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Correlates of viral load suppression among people living with HIV on antiretroviral treatment in Mbujimayi, Democratic Republic of Congo

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Abstract

Context

This study was conducted in Mbujimayi to assess viral load suppression in people living with HIV (PLWH) on antiretroviral therapy (ART). The main objective was to identify the key factors influencing the success of viral suppression in terms of treatment outcomes.

Methods

The study involved a sample of 561 PLWH from ten healthcare facilities in the city where the viral load results were available. Data on treatment adherence, sexual behavior, viral load, and other socioeconomic and demographic factors were collected. The end point was the viral load of each PLWH.

Results

The median age was 49 years (IIQ: 18), the median duration of ART was 9 years (IIQ: 7), 66.31% were female, 67.56% were in clinical stage III, 67.91% used condoms, 84.31% did not have an occasional sexual partner, 91.78% did not consume alcohol, and 86.45% correctly observed ART. Multivariate analysis via binomial logistic regression predicted factors associated with viral load suppression, such as ART adherence (AOR 11.743 [95% CI: 4.153–33.204]], $p < 0.001$), the absence of casual sexual partners (AOR: 2.179 [95% CI: 1.221–3.888], $p = 0.008$), condom use (AOR: 1.764 [95% CI: 1.144–2.721], $p = 0.010$), and ART duration (AOR: 1.590 [1.086–2.328], $p = 0.045$). However, no alcohol consumption was a protective factor (AOR: 0.486 [95% CI: 0.240–0.985]).

Conclusion

This study highlights the importance of the objective of strict adherence to antiretroviral therapy and the stability of sexual behaviors to ensure viral suppression in PLWH. Health education and psychosocial support programs should be strengthened to encourage adherence to treatment and promote safe sexual behaviors. These findings can help guide public health policies to improve HIV treatment outcomes in the region.

BACKGROUND

Acquired immunodeficiency syndrome (AIDS) is a global public health problem and one of the leading causes of death worldwide between the beginning of the epidemic and 2021; approximately 40.1 million people died from AIDS-related diseases [1]. With improved access to effective prevention, diagnosis, treatment and care, human immunodeficiency virus (HIV) infection has become a chronic disease that can be managed with the assurance of a long and healthy life. The discovery of antiretroviral drugs has

given hope for better control of this pandemic. However, the availability of these antiretrovirals has been a problem, especially in developing countries [2]; thus, in low- and middle-income countries, the majority of ARTs are provided in primary care, where the ability to perform laboratory viral load tests is limited, clinical systems are weak enough to act on viral load results, and there are few evidence-based interventions to improve compliance [2, 3]. According to the WHO and CDC, the main factor determining viral load suppression and transmission risk is good adherence to ART by PLWH. Unfortunately, long-term adherence in low- and middle-income countries faces many patient- and program-related barriers, such as poverty, lack of food, alcohol, tobacco, quality of life, sexual habits, forgetting to take medication, low levels of knowledge, untimely interruptions, distance to travel to clinics, and cost of care [4]. Owing to suboptimal adherence after a period of good adherence and/or following treatment interruption, some patients on long-term ART also experience viral rebound [4–6]. People living with HIV (PLWH) who achieve suppression of the viral load have more robust immune reconstitution, better clinical outcomes and lower mortality rates [7]. In addition, PLWH who maintain an undetectable viral load do not have any risk of sexual transmission to an HIV-negative partner, which has become the message of the campaign being undetectable or untransmissible [7, 8]. Low drug adherence is harmful not only to the individual but also to the community because increased viral load increases the risk of transmission. This is because a portion of the treated population continues to have difficulties achieving or maintaining viral suppression [9]. In the DRC, studies conducted in Kinshasa and Haut Katanga reported viral loads ranging from 62–92.5% among PLWH and viral load undetectability ranging from 53–56.4% [4, 10, 11]. A Spectrum was conducted by the National HIV/AIDS Control Program (PNLS) with the National Multisectoral HIV/AIDS Control Program (PNMLS) to determine the level of progress in achieving the 95-95-95 targets, and according to the Spectrum of its targets, 19% of PLWH had a suppressed viral load [12]. Social determinants of health play important roles in viral suppression. Factors that influence drug adherence include depression, the severity of adverse events, self-efficacy and social support [9]. Low levels of care participation, especially in the early stages of treatment (e.g., missed visits), are correlated with poor adherence to therapy [9]. Despite the large number of PLWH on ART, it has been very difficult to assess the effectiveness of ART because for years, only 19% of PLWH had access to the viral load test because the laboratory's provincial coordination of the national HIV/AIDS program in East Kasai is not equipped to carry out this test, which creates a major problem in the follow-up of patients to ensure the effectiveness of the treatment [13]. Despite the WHO recommendation to intensify systematic surveillance of the viral load to ensure its elimination, there are still significant gaps, particularly in low- and middle-income countries.

In the DRC in general and East Kasai Province in particular, the results of viral load tests do not always lead to appropriate clinical measures, including advice on compliance. We were interested in the factors determining viral load suppression among people living with HIV on highly active antiretroviral therapy (HAART) in Mbujimayi.

The objective of this study was to contribute to improving the health of PLWH with the goal of reducing morbidity and mortality due to HIV.

MATERIALS AND METHODS

Study Design and Setting

We conducted a cross-sectional descriptive study to document the factors that can influence the correct adherence of PVVIHs to ART in the city of Mbujimayi, the capital of East Kasai Province in the Democratic Republic of the Congo. Mbujimayi town comprises 10 of East Kasai Province's 19 health zones. We conducted our study at 10 healthcare facilities in Mbujimayi (Hospital Bonzola Hospital, Dipumba Hospital currently Clinique Universitaire de Mbujimayi, Presbyterian Hospital, Kansele Hospital, Kayembe Hospital, Saint Franciscans Hospital, Bena Cibuabua Center, Camp Nsele Center and Centre Nyongolo Center), which care for PLWH and have viral load results.

Study population

The target population of the study was HIV-positive people on ART attending HIV/AIDS treatment and diagnosis centers in the city of Mbujimayi. Given the constraints related to the achievement of the viral load (VL), the accessible population on which we worked was composed of PLWH attending the targeted hospitals and organizing the VL between the study period.

Study eligibility criteria

Inclusion criteria

The inclusion criteria for the study participants were individuals who met the following conditions: all HIV patients on antiretroviral treatment who received a viral load in the selected facilities during the study period.

Non-inclusion criteria

All PLWH who did not meet the inclusion criteria and those from other nontargeted medical facilities were not included in the study.

Sample size

We estimated the sample size using the Fleiss formula for two proportions [14]:

$$N = \frac{[Z_{\alpha}\sqrt{p(1-p)(\frac{1}{q_1}+\frac{1}{q_2})}\:+\:Z_{\beta}\sqrt{p_1(1-P1)\frac{1}{q_1}+p_2(1-P2)\frac{1}{q_2}}]^2}{(P2-P1)^2}$$

where p1 is the proportion of patients with a suppressed viral load, 0.19 [12], and p2 is the expected proportion of nonsuppressed patients in the study (35%). We set the power at 80% (Zβ = 0.84) and the confidence interval at 95% (Zα = 1.96) with a nonsuppressed/suppressed ratio of 2:1. Consequently, the

initial estimated sample size was approximately 561 PLWH on ART, including 187 suppressed PLWH and 374 nonsuppressed PLWH.

Data collection

We used a data collection grid in PLWH files. Data collection took place from November 7, 2022, to January 9, 2023. Pretesting of the data collection tool (questionnaire) was carried out in two healthcare facilities (Muya Hospital and Christ-Roi Hospital) before the actual data collection was launched in the selected care facilities. Final modifications were made to the data collection tool immediately after the pretest, and enumerators were reassessed for suitability; unsuitable enumerators were automatically excluded from the study. Given that our main source of data was the records of PLWH on targeted ART in health facilities, and supplemented by interviewing patients about missing elements in the record, we were able to select PLWH who had achieved a viral load and whose result was available, respecting the ratio of 1 suppressed for 2 not suppressed. Once selected, cases were approached by investigators or research assistants at the earliest opportunity.

Statistical analysis

The data were encoded using Excel 2019 and analyzed using STATA version 17. The results are presented in tables with observed numbers, proportions with 95% CI, medians (Me) and interquartile intervals (Q1–Q3). To identify the likely determinants of viral load suppression in Mbujimayi, the variables were dichotomized and investigated in a series of bivariate analyses using viral load suppression as the dependent variable. The outputs were the crude odds ratios (COR), and their 95% CI were estimated for each of these factors. Variables with $p < 0.2$ in the bivariate analysis, such as profession, provenance, casual sexual partner, condom use, smoking, alcoholism, pulmonary tuberculosis, clinical stage, ART duration and adherence, were added to the multivariable model via binomial logistic regression to eliminate all confounding factors and predict the variability of the response as a function of the explanatory variable. Adjusted odds ratios (AOR) were estimated with their 95% CI to measure the strength of the associations between the independent variables considered and the suppression of the viral load. The accuracy was calculated by applying the Mantel–Haenszel test to the significance threshold considered at $p < 0.05$.

Ethical consideration

Ethical authorization was granted by the ethics committee of the Official University of Mbujimayi, registered in number 12/2022. Free and informed consent was used in both French and Tshiluba (the local national language). The ethical regulations outlined in the Declaration of Helsinki were followed throughout the study. The data were stored on a laptop computer with a password-protected and locked cabinet, and only the lead investigator and study supervisor had access to the data.

RESULTS

Descriptive analyses of sociodemographic and clinical characteristics.

This table shows that the median age of PLWH on ART is 49 years (IQI: 19). The median household size is 5 persons (IIQ: 4). The median duration of HIV-PLWH on ART is 9 years (IIQ: 7). The majority of our participants were female (66.31%), married (48.48%) and had a secondary education level (81.11%). A significant proportion of the participants were employed (52.58%), mostly from the different municipalities constituting the city of Mbujimayi (urban area) (89.48%), had low socioeconomic status (99.94%), had a stable sexual partner at 48.66%, and had a casual sexual partner at 15.69%. Smoking and alcohol were found in 14.08% and 8.02% of the participants, respectively; 57.40% had contracted pulmonary tuberculosis and/or had been diagnosed as HIV + due to this pathology, and 67.56% of the PLWH were admitted to stage III WHO. A total of 67.91% of the participants used condoms. All PLWH are currently on the TDF/3TC/DTG (TLD) regimen, and good adherence was achieved at 86.45% (Table 1).

Table 1
Sociodemographic and economic characteristics and clinical and therapeutic variables

Variables	N = 561	% [95%CI]	Median (Q1 – Q3)
Age (year)			49 (39–57) years
[15–49]	296	52.76 [48.63–56.86]	
Beyond 49	265	47.24 [43.14–51.37]	
Household size (person)			5 (3–7)
[0–5]	339	60.43 [56.32–64.39]	
Beyond 5	222	39.57 [35.61–43.68]	
Duration ART (year)			9 (6–13) years
[0–9]	297	52.94 ǀ48.80–54.04]	
[Beyond 9]	264	47.06 [42.96–51.20]	
Viral load (copy/ml)			
[≤ 40]	164	29.23 [25.62–33.13]	
[41–1000]	23	4.10 [2.75–6.08]	
[Beyond 1000]	374	66.67 [62.66–70.44]	
Sex			
Female	372	66.31 [62.30–70.10]	
Male	189	33.69 [29.90–37.70]	
Marital status			
Single	86	15.33 [12.59–18.55]	
Married	272	48.48 [44.37–52.62]	
Widower	155	27.63 [24.09–31.47]	
Divorced	48	8.56 [6.51–11.16]	
Education			
Uneducated	13	2.32 [1.36–3.92]	
Primary	59	10.52 [8.24–13.33]	
Secondary	455	81.11 [77.66–84.13]	
Higher and University	34	6.06 [4.37–8.35]	
Main activities (occupation)			

Variables	N = 561	% [95%CI]	Median (Q1 – Q3)
Employees	295	52.58 [48.45–56.69]	
Nonemployees & others	266	47.42 [43.31–51.55]	
Provenance			
Urban	502	89.48 [86.67–91.76]	
Rural	59	10.52 [8.24–13.33]	
Socioeconomic status			
Low	527	93.94 [91.65–95.63]	
Average	34	6.06 [4.37–8.35]	
Stable sexual partner			
Yes	273	48.66 [44.55–52.79]	
No	288	51.34 [47.21–55.45]	
Casual sexual partner			
Yes	88	15.69 [12.91–18.93]	
No	473	84.31 [81.07–87.09]	
Smoking			
Yes	79	14.08 [11.45–17.21]	
No	482	85.92 [82.79–88.55]	
Alcohol use			
Yes	45	8.02 [6.05–10.57]	
No	516	91.98 [89.43–93.95]	
Pulmonary tuberculosis			
Yes	322	57.40 [53.27–61.43]	
No	239	42.60 [38.57–46.73]	
Clinical stage			
Stage I	11	1.96 [1.10–3.48]	
Stage II	105	18.72 [15.71–22.15]	
Stage III	379	67.56 [63.58–71.30]	
Stage IV	66	11.76 [9.35–14.69]	

Variables	N = 561	% [95%CI]	Median (Q1 – Q3)
Condoms use			
Yes	381	67.91 [63.94–71.64]	
No	180	32.09 [28.36–36.06]	
ART adherence			
Yes	485	86.45 [83.37–89.04]	
No	76	13.55 [10.96–16.63]	
Viral load suppression			
Yes	187	33.33 [29.56–37.34]	
No	374	66.67 [62.66–70.44]	

Bivariate et Multivariate analysis (Binomial logistic regression).

The bivariate analysis revealed a statistically significant relationship between nonexistence of casual sexual partners (p = 0.005), condom use (p = 0.0011), pulmonary tuberculosis (p = 0.013), clinical stage (p = 0.32), duration of ART (p = 0.004) and adherence (p < 0.001) with viral load suppression. Multivariate analysis via binomial logistic regression revealed that the absence of a sexual partner (AOR: 2.179 [95% CI: 1.211–3.888], p = 0.008), condom use (AOR: 1.764 [95% CI: 1.144–2.721], p = 0.010), duration of ART beyond 9 years (AOR: 1.590 [1.086–2.328], p = 0.017), and adherence (AOR: 11.743 [4.153–33.204], p < 0.001) were factors associated with viral load suppression in PLWH on ART. Alcohol abstinence was also a protective factor (AOR: 0.486 [0.240–0.985], p = 0.045) (Table 2).

Table 2
Prediction factors (bivariate analysis and multivariate analysis with binomial logistic regression)

Variables	Viral load suppression		COR [95%CI]	p	AOR [95%CI]	p
	Yes (n = 187)	No (n = 374)				
Age						
[15–49]	94 (31.76)	202 (68.24)	0.861 [0.606–1.223]	0.403		
Beyond 49	93 (35.09)	172 (64.91)	1			
Sexe						
Female	118 (31.72)	254 (68.28)	0.869 [0.559–1.167]	0.260		
Male	69 (36.51)	120 (63.49)	1			
Marital Status						
Living alone (single, widowed, divorced)	97 (33.56)	192 (66.44)	1.022 [0.719–1.452]	0.905		
Married	90 (33.09)	182 (66.91)	1			
Instruction						
Uneducated & Primary	21 (29.17)	51 (70.83)	0.801 [0.466–1.377]	0.422		
Secondary & High/University	166 (33.95)	323 (66.05)	1			
Household size (person)						
[0–5]	110 (32.45)	229 (67.55)	0.905 [0.632–1.294]	0.583		
Beyond 5	77 (34.68)	145 (65.32)	1			
Profession						

Variables	Viral load suppression		COR [95%CI]	p	AOR [95%CI]	p
	Yes (n = 187)	No (n = 374)				
Age						
Employees	109 (36.95)	186 (63.05)	1.412 [0.991–2.013]	0.056	1.280 [0.808–1.915]	0.208
Nonemployees & others	78 (29.32)	188 (70.68)	1		1	
Provenance						
Urban	174 (34.66)	328 (65.34)	1.877 [0.987–3.569]	0.052	1.412 [0.712–2.801]	0.323
Rural	13 (22.03)	46 (77.97)	1		1	
Socioeconomic status						
Law	177 (33.59)	350 (66.41)	1.214 [0.568–2.594]	0.617		
Average	10 (29.41)	24 (70.59)	1			
Stable sexual partner						
Yes	91 (33.33)	182 (66.67)	1.00 [0.704–1.421]	1.000		
No	96 (33.33)	192 (66.67)	1			
Casual sexual partner						
Yes	18 (20.45)	70 (79.55)	1		1	
No	169 (35.73)	304 (64.27)	2.162 [1.246–3.751]	0.005	2.179 [1.221–3.888]	0.008
Condoms use						
Yes	144 (37.80)	237 (62.20)	1.936 [1.297–2.889]	0.0011	1.764 [1.144–2.721]	0.010
No	43	137	1		1	

Variables	Viral load suppression		COR [95%CI]	p	AOR [95%CI]	p
	Yes (n = 187)	No (n = 374)				
Age						
	(23.89)	(76.11)				
Smoking						
Yes	32 (40.51)	47 (59.49)	1		1	
No	155 (32.16)	327 (67.84)	0.696 [0.427–1.134]	0.145	0.895 [0.514–1.556]	0.694
Alcohol						
Yes	21 (46.67)	24 (53.33)	1		1	
No	166 (32.17)	350 (67.83)	0.542 [0.293–1.002]	0.068	0.486 [0.240–0.985]	0.045
Pulmonary tuberculosis						
Yes	121 (37.58)	201 (62.42)	1.578 [1.098–2.267]	0.013	1.413 [0.947–2.107]	0.090
No	66 (27.62)	173 (72.38)	1		1	
WHO clinical stage						
Stage 1 & 2	29 (25.00)	87 (75.00)	1		1	
Stage 3 & 4	158 (35.51)	287 (64.49)	1.652 [1.040–2.624]	0.032	1.578 [0.956–2.605]	0.075
ART duration (years)						
[0–9]	83 (27.95)	214 (72.05)	1		1	
Beyond 9	104 (39.39)	160 (60.61)	1.676 [1.177–2.387]	0.004	1.590 [1.086–2.328]	0.017
ART adherence						

Variables	Viral load suppression		COR [95%CI]	p	AOR [95%CI]	p
	Yes (n = 187)	No (n = 374)				
Age						
Yes	183 (37.73)	302 (62.27)	10.907 [3.920–30.352]	< 0.001	11.743 [4.153–33.204]	< 0.001
No	4 (5.26)	72 (94.74)			1	

ROC Curve

The area under the curve (AUC) values indicated that the ability to predict viral load suppression among PLWH was approximately 72.5% (AUC: 0.725 [95% CI: 0.682–0.769], p < 0.001) (Fig. 1).

DISCUSSION

This study highlights the following: the factors determining viral load suppression in our study were adherence and the absence of an occasional sexual partner.

In our work, we found that therapeutic adherence was 86.45%, whereas nonadherence was 14.55%. Abdullahi *et al.* (2020), in their 2020 work in Ethiopia, reported that 36.1% of participants had low adherence and that poor adherence was associated with a 10-fold increased risk of an unsuppressed viral load [15]. This result is different from ours, mainly because of the therapeutic regime and the history of poor observation, which were the basis for low compliance. Ladak *et al.* (2019) reported that ART adherence was greater than 95% [16]. Touzard Romo *et al.* (2014) reported significant variation in ART adherence rates between 2003 and 2010, ranging from 67–86% [17]. According to Kalichman *et al.* (2014), 47% of patients did not observe ART properly and found that nonobservance was related to alcohol consumption, lack of medication and certain social situations [18].

In previous studies on the determinants of suppression or nonsuppression of the viral load, the authors consistently reported increased risks of nonsuppression in people with poor adherence to therapy [15, 18–20]. A high viral load is observed in people with poor adherence because an optimal drug concentration is needed to control viral replication. It has been reported that 95% or more adhesion is required for sustained viral suppression [15, 21]. The other important predictor of an unsuppressed viral load that was identified by some authors was the nondisclosure of serological status. Those who did not disclose their status were found to have a higher probability of unsuppressed viral load, mainly due to difficulty in adherence and follow-up [10, 15]. Those who disclosed their status reported more supportive responses, encouragement and less depression, which may have had a positive effect on treatment outcomes [10, 15]. The disclosure of HIV status in our environment is still far from realistic because,

despite increasing awareness of the stigma attached to PLWH, the disease is still considered taboo. Disclosing their status may be a reason for abandonment and demonization. We believe that over time, this situation can improve and provide support for PLWH, which could lead to optimal conditions for viral load suppression.

There are known factors that can significantly influence the viral load, even when people living with HIV (PLWH) are receiving treatment. These factors may include the presence of coinfection with a sexually and blood-borne infection, the type of ART, suboptimal adherence to treatment, resistance to treatment, and the stage of infection [22]. Adherence to antiretroviral drugs must be persistent to achieve optimal viral suppression. Although several studies have examined alcohol consumption in relation to compliance, less attention has been given to the impact of alcohol consumption and viral suppression. Enhanced adherence was the major factor in suppressing these PLWH, resulting in 88% of PLWH in India experiencing viral load suppression, with 48% initially experiencing clinical or immunological failure [23]. The development of ART-resistant strains may mean that people who adhere to them still have an unsuppressed viral load. Treatment-resistant viruses are often the result of a history of poor adherence to ART [18].

In our series, we found that adherence was significantly associated with viral load suppression ($p < 0.001$). Good adherence increased the chance of viral load suppression by 11-fold (AOR: 11,743 [95% CI: 4,153–33,204]). This result highlights interest and reinforces the need to improve adherence and therapeutic compliance at a high level, more than 90%, to ensure the sustained and lasting effectiveness of the ART for the suppression of the viral load.

Previous studies have shown that good adherence, duration of ART, and disclosure of status are factors in viral load suppression [10, 18, 23–25]. A study conducted in 2022 in Kinshasa and Upper Katanga in the DRC before and after COVID-19 by Shah *et al*. revealed that viral load suppression was associated with the timing of ART initiation (AOR: 2.50), female sex (AOR: 1.23), rural residence (AOR: 1.83), and the timing of the last visit (AOR: 1.50) [11]. However, homelessness and lack of moral support [26], male sex, initiation of ART < 15 years, treatment for tuberculosis, duration of one year and more than 10 years under ART [27], drug and alcohol use [16], poor adherence to therapy [9, 28], and nevirapine-based treatment [29] are associated with nonsuppression of the viral load and/or rebound.

In East Kasai Province in the DRC, 19% of HIV patients on ART had access to a viral load test [13]. This low rate of access is explained by the difficulty in supplying inputs to the provincial laboratory, thus having a negative impact on the follow-up of patients. Currently, many more than 1000 unanalyzed samples are at the National Institute for Biomedical Research, possibly because either the influx of samples or the samples are not taken in the standards and are unanalyzable. We believe that if the provincial laboratory was supplied with inputs to achieve a viral load, PLWH would be monitored without any problems, which would lead to better monitoring of patients [13].

The absence and/or absence of an occasional sexual partner was significantly associated with viral load suppression and was also a factor determining viral load suppression (AOR: 2,179 [95% CI: 1,221–3,888],

p = 0.008. This could be explained by the fact that sexual abstinence in PLWH living alone or without occasional partners is necessary to avoid becoming infected or overinfected with another strain of HIV that is more resistant or to avoid opportunistic infections such as syphilis, herpes, zona or hepatitis, which could have a negative impact on the viral load.

We also found that condom use (AOR: 1,764 [95% CI: 1,144–2,721]) and the duration of treatment beyond 9 years (AOR: 1,590 [95% CI: 1,086 – 2,328]) were also factors in viral load suppression in PLWH. In contrast, alcohol was a protective factor (AOR: 0.486 [95% CI: 0.240–0.985]). Some authors found factors in their study that predicted viral load suppression. These factors include a longer duration of antiretroviral treatment (> 3 years) [30], WHO stage I diagnosis, good adherence to antiretroviral therapy, nevirapine-based treatment and increasing duration of treatment [31]; women and people with higher levels of education [32]; and reduced alcohol consumption [33].

On the other hand, the probability of viral load suppression was lower in people who had been on antiretroviral therapy for 36 to 59 months [32]. Occasional and frequent heavy drinking is associated with viral nonsuppression [34–36]. The authors also showed that the association was not statistically significant when restricted to people on antiretroviral treatment, suggesting that the relationship between alcohol consumption and viral suppression is explained by the use of antiretroviral treatment [35]; young people aged 15–29 years, among men, people reporting irregular condom use with nonmarital/casual partners versus people with marital/permanent partners only [36]. Other authors have reported a nonassociation between abusive, hazardous, harmful and dependent alcohol consumption and HIV viral suppression [37, 38].

A meta-analysis revealed that on the basis of scientific evidence and high-quality data, the risk of sexual transmission of HIV is negligible when an HIV-positive sexual partner is on antiretroviral therapy and maintains a suppressed viral load of less than 200 copies/ml, measured every 4–6 months. Sexual transmission of HIV occurs when the viral load is above 200 copies/ml with antiretroviral therapy or when condoms alone are used, although the risk remains low [39]. One study reported irregular condom use in the first year after HIV diagnosis of 47.0–17.5% ($p < 0.05$) and 49.6–17.8% ($p < 0.01$) for anal sex primary and casual partners, respectively. The rate of irregular condom use remained at approximately 20% after treatment initiation and viral load suppression [40].

While the use of antiretroviral treatment to prevent the sexual transmission of HIV is rational, the avoidance of risky sexual behavior should also be a priority for HIV-positive people [41].

Study limitations

The population of our study is PLWH, a category of patients who has been subject to discrimination and stigma to date. We had difficulties collecting data because of the confidential and stigmatizing nature of the data. We have seen some patients refusing to participate in the survey, fearing disclosure of their status and refusing to go underground, which allowed us to use the service providers to give confidence to the respondents in order to complete the missing elements. Health care providers were very helpful in

our acceptance of the study population. Some variables, such as weight, height or even the calculation of body mass index, were not considered. We had to collect data from several health care facilities because of the nonavailability of viral load results despite sampling due to the nonfunctioning of the provincial laboratory and the fact that all samples were sent to Kinshasa or Lubumbashi for analysis.

CONCLUSION

This study of viral load suppression in people living with HIV on antiretroviral therapy (ART) highlighted the effectiveness of current treatments in managing HIV and reducing the viral load to undetectable levels. The results showed that, in many situations, PLWH on ART achieve viral suppression only when they adhere correctly to treatment, use condoms and have no casual sexual partners, which not only improves their quality of life but also reduces the risk of HIV transmission.

In addition, although antiretrovirals have significantly improved HIV management, strengthening patient support strategies, particularly with respect to treatment adherence and compliance education, comorbidity prevention and stigma reduction, remains crucial. A holistic approach that combines medical care, psychosocial support and treatment accessibility is essential to optimize ART outcomes and ensure a healthy, fulfilling life for PLWH.

These results highlight the crucial impact of treatment adherence and sexual health practices on viral control. They support the implementation of targeted strategies to strengthen patients' commitment to treatment and reduce risk behaviors.

Declarations

Ethics approval and consent to participate

N/A

Consent for publication

All participants provided consent for the publication of the study results, with full respect for confidentiality and anonymity.

Competing interests

The authors declare that they have no competing interests.

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Author Contribution

CRediT author statementConceptualization: DB and GNMethodology: AM and PLData curation: DB, BMN and CTFormal analysis: AM and BMNWriting – original draft: CT, CKMWriting – review & editing: AMK, PL and CKMSupervision: GN, PL and CKMValidation: All authorsFinal approval of the manuscript: All authors

Data Availability

The datasets used and/or analysed during the current study are available from the corresponding author on reasonable request.

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Figures

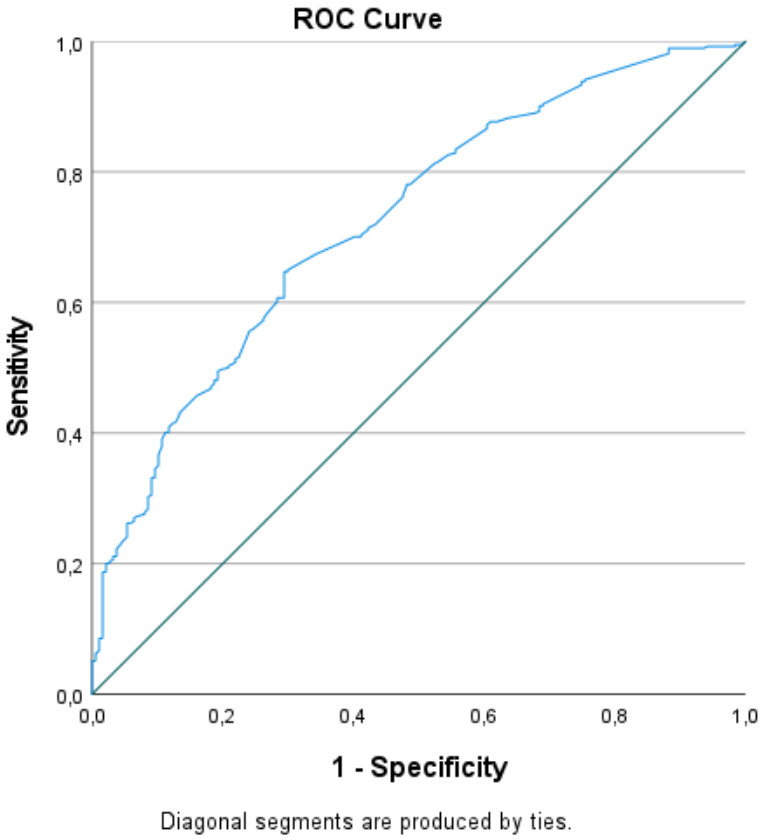

Figure 1

ROC curve