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RESEARCH ARTICLE

Clinical profile and predictors of viral suppression in HIV-infected older adults at a University Hospital in Kumasi, Ghana

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ABSTRACT

Availability of effective antiretroviral therapy (ART) has improved patient survival and older adults (≥50 years old) constitute 10% of the world's HIV population. However, data on this population are lacking, especially in sub-Saharan Africa. To identify the profile of older adults with HIV infection receiving ART and factors associated with viral suppression. A retrospective cross-sectional study involving HIV patients ≥50 years, registered at a University Hospital in Kumasi, Ghana from January 2010 to July 2020. All study participants had been on ARTs for ≥12 months. Data were analysed using STATA® and multivariate logistic regression was done to determine the association between variables. We recruited 132 study participants with a mean age of 58.1 years (±6.8). Non-communicable diseases (NCD) comprised the commonest comorbidity (67.4%; $n = 89$) and hypertension was the most prevalent (47.2%). The mean duration of ART was 63.2 months (±32.0) and approximately 84.1% ($n = 111$) achieved viral suppression (≤50 copies/ml). After adjustment, factors independently associated with viral suppression were widow(ed) (aOR = 0.23; 95% CI = 0.07–0.72) and good ART adherence (aOR = 3.51; 95% CI = 1.03–11.99). Hypertension is prevalent among this cohort of HIV patients. Approximately 84% of elderly patients on ARTs achieve viral suppression, influenced by widowhood and good drug adherence.

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Older adults; HIV; viral suppression; comorbidities; Ghana

Introduction

In sub-Saharan Africa, approximately three million adults aged ≥50 years are living with human immunodeficiency virus (HIV) (Negin & Cumming, 2010). Although older heterosexual couples form the largest group of new infections in most African countries, relatively few prevention programmes have been directed towards them (UNAIDS, 2009). They have limited access to HIV-related services and are more likely to advance to acquired immune deficiency syndrome (AIDS) and death (UNAIDS, 2009).

Provision of effective HIV care to this cohort of patients is essential as they contribute to the economic, sociocultural and political growth of most countries. Older adults provide family support, care for younger ones and comprise an essential component of the labour force in developing countries (Harper, 2020). Population ageing seems global and the growth of the older population in sub-Saharan Africa is expected to outstrip that of any other region in the world. It has been projected that by 2100, Africa will see a 15-fold growth in the number of older adults, from 46 million to 694 million (Aboderin, 2018).

Although numerous positive gains have been made in HIV care, people aged ≥50 years have not received adequate attention and there is paucity of data on persons with the infection within this population (Barnett, 2006). The limited studies on HIV infection among older adults have been found largely in developed countries (Bhavan et al., 2008; Orchi et al., 2008; Pitts et al., 2005). The aim of this study was to conduct a retrospective review of a 10-year clinical data of older adults who are HIV-positive and registered at the Infectious Disease Unit (IDU), Kwame Nkrumah University of Science and Technology (KNUST). We sought to identify their socio-demographic and clinical characteristics, prevalence of comorbidities and factors associated with viral suppression after 12 months on treatment.

Methods

Study design: This was a retrospective cross-sectional study involving review of data on all HIV-positive

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older adults (at least 50 years) registered at the Infectious Disease Unit (IDU) of the University Hospital, Kwame Nkrumah University of Science and Technology (KNUST) in Kumasi in the Ashanti Region of Ghana.

The study site: The University Hospital is a district-level institution located on the campus of KNUST. It is a 125-bed hospital which provides both general and specialist services. The Infectious Disease Unit (IDU) of the hospital was set up in the year 2010 and attends to patients diagnosed with HIV/AIDS, tuberculosis, hepatitis B and C. Since April 2020, the IDU has been involved in home visits and management of patients with the 2019 coronavirus disease (COVID-19) (Ayisi-Boateng et al., 2020b). The Unit has approximately 1200 registered clients with HIV/AIDS.

Study population: The study population consisted of all HIV-positive older adults registered at the IDU of the University Hospital, KNUST from 1 July 2010 to 31 July 2020. Participants included were HIV-positive patients (male and female) registered at the IDU who were at least 50 years old and had been on antiretroviral therapy for at least 12 months. Data excluded were those of patients who had died or had been lost to follow up at the time of data collection (Figure 1).

Data collection and statistical analysis

Anonymized data on demographic characteristics, clinical parameters, drug adherence and other information were retrieved from the patients' medical records, treatment logs and laboratory reports. There was no direct interaction with the patients recruited. We defined viral suppression as HIV RNA <50 copies/ml (Supervie, n.d.). Good adherence was defined as a patient who had consistently reported to the IDU on all scheduled appointments with no record of missing appointment or defaulting treatment. Non-adherence was defined as a patient ever defaulting treatment or missing a clinic appointment documented at least once in the patient's medical records. The data were entered into an Excel spreadsheet, cleaned and exported to STATA® 14 (College Station, TX) for analysis. Chi-squared test or Fisher's exact test was used to determine associations between viral suppression and factors associated where appropriate. All variables with a p-value ≤ 0.05 were considered statistically significant. Multivariate logistic regression was employed to determine the independent risk factors associated with the outcome variable (viral suppression after 12 months on treatment).

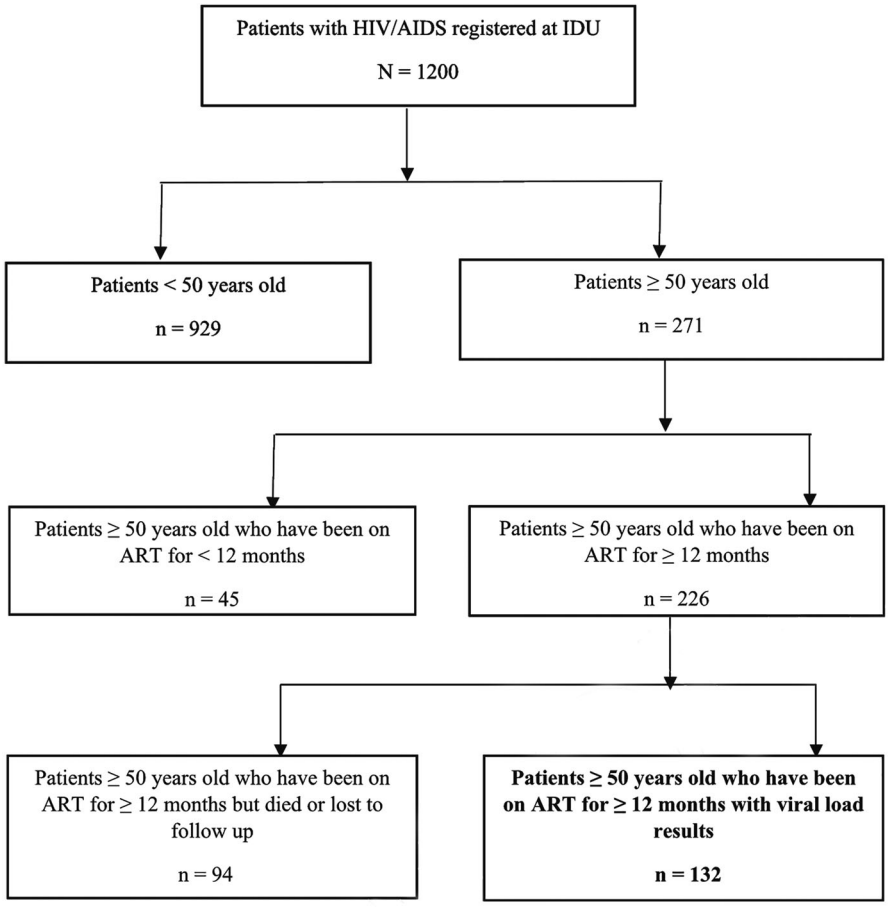

Figure 1. Consort diagram: Patient exclusion and inclusion.

Results

Demographic characteristics of study participants

A total of 132 older adults with HIV were recruited for the study. Out of this, 73.5% (97) were females. Those who had secondary education were 43.9% ($n = 58$) whilst 65.9% ($n = 87$) were in informal employment. Approximately 42.4% ($n = 56$) were married and 23.5% ($n = 31$) were either divorced or separated (Table 1). Majority ($n = 85$, 64.4%) of the participants belonged to the age group 50–59 years. The mean age of the participants was 58.1 years ($SD \pm 6.8$) with a minimum age of 50 and a maximum age of 78 (Table 1).

Clinical parameters and comorbidities among study participants

Of the 132 participants, 93.2% ($n = 123$) tested positive for HIV 1 serotype while half ($n = 66$, 50%) of the participants presented at WHO clinical stages I and II (early stages of infection). Approximately 59.9% ($n = 136$) of the participants had disclosed their HIV status to their sexual partners (Table 2).

The mean duration (in months) a participant had been on treatment was 63.4 ($SD \pm 31.7$) with a minimum duration of 12 months and a maximum duration of 143 months. Those who achieved viral suppression after 12 months of treatment were 111 (84.1%), whilst 8.3% ($n = 11$) had viral load persistently >1000 copies/ml (Table 2).

Over 84.9% ($n = 112$) had good treatment adherence while the remaining 15.1% ($n = 20$) were classified as "non-adherence" (Table 2). The median CD4 count recorded at all time points was 296.0 (IQR = 171.5–467.5). The CD4 count recorded at the initial time point [210; IQR = 138–327] was lower compared to count at 6 months [317; IQR = 237.8–432.5] and 12 months [470; IQR = 302–560]. This trend was significant ($p < 0.001$) (Figure 2). A further analysis of the CD4 counts by age group and gender was however not significant (Figure 3).

All the participants recorded comorbidities which were either non-communicable diseases (NCD) ($n = 89$, 67.4%) or co-infections ($n = 43$, 32.6%) (Table 2).

Table 1. Demographic characteristics of study participants.

Variable	Frequency ($N = 132$)	Percentage (%) [Range]
Age (years), Mean [±*SD*]	*58.1* (±*6.8*)	[50–78]
50–59	85	64.4
60–69	36	27.3
>69	11	8.3
Gender		
Male	35	26.5
Female	97	73.5
Relationship status		
Married	56	42.4
Divorced/separated	31	23.5
Widow(ed)	35	26.5
Single	10	7.6
Level of education		
Basic	36	27.3
Secondary	58	43.9
Tertiary	7	5.3
No Education	31	23.5
Employment status		
Informal employment	87	65.9
Formal employment	15	11.4
Unemployed	30	22.7

SD, standard deviation

Table 2. Clinical parameters and comorbidities among study participants.

Variable	Frequency ($N = 132$)	Percentage (%) [Range]
HIV type		
HIV 1	123	93.2
HIV 2	2	1.5
Both HIV 1 & 2	7	5.3
WHO stage		
Stage I	37	28.0
Stage II	29	22.0
Stage III	60	45.5
Stage IV	6	4.5
Duration on ART (months), Mean [±*SD*]	*63.4* (±*31.7*)	[12–142]
12–24	13	9.9
25–36	19	14.5
37–48	17	12.9
>48	83	62.9
Mean CD4 count [±*SD*]		
At initiation	266.1 (±*205.0*)	[9–1150]
At 6 months	381.7 (±*234.1*)	[64–1020]
≥12 months	444.6 (±*196.4*)	[45–798]
Viral load at 12 months (Copies/ml)		
<50 (Undetectable)	111	84.1
50–1000	10	7.6
>1000	11	8.3
Type of medication		
NRTI	109	82.6
INSTI	92	69.7
NNRTI	25	18.9
PI	13	9.8
ART Adherence		
Non-adherence	20	15.1
Good adherence	112	84.9
Non-communicable diseases ($n = 89$)		
Anaemia	5	5.6
Diabetes mellitus	4	4.5
Gastrointestinal disorders	6	6.7
Hypertension	42	47.2
Joints and back pains	17	19.1
Skin diseases	10	11.2
Sleep disturbance	5	5.6
Co-infections ($n = 43$)		
Candidiasis	6	14.0
Hepatitis B	8	18.6
Malaria, other acute infections	19	44.2
Pulmonary tuberculosis	10	23.3

Note: NRTI – Nucleoside/Nucleotide Reverse Transcriptase Inhibitor; INSTI – Integrase Strand Transfer Inhibitor; Non-Nucleotide Reverse Transcriptase Inhibitor; PI – Protease Inhibitor.

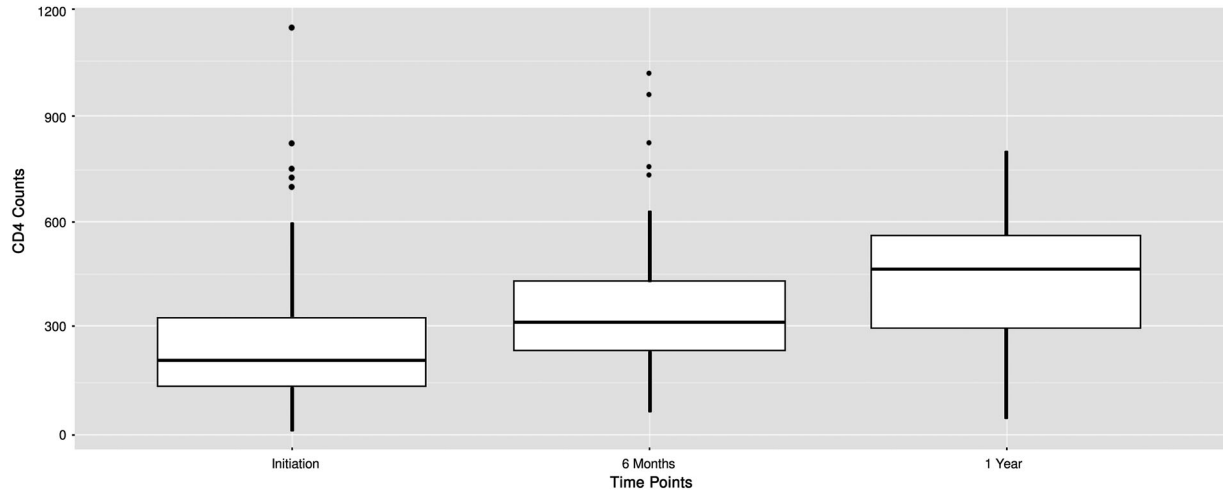

Figure 2. Variation of CD4 count at treatment initiation, 6 months and 12 months post-treatment.

Factors associated with viral suppression after at least 12 months on treatment

Participants' relationship status ($p = 0.003$), ART adherence ($p = 0.011$) and presence of comorbidities ($p = 0.035$) among study participants were significantly associated with viral suppression after 12 months on treatment (Table 3).

Table 4 shows the results of the multiple logistic regression analysis of the factors associated with viral suppression after at least 12 months on treatment among study participants. Each variable in the univariate analysis was adjusted for using the other independent variables in the multivariate analysis. The odds of a widow(ed) HIV patient achieving viral suppression after at least 12 months on treatment was less (aOR = 0.23; 95% CI = 0.07–0.72) compared with a married HIV older adult.

Similarly, odds of an older adult with HIV that had good ART adherence achieving viral suppression was more (aOR = 3.51; 95% CI = 1.03–11.99) compared

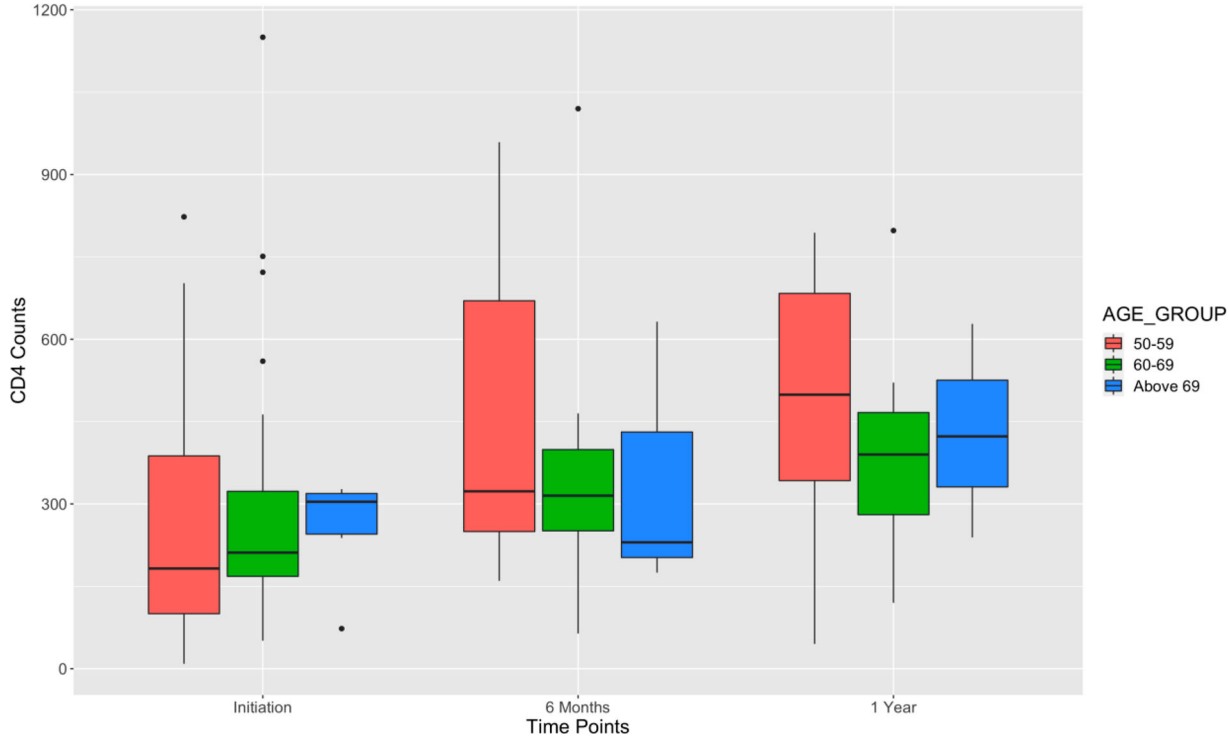

Figure 3. CD4 count at treatment initiation, 6 months and 12 months post-treatment stratified by age groups.

Table 3. Factors associated with viral suppression after 12 months on treatment among study participants.

Factors	Viral Suppression: Achieved (viral load <50) n (%)	Viral Suppression: Not achieved (viral load ≥50) n (%)	X^2	*P*-value
Age (years)				
50–59	73 (85.9)	12 (14.1)		0.484[a]
60–69	30 (83.3)	6 (16.7)		
>69	8 (72.7)	3 (27.3)		
Gender			0.7	0.398
Male	31 (88.6)	4 (11.4)		
Female	80 (82.5)	17 (17.5)		
Relationship status				0.003[a]
Married	50 (91.1)	6 (8.9)		
Divorced/separated	30 (96.8)	1 (3.2)		
Widow(ed)	23 (65.7)	12 (34.3)		
Single	8 (80.0)	2 (20.0)		
HIV type				1.000[a]
HIV 1	103 (83.7)	20 (16.3)		
HIV 2	2 (100.0)	0 (0.0)		
Both HIV 1 & 2	6 (85.7)	1 (14.3)		
WHO stage				0.507[a]
Stage I	31 (83.8)	6 (16.2)		
Stage II	26 (89.7)	3 (10.3)		
Stage III	50 (83.3)	10 (16.7)		
Stage IV	4 (66.7)	2 (33.3)		
Duration on ART (months)				0.346[a]
12–24	9 (69.2)	4 (30.8)		
25–36	16 (84.2)	3 (15.8)		
37–48	16 (94.1)	1 (5.9)		
>48	70 (84.3)	13 (15.7)		
Comorbidities			4.5	0.035
Co-infections	32 (74.4)	11 (25.6)		
Non-communicable diseases	79 (88.8)	10 (11.2)		
Type of medication				
PI				0.434[a]
Yes	10 (76.9)	3 (23.1)		
No	101 (84.9)	18 (15.1)		
NNRTI				0.764[a]
Yes	22 (88.0)	3 (12.0)		
No	89 (83.2)	18 (16.8)		
INSTI			0.72	0.397
Yes	79 (85.9)	13 (14.1)		
No	32 (80.0)	8 (20.0)		
NRTI				0.762[a]
Yes	92 (84.4)	17 (15.6)		
No	19 (82.6)	4 (17.4)		
ART adherence			6.42	0.011
Non-adherence	13 (65.0)	7 (35.0)		
Good adherence	98 (87.5)	14 (12.5)		

[a]Analysed using Fischer's exact.

with an older adult that had ART non-adherence (Table 4).

Table 4. Multiple logistic regression analysis showing factors associated with viral suppression after at least 12 months on treatment among study participants.

Factors	Unadjusted OR (95%CI)	*P*-value	Adjusted OR (95% CI)	*P*-value
Relationship status				
Married	1.00		1.00	
Divorced/ separated	3.60 (0.41–31.37)	0.246	3.16 (0.35–28.51)	0.306
Widow(ed)	0.23 (0.08–0.69)	0.009	0.23 (0.07–0.72)	0.012
Single	0.48 (0.08–2.81)	0.415	0.23 (0.03–1.56)	0.133
Comorbidities				
Co-infections	1.00		1.00	
Non-communicable diseases	2.72 (1.05–7.02)	0.039	2.53 (0.85–7.56)	0.097
ART adherence				
Non-adherence	1.00		1.00	
Good	3.77 (1.29–11.06)	0.016	3.51 (1.03–11.99)	0.045

NB. Adjusted for relationship status, comorbidities and ART adherence in the multivariate analysis.

Discussions

The mean age of our study participants was 58.1 years with a highest proportion (64.4%) of study participants in the 50–59 year group. As the care of people living with HIV (PLHIV) improves across the globe with improved morbidity and survival rate, there is an ongoing shift in the age composition towards older persons (Hontelez et al., 2012). The Joint United Nations Programme on HIV/AIDS (UNAIDS) in 2013 reported an increasing prevalence of HIV infection among ageing (≥50 years) individuals as compared with the rate of infection among the 15–49 year group (UNAIDS, 2013). Lower use of condoms among older patients compared with their younger counterparts could contribute to this (Mpondo, 2016). Additionally, there has been increased availability of ARTs across the globe and improved care of people living with HIV; hence, patients are living longer with a resultant increase in elderly HIV population. Our study recorded a higher elderly female prevalence of HIV (73.5%). This is consistent with the global trend in which there are more female HIV-positive individuals than males across all age groups (Wang et al., 2016) and among other cohorts of Ghanaian HIV-positive patients (Ayisi-Boateng et al., 2020a; Lokpo et al., 2020). Our findings are also similar to an earlier one conducted in South Africa (Shisana et al., 2014) where the majority of older HIV-positive patients were females. Factors attributable to this include biological changes associated with menopause such as thinning of the vaginal wall which increases wear and tear during sexual intercourse (Drew & Sherrard, 2018) and sociocultural practices such as wife inheritance and other ritual practices (Bendick, 2019; Zaba et al., 2008).

There have been concerns about late detection of HIV infection, especially among the ageing population and that infected patients do not report early to the ART centres. In our study, as much as 50% of the study participants were at WHO clinical stages III and IV (AIDS stage) at the time of being registered at our

HIV clinic. This may be due to the fact that HIV counselling and testing campaigns are more youth-focused and the older population is hardly included in routine HIV screening. Another factor for a delay in diagnosis includes the fact that the older adults have low immunity and associated comorbidities like diabetes and malignancies may distract attention from suspicion of HIV infection (Mpondo, 2016). In a previous study, 65% of HIV-infected individuals between 50 and 59 years of age had at least one comorbid condition with hypertension comprising 31% (Goulet et al., 2007). The frequency of these comorbid conditions was reportedly higher in HIV-infected group than those uninfected with HIV (Goulet et al., 2007).

Comorbidities identified in our study were classified mainly into non-communicable diseases (67.4%) and co-infections (32.6%). On the surface, the high prevalence of NCDs, particularly hypertension (47.2%), in our elderly HIV patients may simply be attributed to the known NCD pandemic (Damasceno, 2016) and the already high prevalence of hypertension in the general Ghanaian population (Ayisi-Boateng et al., 2020a). However, it has been found that risk of hypertension is high among patients with HIV on prolonged use of ART (Seaberg et al., 2005) resulting from increased carotid intima media thickness (Hsue et al., 2004). There is also evidence to suggest that chronic infections like HIV cause an exaggerated and dysregulated immune response which lead to chronic inflammation, cellular and tissue destruction (Ogoina & Onyemelukwe, 2009). This may increase the risk of multiple pathologies with potential effect on viral suppression, which is the single most important prognostic indicator.

With 93.2% of our patients having HIV type 1 infection, we recorded viral suppression [<50 copies/ml] in 84.1% of them whilst 8.3% had persistent viraemia (≥1000 copies/ml) after 12 months on ART. Despite the ambitious 95–95–95 goal (UNAIDS, 2015) and intensive global efforts, progress report shows only 78% of PLHIV worldwide have achieved viral suppression (Levi et al., 2016), while viral suppression has been seen in 86% of the HIV population in Europe and Central Asia (Lokpo et al., 2020) and between 13 and 50% in some countries in Africa and South America (Levi et al., 2016). The relatively high (84.1%) viral suppression rate in our patients is comparable to a previous study which recorded 81% rate of viral suppression and postulated that older people on ART are more likely to experience viral suppression, attend clinic more frequently and are apparently more adherent to their treatment (Hasse et al., 2011). Global estimates of viral suppression specific to the older HIV patients are rare. The disparities in global percentages of viral suppression are due to varying cut-off values of HIV RNA used in defining viral suppression, the diversity in research methodology and challenges with HIV care across the WHO regions.

In our study, viral suppression was not associated with age, gender, HIV serotype, WHO clinical stage at presentation, type of ART combination or duration on ARTs. Elsewhere, age and socioeconomic status have been found to influence HIV RNA suppression (Beer & Skarbinski, 2014; Goulet et al., 2007). In our study, in univariate analysis, we found a statistically significant association ($p < 0.05$) between viral suppression and good ART adherence, relationship status and presence of comorbidities. Although comorbidities have been found to increase HIV replicative activity through the induction of proinflammatory cytokines and upregulation of chemokine receptors (Modjarrad & Vermund, 2010; Pisell et al., 2002; Xiao et al., 1998), after adjusting for all the other variables in multivariate logistic analysis, the independent predictors of viral suppression were good ART adherence and widowhood. This supports a study in Kenya, in which ART adherence was an independent predictor of viral suppression (Cherutich et al., 2016). Among our participants, good ART adherence was 84.9%. This supports findings from a previous study which showed high medication adherence among older adults, resulting in viral suppression (Hasse et al., 2011). We surmise that because all our patients had comorbidities and were on long-term medications, they were more likely to remember to take their ARTs as often as they took their other medications. However, this was not explored in this study.

In the Kenyan study, unlike ours, widowhood had no association with viral suppression (Cherutich et al., 2016). Matrimony has been found to play a huge role in HIV transmission (Francis et al., 2016) and HIV prevalence is reportedly high (54%–61%) among widowed individuals in Zimbabwe (Lopman et al., 2009). Although married older women are presumably more sexually active than unmarried older women (widowed or single), unmarried women who have partners are less likely to use a barrier contraceptive method (Mpondo, 2016). Additionally, the rates of partner change and transactional sex are heightened among widowed women than married ones (Lopman et al., 2009).

Limitations and strengths

Viral load data used for each participant in our analysis were the first one done after 12 months of treatment. We did not analyse viral load results after this period to determine sustained viral suppression or rebound.

Additionally, the prohibitively expensive cost of resistance testing did not afford us the means to assess drug resistance in patients with persistently high viral load after being on treatment for 12 months. With adequate funding, it will be interesting to undertake future studies which will follow up patients to evaluate viral loads at more than one time point post-12 months ART as well as rule out drug resistance. Our assessment of medication adherence relied on regular hospital attendance by patients and how they reported on appointment dates for drug refill. Since this was a retrospective study, this was a more implementable method. However, we recommend that future studies should employ more robust tools for assessing medication adherence. These, notwithstanding, our study provides a useful baseline data on HIV infection among elderly patients which will guide physicians, HIV healthcare providers, policy makers and other researchers in addressing challenges in managing this cohort of HIV patients.

Conclusion and recommendations

Non-communicable diseases such as Hypertension are common among patients with HIV who are ≥50 years. With effective antiretroviral therapy and retention in care, viral suppression can be achieved in more than 80% of them but this can be limited by patient's relationship status and ART adherence. Given the increasing number of elderly patients with HIV, coupled with the associated challenges of aging, HIV care providers, researchers and policy makers should channel essential resources and attention to this peculiar population.

What is known on this topic?

1. Older adults have limited access to HIV-related services and are more likely to advance to acquired immune deficiency syndrome (AIDS) and death.
2. HIV care in older adults poses some challenges such as comorbidities, vulnerability to other infections and increased risk of side effects from antiretroviral treatment (ART).

What this study adds to subject of HIV among older adults?

1. Widowed elderly HIV patients were less likely to achieve viral suppression after 12 months on treatment compared with married HIV older adults.
2. Factors associated with viral suppression among elderly HIV patients included ART adherence and relationship status.

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Disclosure statement

No potential conflict of interest was reported by the author(s).

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