (9.1)		
Gender				
Male	183 (24.3)	16 (18.2)	0.199	2.08[1.12 – 3.85]
Female	569 (75.7)	72 (81.8)		1
Education of respondent				
No Formal Education	42 (5.6)	2 (2.3)	0.530	NA
Primary Education	280 (37.2)	32 (36.4)		
Secondary Education	320 (42.6)	42 (47.7)		
Tertiary Education	110 (14.6)	12 (13.6)		
Employment status of respondent				
Self employed	555 (89.1)	68 (10.9)	0.702	NA
Salary earners	107 (89.9)	12 (10.1)		
Unemployed/student	90 (91.8)	8 (8.2)		
Number of years on HAART				
>4	317 (92.4)	26 (7.6)	0.023	1.92[1.17-3.16]
1-4	435 (87.5)	62 (12.5)		1
Area of residence				
Urban	261 (90.9)	26 (9.1)	0.334	NA
Rural	491 (88.8)	62 (11.2)		
Socio-economic status				
Low socio-economic status	380 (89.4)	45 (10.6)	0.915	NA
High socio-economic status	372 (89.6)	43 (10.4)		
Alcohol Intake				
No	685 (91.1)	66 (75.0)	<0.001	3.67[2.01-6.70]
Yes	67 (8.9)	22 (25.0)		1
Cigarette/Tobacco intake				
No	737 (98.0)	86 (97.7)	0.861	NA
Yes	15 (2.0)	2 (2.3)		
Traditional medicine intake				
No	717 (95.3)	75 (85.2)	<0.001	2.76[1.33-5.73]
Yes	35 (4.7)	13 (14.8)		1
Cost of transportation to health facility (Naira)				
≤400	413 (57.0)	47 (56.6)	0.953	NA
>400	312 (43.0)	36 (43.4)		
Baseline CD4 staging (cells/µL)				
≥ 500	65 (8.6)	2 (2.3)	0.041	5.67[1.32-24.32]
350 - 499	106 (14.1)	13 (14.8)		1.43[0.72-2.81]
200 - 349	268 (35.6)	25 (28.4)		1.78[1.05-3.03]
0 - 199	313 (41.6)	48 (54.5)		1

p-value on bivariate,* AOR-Adjusted Odds Ratio at 95% Confidence Interval,** NA-Not Applicable (as only variables with p-value<0.2 at bivariate were logged into multiple logistic regression model)

washing machine, gas cooker and electric iron. Weights were assigned to the different variables and categories. The wealth index was calculated using the 'balanced weight' of the variables. Each respondent was categorized into 2; either a low or high SES index based on the wealth index score of their household.

Results

Table 1shows the socio-demographic characteristics of our respondents; themean age of respondents was 38.5±9.8 years. The highest proportion of respondents were aged 30–39 years. The majority of respondents were females (76.3%), which reflects the present demographics of patients receiving HIV/AIDS care and treatment in Nigeria. Most

Table 4. Predictors of retention

Variable	Retention Yes	Retention No	p-value*	AOR[95%CI]**
Age in groups				
<30 years	115 (15.7)	21 (19.4)	0.359	NA
30-39 years	316 (43.2)	37 (34.3)		
40-49 years	195 (26.6)	33 (30.6)		
≥50 years	106 (14.5)	17 (15.7)		
Gender				
Male	169 (84.9)	30 (15.1)	0.285	NA
Female	563 (87.8)	78 (12.2)		
Education of respondent				
No formal education	40 (5.5)	4 (3.7)	0.545	NA
Primary Education	266 (36.3)	46 (42.6)		
Secondary Education	317 (43.3)	45 (41.7)		
Tertiary Education	109 (14.9)	13 (12.0)		
Employment status of respondent				
Self employed	545 (87.5)	78 (12.5)	0.725	NA
Salary earners	101 (84.9)	18 (15.1)		
Unemployed/student	86 (87.8)	12 (12.2)		
Number of years on HAART				
1 - 4	435 (87.5)	62 (12.5)	0.690	NA
>4	297 (86.6)	46 (13.4)		
Area of residence				
Urban	263 (91.6)	24 (8.4)	0.005	1.90[1.17-3.06]
Rural	469 (84.8)	84 (15.2)		1
Socio-economic status				
Low socio-economic status	362 (85.2)	63 (14.8)	0.085	0.9[0.6 – 1.4]
High socio-economic status	370 (89.2)	45 (10.8)		1
Alcohol intake				
No	652 (89.1)	99 (91.7)	0.413	NA
Yes	80 (10.9)	9 (8.3)		
Cigarette/Tobacco Intake				
No	717 (98.0)	106 (98.1)	0.892	NA
Yes	15 (2.0)	2 (1.9)		
Traditional Medicine intake				
No	689 (94.1)	103 (95.4)	0.603	NA
Yes	43 (5.9)	5 (4.6)		
Cost of transportation to health facility (Naira)				
≤400	402 (57.1)	58 (55.8)	0.798	NA
>400	302 (42.9)	46 (44.2)		
Baseline CD4 staging (cells/µL)				
0 - 199	306 (41.8)	55 (50.9)	0.029	0.39[0.14-1.12]
200 - 349	252 (34.4)	41 (38.0)		0.45[0.15-1.30]
350 - 499	111 (15.2)	8 (7.4)		0.98[0.28-3.39]
≥ 500	63 (8.6)	4 (3.7)		1

p-value on bivariate,* AOR-Adjusted Odds Ratio at 95% Confidence Interval,** NA-Not Applicable (as only variables with p-value<0.2 at bivariate were logged into multiple logistic regression model)

respondents were self-employed (74.2%) and there was a greater proportion of respondents residing in rural areas (65.8%). More than 50% ofrespondents (497) had been on HAART for less than 4 years. Furthermore, there were more respondents on a first line regimen (80.4%) than those on a second line regimen (19.6%).When defined by a CD4 count <200 cells/µl, 43% of our study participants (n=361) had AIDS. Our analysis identified that there was good adherence to anti-retroviral treatment in 89.5% (752) of the respondents (Table 2). Approximately 87% (732) of respondents were found to have adequate retention. Male respondents were twice as likely to adhere to their

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ART than their female counterparts though the difference in proportion was not found to be statistically significant (adjusted odds ratio [AOR]: 2.08; 95% confidence interval [CI]: 1.12–3.85) p=0.199 (Table 3). Respondents on HAART for more than 5 years were also twice as likelyto achieve adherence when compared with those who had taken HAART for less than 5 years and the difference in proportion was statistically significant (AOR: 1.92; 95% CI: 1.17–3.16) p=0.023. Similarly, respondents who did not take alcohol had approximately four times the odds of being adherent to their medications when compared to those who did use alcohol. There was a statistically significant difference in this proportion (AOR 3.67, 95% CI: 2.01–6.70) p<0.001. Those who did not consume traditional medicine were approximately three times more likely to have better adherence than those who did consume traditional medicine (AOR: 2.76; 95% CI: 1.33–5.73) p<0.001. Respondents with a baseline CD4 count >500cells/µl were approximately six times more likely to be adherent when compared with those having a baseline CD4 count < 200 cells/µl (AOR: 5.67; 95% CI:1.32–24.32). The difference in proportion was statistically significant (p=0.041). Participants who resided in urban areas were approximately twiceas likely to show adequate retainment as those who resided in rural areas (AOR: 1.90; 95% CI: 1.17–3.06) This was statistically significant (p=0.005) (Table 4). Comparable proportion of participants who had low SES had approximately one time the odds of being adequately retained than those with high SES (AOR: 0.90; 95% CI: 0.62-1.46) P=0.085. The respondents with baseline CD4 <200 cells/ µl were three times less likely to be adequately retained when compared with their counterparts having baseline CD4 >500 cells/µl (AOR: 0.39; 95% CI: 0.14-1.12) and the difference in proportions was found to be statistically significant (p=0.029). The commonest reasons for missing medication were being away from home (41.8%) and forgetfulness (35.0%). Other reasons included physical discomfort (6.8%), running out of medication (12.6%), could not hide to take the drugs (2.4%) and fasting (1.4%) (Figure 1).

Discussion

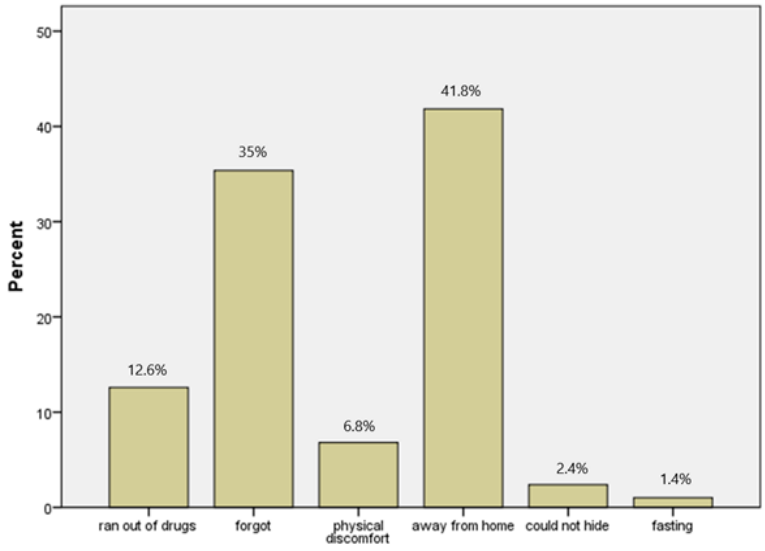

Figure 1. Reasons for missed medications (N=294)

The WHO reports that approximately one-third of patients suffering from HIV/AIDS take their medication as prescribed[24].However, this remains a significant challenge for patients living in both developed and developing countries. The self-reported adherence to ART in this study was 89.5%, slightly higher than the 85.8% that was previously reported in Nnewi, another city in south-east Nigeria[25]. Seven years ago, when ART programs were only just being developed in our study area, the level of adherence was as low as 75%[5]. This may possibly have been due to the lack of drugsin several health facilities during this period of time. Thus, inconsistent access to medications could have presented a challenge to the delivery system and unwittingly encouraged non-adherence. However, with enhanced availability and accessibility to medications, as well as the provision of free ART services, it is evident that adherence has improved significantly in this region. The results of our study were consistent with previous findings from some other developing African countries, where a high rate of adherence (based on self-reporting) has also been reported, including Ghana (86%)[26],Rwanda (77%)[27] and Ethiopia (95%)[28]. Interestingly, this finding is in direct contrast to a previous WHO report which stated that themean adherence rate to long-term therapy for chronic illnesses in developed countries was approximately 50%, and that in developing countries, the rates were even lower[24].

We found that being away from home and forgetfulness were reported as the major reasons for missing medication; similar factors were noted in some other studies[29,30]. Other, less frequently reported reasons for missed doses included stock control problems for drugs, discomfort/side effects, being ashamed of taking medication in front of others and fasting.

The retention of PLHIV on ART in this study (87.1%) was higher than the 82.6% and 66.5% previously reported in private and public facilities in South-East Nigeria, respectively[21]. Previous retrospective studies of Nigeria, carried out over 7 (2005–2012) and 5 years (2009–2013), showed retention ratesof 63% and 76.1%, respectively[14,31]. Based on these findings, we can therefore infer that although patients are still LTFU, and there is clear potential for the development and transmission of drug-resistant strains of HIV, there has been a progressive improvement in the rate of retention in Nigeria. However, the approach of measuring retention in these retrospective studies focused on only one or more visits to the clinic each yearand could therefore overestimate the level of retention as patients LTFU would not have been included. A similar progressive increase in retention has been documented in Ethiopia, where the retention rate has risen from 77% (2004–2005) to 92% (2012–2013)[13]. These progressive increases in retention rates could be due to the massive scale-up of HIV services and recent intervention programs aimed at improving retention in these countries.

Our bivariate analyses revealed that there was a statistical association between adherence to medication and gender, the number of years on HAART, alcohol intake, the intake of traditional medicine and baseline CD4 cell count. The finding that men were more likely to adhere to their medication than women is a true reflection of gender issues in sub-Saharan Africa as African men are generally seen to have more"free" time and money at their disposal than women[32]. This finding was similar to a previous study carried out in south-east Nigeria, which found that females were less adherent to their medications due to forgetfulness, poor communication and the side effects of drugs[19]. Furthermore, due to cultural barriers, women in our study setting may have had difficulties disclosing their status, thus meaning that they

needto hide while taking their medications.

Patients who have been on HAART for a longer duration would have been exposed to the relative advantages and disadvantages of adhering to their medicationas they would have witnessed treatment failure and possibly the death of non-adherent patients. Poor adherence rates among those who have been on HAART for short durations could also be the result ofanti-retroviral-related toxicity experienced when the medication was first introduced. This significant finding implies that adherence improves over longer durations of treatment.Similar findings were described for Botswana, where patients who had been receiving ART for the shortest duration of time (1–6 months) had the poorest adherence to medication[33]. However, a conflicting finding was reported for HIV-positive pregnant women in south-east Nigeria; in this particular cohort of patients, there was a lower rate of adherence reported for those who had been on HAART for long periods of time[34]. This finding was attributed to complacency, especially among long-term patients who saw clear improvements in theirphysical and psychological function. This may have reduced their motivation to adhere to anti-retroviral medications after delivery. Our study further showed that patients who took alcohol and traditional medicine showed poor adherence to their medications.The association between alcohol intake and adherence has been documented in previous studies[35]. In contrast to our present findings, drinking alcohol was not associated with non-adherence to antiretroviral therapy in a study carried out in Ethiopia[36]. This inconsistency could represent socio-cultural differences in the two different study settings. Although the intake of traditional concoctions has been reported as a barrier to ART adherence, PLHIV on anti-retrovirals in South Africa still ingest these concoctions, which are sourced from traditional healers, while adhering to their ART, as they are reported to act as an internal body cleanser[37].

In most resource-limited countries of Africa, where most of the world's HIV-infected people live, the diagnosis of HIV infection is often made during advanced stages when AIDS-defining illnesses begin to manifest[38]. It is therefore not surprising that a CD4 count <200 cells could predict adherence to medication in this study; 43% of patients presented with a CD4 count <200 cells at baseline. Similarly, other studies have reported that patients with CD4 counts>200 cells at the beginning of ART were at a higher risk of non-adherence[7,39]. These patients probably deem themselves to be healthy and therefore decided not to carry on with their medications. Retaining PLHIV has the potential not only to limit health care costs but also to provide the opportunity to implement preventive health care interventions.This may promote behavioural changes in healthcare, thus leading to a reduction in HIV transmission and burden, thus leading to a general improvement in public health[40].We found that the area of residence was a significant predictor of retention in our present study. Patients residing in rural areas might have difficulties accessing health facilities. This is because more health facilities offer HIV treatment services in urban areas than rural areas, thus making it difficult for those in rural areas to access care. Distance to the clinic, as well as travel times that exceed 2 hours due to bad roads, or financial constraints, have also been identified as major barriers to retention in previous studies[14,40].

Conclusion

The rate of adherence to medication and retention-in-care was higher in our study area than other studies conducted in Nigeria. Gender, the number of years on HAART, alcohol intake and the intake of traditional medicine predicted non-adherence to medication while residence in urban areas predicted retention. While some of these factors are modifiable, others are not. Based on this study,we recommend that to achieve good adherence and adequate retention, programs and research should focus on interventions that can particularly improve adherence among females and lead to behavioural modifications whichcan reduce the intake of alcohol and traditional medications in the study area. These practices will invariably improve the adherence to ART in this region. Although the level of adherence to medication among PLHIV is increasing insouth-east Nigeria, there is a need for sustained improvement to ensure optimal health outcomes.A decline in adherence has been projected in resource-limited settings as treatment access increases. Although the number of available treatment facilities continues to increase in this setting, patients may continue to avoid accessing care from facilities within their communities because of stigma. Consequently, the scale-up of treatment facilities must be coupled with social support from the community. Our findings also support the need to evaluate access to health facilities based on their localities to ascertain measures to specifically support patients in rural settings.

Limitations

There is no gold standard for measuring adherence. In the present study, we based adherence only by analysing the self-reporting of missed doses over a period of 28 days. It is possible that this may be affected by recall bias and overestimation[7].The use of more objective measures, such as a microelectronic monitoring system for pill counts, would have provided a more comprehensive assessment of adherence than self-reporting. However, a simple self-report adherence questionnaire, such as the one used in this study, has previously been reported to provide a profound degree of non-adherence that predicts viral rebound and is almost always reliable7.Finally, the exclusion of patients who have been on HAART for less than a year, as well as patients in HIV clinical stage 3 and 4, may also affect the generalization of the findings of this study.

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Conflicts of interest

The authors have no conflicts of interest to declare.

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Ethical considerations

Ethical approval for this study was obtained from the Health Research and Ethics Committee of Enugu State University Teaching Hospital (ESUTH) Enugu, Nigeria.Approval was also obtained from the Enugu State Ministry of Health and the management of the selected health facilities. Written informed consentwas obtained from each of the participants.

Availability of data and materials

Materials and data are available from the Department of

Community Medicine, Enugu State University Teaching Hospital for a period of 5 years following publication.

Authors' contributions

OC conceived, designed and drafted this study. CO analysed and interpreted the data, while EN provided administrative and technical support. All authors critically revised the manuscript and approved the final version for publication.

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