

Predictors and Facilitators of High Viral Load in HIV Positive Persons on Antiretroviral Treatment in the East Region of Cameroon

Athanasius Fang Ebua^{1*}, Nsagha Dickson Shey², Nyoun Ernestine Keseh³, Ngouamkeu Yannick⁴, Nkwawir Aurelia Dzekem⁵

¹Department of Public Health, Texila America University, Cameroon

²Department of Public Health, University of Buea, Cameroon

³Department of Laboratory Sciences, Eto-ebe Baptist Hospital

⁴Team Lead, Georgetown University Global Health

⁵Facility Nurse, Georgetown University Global Health

Abstract

Viral load (VL) determination is the standard to assess the effectiveness of Anti-retroviral Therapy (ART) in people living with HIV (PLWIV). According to Cameroon national ART guidelines, VL determination in PLHIV should be done after six months of starting ART and then every 12 months. Unsuppressed VL occurs when ARV's fails to suppress viral load and is associated with decreased survival and increased risk of HIV transmission, morbidity, and mortality. A sequential and exploratory facility and community-based cross-sectional study was conducted on 391 patients on first-line ART in public health facilities in the East region of Cameroon from January 2021 to January 2022. Structural questionnaires and a review of medical records were the data source of the study. SPSS version 26 was used for data analysis, and Chi-squared (χ^2) tests to explore the associations between outcome variables and the independent variables. Logistic regression analysis was performed to identify predictors and facilitators of high viral load at 95% CI and $P < 0.05$ statistically significant level. Age, marital status, Occupation, food insecurity, switching regimen, and non-adherence were found to be the predictors of high viral load, while the distance from the clinic, medication side effects, substance use, poverty, missing clinical appointment or ARV doses, knowledge on ARV and health personnel attitudes were found to be facilitators. Unsuppressed viral load among PLWH in the East region of Cameroon is caused by predictors and facilitators. Therefore, need for targeted interventions for patients on ART who are at high risk of becoming virally unsuppressed.

Keywords. Adherence, Anti-retroviral therapy, Enhanced adherence counselling (EAC), Suppressed, Unsuppressed, Viral load.

Introduction

Effective treatment with anti-retroviral therapy (ART) results in undetectable viral loads (VL) [1], which has benefits both at the individual level (by reducing morbidity and mortality) and at the population level by reducing transmission, U=U [2]. Given these benefits of ART, UNAIDS set a '95-95-95' target by 2025 to diagnose and counsel 95% of all HIV-positive individuals, provide ART for

95% of those diagnosed as HIV-positive, and achieve sustained viral suppression for 95% of those on treatment. This translates to 86% of all HIV-positive individuals being virally suppressed. Viral load (VL) determination is the standard to assess people living with HIV (PLHIV's) responses to Anti-retroviral therapy (ART).

According to Cameroon national ART guidelines, the first VL determination for people

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*Corresponding Author: ebuafang@gmail.com¹

living with HIV (PLHIV) should be done after six months of post anti-retroviral treatment and then every 12 months routinely [3]. Unsuppressed VL count (>1000 copies/mL) in patients on ART occurs when ART treatment fails to suppress a person's VL and is associated with decreased survival and increased HIV transmission [4]. It suggests the virus is not controlled by the existing anti-retroviral drugs regimen [5]. As a result, patients with unsuppressed VL count have an increased risk of morbidity and mortality.

In Cameroon, 500,000 people were living with HIV in 2020 (1.3% of the world's burden)

with an HIV prevalence of 3% (2.7% - 3.2%). 15,000 new HIV infections were recorded in 2020, and 14,000 AIDS-Related deaths [6]. Of all people living with HIV in Cameroon in 2020, 390,000 (78%) knew their HIV status, and 370,000 (74%) were on ART [6]. Viral suppression (VLS) stood at 44.7% among the age group 15-64 years, with 45.6% being female and 42.5% being male [7].

The East region had a viral suppression of 45.4%. Therefore, 55.6% of people living with HIV who are on ART in the East region were unsuppressed (Figure 1).

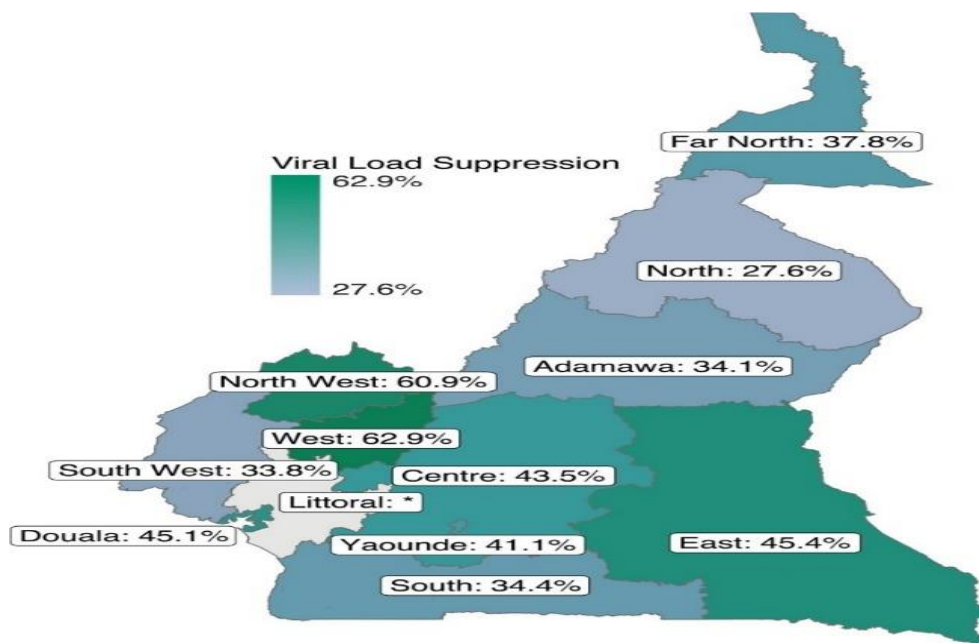


Figure 1. Viral Suppression Rate per Region in Cameroon as per CAMPHIA 2017 Survey Report

Globally, strategies to attain epidemic control efforts are being rolled out in the region by PEPFAR (implemented by Georgetown University) to reduce new HIV infections and improve the well-being of PLWHIV by continuous monitoring of the viral load trends.

Rationale for the Study

The fight against HIV/AIDS is a moral and human rights imperative and a public health necessity that leaves no one indifferent [8]. HIV-related vulnerabilities are fueled by inequalities and prejudices entrenched within the social and economic structures of society.

Harmful cultural and social gender norms and implementation of HIV programs impaired the treatment cascade and increase risky behaviours, which may lead to a rebound of viral load in HIV persons on ART. These behaviors are associated with lower adherence to care and treatment and in effect low viral suppression [9]. The HIV treatment cascade is a complex series of sequential steps that PLWH must navigate to effectively maintain their own health, reduce the risk of HIV transmission and ensure a healthy community [10]. At each step of the process, loss to follow-up of clients is a major challenge to programme effectiveness [11].

An approach that is effective in lowering attrition along the HIV treatment cascade is the patient-centered model, and especially their participation at the community level. This strategy confers additional benefits of improved adherence to ART and increased HIV-free survival [12].

To determine the predictors and facilitators of unsuppressed viral load (VL) among HIV-positive persons who have been on ART for post 6 months period in the East region of Cameroon.

1. To determine if age, gender, and other socio-demographic factors are predictors or facilitators of high viral load in HIV-infected persons.
2. To determine if socio-economic factors are predictors or facilitators of high viral load in HIV-infected persons.
3. To determine if non-adherence and side effects of anti-retroviral drugs are predictors or facilitators of high viral load.
4. To determine if treatment-related factors predict or facilitate viral load suppression.

Limitations

After random selection, reaching the participants was challenging due to the poor network coverage, bad roads, and low visitation of health facilities due to the COVID-19 pandemic in the East. Self-reporting was used for data collection and, therefore, may be affected by recall or social desirability bias. Efforts were made to minimize this bias through comfortable, confidential interview environments and using clear time references within questions.

Materials and Methods

Study Area

This study was conducted in the East region of Cameroon. It is the largest region in the country in terms of surface area (109,002 square Km), with the lowest population density of 5 per square km and a population of over 1,000,000 inhabitants. It is situated at the southeastern portion of the country and is bordered in the east

by the Central Africa Republic, in the south by the Republic of Congo, in the north by the Adamawa region, and in the west by the Center and South regions of Cameroon.

Study Design

This study employed a mixed study involving a sequential and exploratory research designs. The qualitative design employed a review of medical records. The quantitative design employed a community and hospital base cross-sectional study among patients who had been on post-6 months of ART treatment and had a high viral result within the study period.

Sampling Techniques

Given the exploratory nature of the study, a convenience sample was recruited for the study from clients with high viral load (HVL) documented within the study period. A time-limited sampling technique was used to select participants. Eligible participants were identified with the assistance of healthcare providers, Psychosocial agents, and community health workers.

Review of Records

The medical records of participants were reviewed to triangulate data like age, VL results, previous and current regimen, date of initiation, WHO clinical staging, and enrollment into enhanced adherence counselling sessions.

The Research Instruments

The research instrument for the study consisted of:

1. Review of record extraction form.
2. Structure questionnaires, made up of open and close (force) ended questions.

Statistical Analysis

A database was created using the data generated from both the review of the medical record and the structural questionnaires. The data was captured, and quality assurance was performed by checking a random 10% of the questionnaires for data capturing errors. Coding

of the variables was the major data analysis activity that took place after the completion of the data collection processes. Data entry and analysis was done using the Statistical Package for Social Sciences (SPSS) software package version 26. Statistical analysis consisted of cross-tabulation of variables whereby frequencies were computed and presented in tables and graphs. Bivariate analysis with Pearson chi-squared statistics test and p-value <0.05 (P<0.05) at 95% confidence interval was used to determine any associations between the independent variables and the main outcome (dependent) variables of interest. A binary logistic regression model was built with variables that were significant with the bivariate analysis and were computed with the outcome

variable to bring out variables with the highest impact of predicting high viral load.

Results

WHO Clinical Staging

The review of records revealed that 301(77%) of respondents were initiated on ARV for WHO Stage 1 disease, and at the time of the study, only 275(71.1%) were still on WHO clinical stage 1. This shows disease progression after post-initiation of ARV (Figure 2). WHO clinical staging was statistically significant, with the outcome variable at P<0.001, and 219(56.6%) of respondents at this disease stage were virally unsuppressed (Table 1).

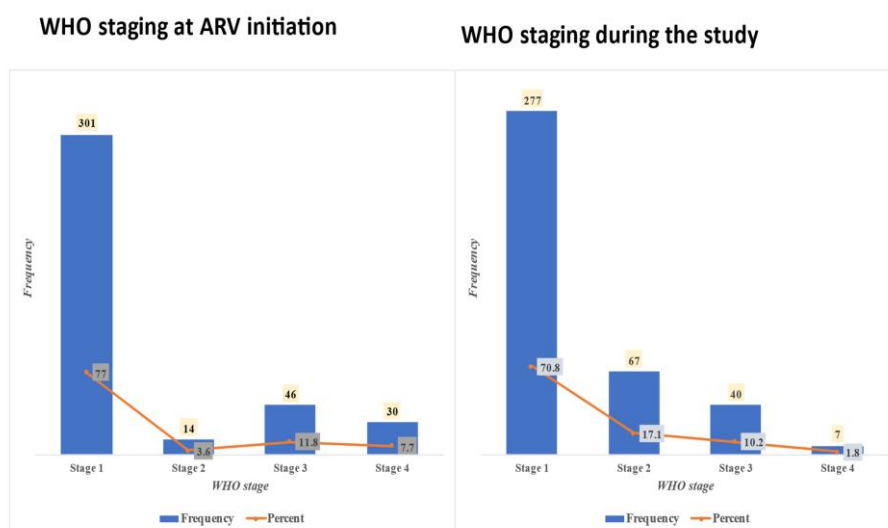


Figure 2. WHO Clinical Staging of People Living with HIV on ART in the East Region of Cameroon in 2021

Table 1. WHO Clinical Staging of People Living with HIV (PLWH) on ART in the East Region of Cameroon as Compared to Viral Load Suppression in 2021 (n=391)

Variable		Total	Viral Load Suppression		Inferential Stat	
			Suppressed	Unsuppressed	χ^2	P
		N° (%)	N° (%)	N° (%)		
WHO disease stage at current	Stage 1	275(71.1)	56(14.5)	219(56.6)	-	-
	Stage 2	66(17.1)	30(7.8)	36(9.3)	-	-
	Stage 3	39(10.1)	16(4.1)	23(5.9)	21.51	0.001
	Stage 4	7(1.8)	2(0.5)	5(1.3)	-	-
	Total	387(100)	104(26.9)	283(73.1)	-	-

Switching of ARV Treatment Regimen

Switching regimen due to stock tension/out or discovering of better regimen (TLD) pose a challenge and may affect viral suppression. The study indicated that of the 65% of respondents who were initially initiated on Efavirenz base regimen “TDF/3TC/EFV” (TELE) only 12.8% are still on that regimen during the study period.

79.8% of respondents had been switched to a DTG base regimen (TDF/3TC/DTG(TLD)) during the study period (Figure 3). Logistic regression analysis with Omnibus test of χ^2 (391, N=391) = 26.14, P < 0.009, for model fit and Hosmer and Lemeshow test of P, = 0.46 of data fitting the model at 72.4% accuracy indicated that switching ARV regimen was a predictor of HVL (P = 0.006) (Table 2).

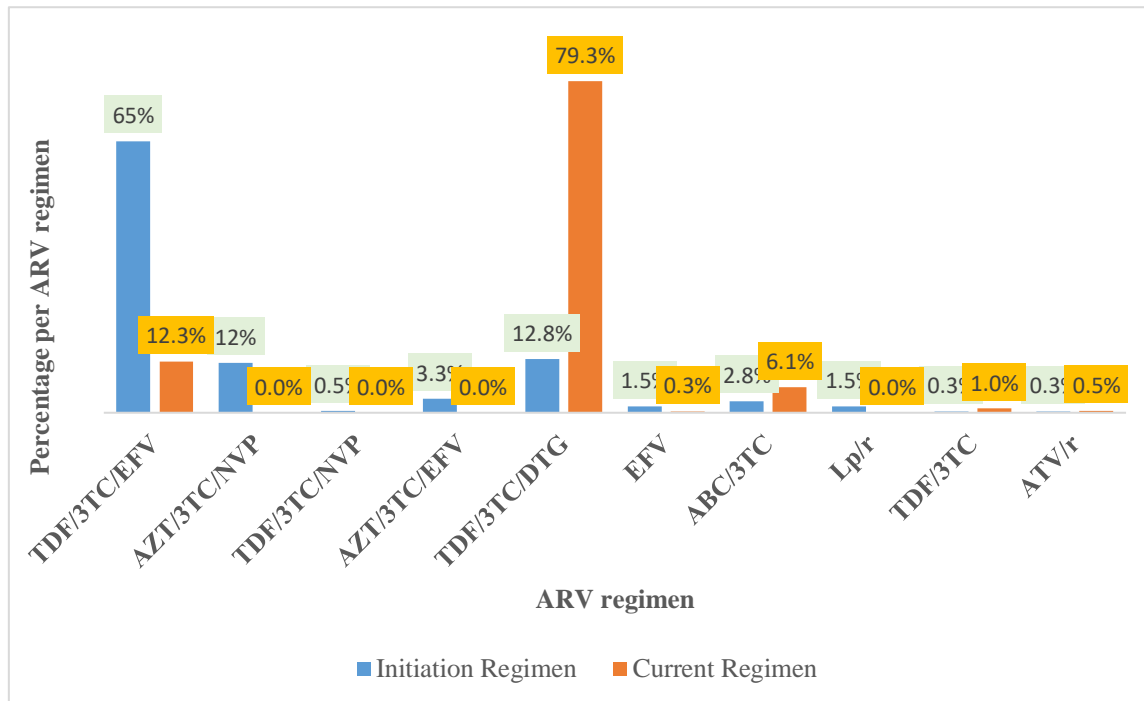


Figure 3. ARV Regimen of PLWH on ART in the East region of Cameroon in 2021

Table 2. Treatment Factors Predictors of High Viral Load in the East region of Cameroon in 2021

Factors	Odd Ratio	95% C.I.for Odd Ratio		P-Value
		Lower	Upper	
Switching ARV regimen	0.402	0.211	0.769	0.006
WHO Stage 1	-	-	-	0.349
WHO Stage 2	0.628	0.201	1.961	0.423
WHO Stage 3	0.917	0.46	1.826	0.805
WHO Stage 4	0.513	0.236	1.115	0.092

Sexual Relationship and Safer Sex

The study also observed that of the 391 participants, 146(51.8%) were in a stable relationship with their partner, and 29(10.3%)

had multiple partners. Being in a relationship was not significant with the outcome variable (P>0.645) but not using condoms during sexual intercourse showed a significant relationship (P<0.03) (Table 3).

Table 3. Sex Related Factors of High Viral Load in PLWH in the East Region of Cameroon in 2021 (n=391)

Variable		Viral load suppression			χ^2	P
		Total	Suppressed	Unsuppressed		
		N° (%)	N° (%)	N° (%)		
Sexual relationship	Not in a relationship	143(36.6)	36(33)	107(37.9)	-	-
	Stable relationship	206(52.7)	60(55)	146(51.8)	0.877	0.645
	Multiple partners	42(10.7)	13(11.9)	29(10.3)	-	-
	Total	391(100)	109(27.9)	282(72.1)	-	-
Condom use	Never use Condom	304(77.7)	75(68.8)	229(81.2)	-	-
	Use condom sometimes	73(18.7)	28(25.7)	45(16)	7.104	0.029
	Use condom consistently	14(3.6)	6(5.5)	8(2.8)	-	-
	Total	391(100)	109(27.9)	282(72.1)	-	-

Socio-demographic Factors Influencing High Viral Load

100(26%) males and 291(74%) females took part in the study. The age ranges from 2 to 70 years old, with a mean age of 35(S.D = 14.492). Table 4 shows more females, 215(55%) being virally unsuppressed than the male 68(17.4%). Gender, according to the study was not statistically significant with the outcome variable ($P>0.29$). The age category analysis shows that 124(31.7%) of respondents with HVL are in the age group of 30-39 years old group with 98(33.7%) females and 26(26%) males. Age shows a significant relationship with the outcome variable at $P<0.001$ level at 95% confidence interval. The age group 30-39 years had twice as many chances of becoming virally unsuppressed than the lower age category. It also indicates that unsuppressed viral load increases with the age of persons on treatment (Table 4).

Monogamous couples 62 (22%), cohabiting couples 82 (19.1%), and children less than 15 years old have greater tendencies to become virally unsuppressed. Marital status was statistically significant at $P<0.001$. Though 150(53.2%) of respondent's had achieved primary education, the level of education showed no significant difference with the outcome variable ($P = 0.54$). The study also indicated that respondents whose occupation was agriculture 89(31.6) and housewives 80(28.4) as compared to other occupations, have higher chances of becoming unsuppressed ($P<0.001$) (Table 4). Logistic regression of the socio-demographic variables indicated that. Holding all other variables constant, the odds of unsuppressed viral load increase between the age range 20-60 years old ($P<0.05$), while those in a cohabiting relationship are four times more likely to be unsuppressed than those who are not married (Table 5).

Table 4. Sociodemographic Factors Affecting HIV Viral Suppression in PLWH in the East Region of Cameroon in 2021 (n=391)

Variable		Total	Viral load suppression		χ^2	P
			Suppressed	Unsuppressed		
		N*(%)	N* (%)	N* (%)		
Gender	Female	291(74.4)	76(19.4)	215(55)	-	-
	Male	100(25.6)	32(8.2)	68(17.4)	1.29	0.26
	Total	391(100)	108(27.6)	283(72.4)	-	-
Age group	Below 15 years	48(12.3)	2(0.5)	46(11.80)	-	-
	15-19 years	7(1.8)	1(0.3)	6(1.5)	-	-
	20-29 years	68(17.4)	20(5.1)	48(12.3)	-	-
	30-39 years	124(31.7)	37(9.5)	87(22.3)	21.84	0.001
	40-49 years	74(18.9)	28(7.2)	46(11.8)	-	-
	50-59 years	52(13.3)	18(4.6)	34(8.7)	-	-
	60 years and above	18(4.6)	2(0.5)	16(4.10)	-	-
Total	391(100)	108(27.6)	283(72.4)	-	-	
Marital Status	Not Married	171(43.7)	48(12.3)	123(31.5)	-	-
	Cohabiting	104(26.6)	22(5.6)	82(21)	-	-
	Married Monogamy	92(23.5)	29(7.9)	63(16.1)	4.07	0.26
	Married Polygamy	24(6.1)	9(2.3)	15(3.8)	-	-
	Total	391(100)	108(27.6)	283(72.4)	-	-
Level of education	Never been to school	74(18.9)	16(4.1)	58(14.8)	-	-
	Primary Level	209(53.5)	58(14.8)	151(38.6)	-	-
	Secondary Level	101(25.8)	32(8.2)	69(17.6)	2.17	0.54
	Tertiary Level	7(1.8)	2(0.5)	5(1.3)	-	-
	Total	391(100)	108(27.6)	283(72.4)	-	-
Occupation	Not employed	96(24.6)	13(3.3)	83(21.2)	-	-
	Housewife	107(27.4)	26(6.6)	81(20.7)	-	-
	Agriculture	130(33.2)	41(10.5)	89(22.8)	23.48	0.001
	Employed	58(14.8)	28(7.2)	30(7.7)	-	-
	Total	391(100)	108(27.6)	283(72.4)	-	-

Table 5. Sociodemographic Predictors of High Viral Load in the East region of Cameroon in 2021

Covariate	Odd Ratio	95% C.I.for Odd R		P- Value
		Lower	Upper	
Below 15 years	-	-	-	0.019
15-19 years	0.331	0.024	4.521	0.407
20-29 years	0.115	0.022	0.594	0.01
30-39 years	0.105	0.021	0.536	0.007
40-49 years	0.071	0.014	0.371	0.002
50-60 years	0.106	0.019	0.581	0.01
60 years and above	0.525	0.06	4.569	0.56
Not married	-	-	-	0.023
Cohabiting	2.652	1.391	5.057	0.003

Married monogamy	1.414	0.753	2.654	0.282
Married polygamy	1.035	0.391	2.741	0.944
Not employed	-	-	-	0.007
Housewife	0.889	0.367	2.148	0.793
Agriculture	0.627	0.275	1.427	0.266
Employed	0.287	0.117	0.703	0.006

Socio-economic Variables Influencing High Viral Load

The study findings indicated that 184(65.2%) respondents with unsuppressed VL lived beyond 2km from the health facility where they received treatment, Table 6, shows the distance from the clinic not statistically significant with the outcome variable ($P > 0.43$). On the other hand, the study indicated that, living with relations and not having food was statistically significant,

with the outcome variable at $P < 0.03$ and $P < 0.001$, respectively (Table 6). Logistic regression analyses indicated that food insecurity is a predictor of high viral load at ($P < 0.001$), and Participant cohabiting are four times most likely to be virally unsuppressed compared to those living alone ($P < 0.008$). The Omnibus test indicated $\chi^2 (6, N=391) = 29.45$, $P < 0.001$ model fit, and the Hosmer and Lemeshow test of $P = 0.88$ of data fitting the model with a 72.9% accuracy (Table 7).

Table 6. Socio-economic Factors Affecting Viral Suppression in the East Region of Cameroon in 2021 (n=391)

Variable		Total	Viral load suppression		χ^2	P
			Suppressed	Unsuppressed (HVL)		
			N* (%)	N* (%)		
Distance from clinic	Walking distance to clinic	30(7.7)	11(10.1)	19(6.7)	-	-
	Lives within 2 km perimeter from clinic.	112(28.6)	33(30.3)	79(28)	1.682	0.431
	Live beyond 2 km from clinic.	249(63.7)	65(59.6)	184(65.2)	-	-
Total		391(100)	109(27.9)	282(72.1)	-	-
With whom do you live?	Alone	24(6.1)	9(8.3)	15(5.3)	-	-
	With my husband/wife	99(25.3)	27(24.8)	72(25.5)	-	-
	With my family	180(46)	59(54.1)	121(42.9)	11.073	0.026
	With my friend (s)	5(1.3)	2(1.8)	3(1.1)	-	-
	Cohabiting with a partner	83(21.2)	12(11)	71(25.2)	-	-
Total		391(100)	109(27.9)	282(72.1)	-	-
Lack of food	Never	127(32.5)	21(19.3)	106(37.6)	-	-
	Sometimes	197(50.4)	68(62.4)	129(45.7)	18.28	0.001
	Often	29(7.4)	13(11.9)	16(5.7)	-	-
	Always	38(9.7)	7(6.4)	31(11)	-	-
	Total	391(100)	109(27.9)	282(72.1)	-	-

Table 7. Socio-economic Predictors of High Viral Load in PLWH in the East Region of Cameroon in 2021

Variables	Odd Ratio	95% C.I.for Odd Ratio		P-Value
		Lower	Upper	
Never lacked food	-	-	-	0.001
Often lacked food	0.354	0.203	0.617	0.001
Always lack food	1.005	0.376	2.687	0.992
Live alone	-	-	-	0.027
Live with husband	1.672	0.629	4.448	0.303
Living with family	1.446	0.579	3.609	0.43
Lives with friends	0.801	0.104	6.168	0.831
Cohabiting	4.169	1.442	12.052	0.008

Adherence to ARV on viral Suppression

Not taking ARV correctly as prescribed may lead to viral load rebound and subsequent drug resistance. 200(51.2%) of respondents not adherent to their medication were unsuppressed as observed by the study (P<0.001) (Table 8).

Distance from the clinic, food insecurity, and living with relations were statistically significant at P<0.001 level with adherence to medication (Table 9). Thus, distance from the clinic, food insecurity, and living with a relation are facilitators of HVL.

Table 8. Effect of non-adherence to Medication on Viral Suppression in PLWH in the East Region of Cameroon in 2021 (391)

Variable		Viral load suppression			χ^2	P
		Total	Suppressed	Unsuppressed		
		N° (%)	N° (%)	N° (%)		
Medication Adherence	NO	252(64.5)	52(13.3)	200(51.2)	-	-
	Yes	139(35.5)	56(14.3)	83(21.2)	17.31	0.001
	Total	391(100)	108(27.6)	283(72.4)	-	-

Table 91. Patient-Related Factors Affecting Adherence to Medication in PLWH in the East Region of Cameroon in 2021 (n=391)

Variable		Adherence to ARV			χ^2	P
		Total	No	Yes		
		N° (%)	N° (%)	N° (%)		
Distance from clinic	Lives <1km from clinic	30(7.7)	29(14.8)	1(0.5)	-	-
	Lives within 1-2 km perimeter from clinic	112(28.6)	106(54.1)	6(3.1)	180.193	0.001
	Live beyond 2 km from clinic	249(63.7)	61(31.1)	188(96.4)	-	-
Total		391(100)	196(50.1)	195(49.9)	-	-
Lack of food	Never	127(32.5)	126(57)	1(0.6)	-	-
	Sometimes	197(50.4)	88(39.8)	109(64.1)	164.282	0.001
	Often	29(7.4)	5(2.3)	24(14.1)	-	-
	Always	38(9.7)	2(0,9)	36(21.2)	-	-
Total		391(100)	221(56.5)	170(43.5)	-	-

With whom do you live?	None	24(6.1)	24(8.1)	0(0)	-	-
	With my husband/wife	99(25.3)	86(29.2)	13(13.5)	-	-
	With my family	180(46)	138(46.8)	42(43.8)	44.195	0.001
	With my friend (s)	5(1.3)	1(0.3)	4(4.2)	-	-
	Cohabiting with a partner	83(21.2)	46(15.6)	37(38.5)	-	-
Total		391(100)	295(75.5)	96(24,5)	-	-

Substance use (alcohol, smoking, and injecting drugs) are psychosocial factors that has been proven by literature to affect adherence and, eventually viral suppression. The study indicated that while alcohol ($P < 0.001$) and smoking ($P < 0.001$) are statistically significant

with adherence, injecting drugs shows no significant difference with adherence to ART ($P > 0.75$) (Table 10). Though substance use has an effect on ARV adherence, it shows no significant difference with viral load suppression (Table 11).

Table 10. Effect of Substance Use on Adherence to Medication in PLWH in the East Region of Cameroon in 2021 (n=391)

Variables		Adherence to medication			χ^2	P
		Total	NO	Yes		
		N° (%)	N° (%)	N° (%)		
Use of alcohol	Never	165(42,2)	165(66.3)	0(0)	-	-
	Occasionally	122(31.2)	62(24.9)	60(42.3)	209.703	0.001
	Daily	84(21.5)	8(3.2)	76(53.5)	-	-
	Twice a week	20(5.1)	14(5.6)	6(4.2)	-	-
Total		391(100)	249(63.7)	142(36.3)	-	-
Smoking	Never	349(89.3)	349(97.5)	0(0)	-	-
	Occasionally	20(5.1)	5(1.4)	15(45.5)	37.499	0.001
	Daily	20(5.1)	3(0.8)	17(51,5)	-	-
	Twice a week	2(0.5)	1(0.3)	1(3)	-	-
Total		391(100)	358(91.6)	33(8.4)	-	-
Injecting drugs	Never	387(99)	387(99.2)	0(0)	-	-
	Occasionally	3(0.8)	2(0.5)	1(100)	0.584	0.747
	Daily	1(0.3)	1(0.3)	0(0)	-	-
Total		391(100)	390(99.7)	1(0.3)	-	-

Table 11. Effect of Substance Use on Viral load Suppression in PLWH in the East region of Cameroon in 2021 (n=391)

Variables		Viral load suppression			χ^2	P
		Total	Suppressed	Unsuppressed (HVL)		
		N° (%)	N° (%)	N° (%)		
Use of alcohol	Never	165(42.2)	43(39.4)	122(43.3)	-	-
	Occasionally	122(31.2)	37(33.9)	85(30.1)	2.443	0.486
	Daily	84(21.5)	21(19.3)	63(22.3)	-	-
	Twice a week	20(5.1)	8(7.3)	12(4.3)	-	-

	Total	391(100)	109(27.9)	282(72.1)	-	-
Smoking	Never	349(89.3)	94(86.2)	255(90.4)	-	-
	Occasionally	20(5.1)	9(8.3)	11(3.9)	3.64	0.303
	Daily	20(5.1)	5(4.6)	15(5.3)	-	-
	Twice a week	2(0.5)	1(0.9)	1(0.4)	-	-
	Total	391(100)	109(27.9)	282(72.1)	-	-
Injecting drugs use	Never	387	108(99.1)	279(98.9)	-	-
	Occasionally	3(0.8)	1(0.9)	2(0.7)	0.431	0.806
	Daily	1(0.3)	0(0)	1(0.4)	-	-
	Total	391(100)	109(27.9)	282(72.1)	-	-

Side effects of ARV, according to the study, suppression and adherence to ARV at $P < 0.001$ showed a significant difference both with viral level (Table 12 & 13).

Table 12. ARV Side Effects on Viral Load Suppression in PLWH in the East region of Cameroon in 2012 (n=391)

Variables		Viral Load Suppression			χ^2	<i>P</i>
		Total	Suppressed	Unsuppressed (HVL)		
		<i>N</i> ^o (%)	<i>N</i> ^o (%)	<i>N</i> ^o (%)		
Side effects	No	267(68.3)	61(56)	206(73)	-	-
	Yes	124(31.7)	48(44)	76(27)	10.598	0.001
	Total	391(100)	109(27.9)	282(72.1)	-	-

Table 13. Effect of ARV Medication Side Effects on Adherence in PLWH in the East region of Cameroon in 2021 (n=391)

Variable		Adherence			χ^2	<i>P</i>
		Total	NO	Yes		
		<i>N</i> ^o (%)	<i>N</i> ^o (%)	<i>N</i> ^o (%)		
Side effects	No	267(68.3)	267(76.7)	0(0)	-	-
	Yes	124(31.7)	81(23.3)	43(100)	104.03	0.001
	Total	391(100)	348(89)	43(11)	-	-

Logistic regression analyses indicated that non-adherence to medication for greater than a week could better predict HVL ($P < 0.001$). Missed doses due to substance use or side effects are not predictors of HVL ($P > 0.05$) but are facilitators as they were significant with the outcome variable (Table 14).

Table 14. Patient Related Predictors of High Viral Load in PLWH in the East region of Cameroon in 2021

Covariate	Odd Ratio	95% C.I. for odd Ratio		P-Value
		Lower	Upper	
Non-adherence to ARV for > 1week	0.369	0.231	0.589	0.001
Missed dose due to substance use	0.98	0.606	1.587	0.935
Missed doses due to side effects	0.681	0.331	1.402	0.297

Duration on ART

302(77.2%) of respondents in the study who had been on ART for more than 24 months and 61(21.6%) of those who had been on ART for

12-23 months were unsuppressed. (Table 15). Logistic regression analyses indicated that the duration on ART treatment shows no predictability of HVL (Table 16).

Table 15. Effect of Duration on ARV on Viral Load Suppression in PLWH in the East Region of Cameroon in 2021 (n=391)

Variable		Viral load suppression			χ^2	P
		Total	Suppressed	Unsuppressed (HVL)		
		N* (%)	N* (%)	N* (%)		
Duration on ARV	6 to 11 months	18(4.6)	1(0.9)	17(6)	-	-
	12 to 23 months	71(18.2)	10(9.20)	61(21.6)	14.32	0.001
	more than 24 months	302(77.2)	98(89.9)	204(72.3)	-	-
	Total	391(27.9)	109(100)	282(72.1)	-	-

Table 16. Geospatial Distribution Predictors of High Viral Load in PLWH in the East Region of Cameroon in 2021

Covariate	Odd Ratio	95% C.I.for Odd Ratio		P-Value
		Lower	Upper	
Facility dispensation	-	-	-	0.123
Facility and community dispensation	0.71	0.406	1.241	0.229
Community dispensation	1.587	0.613	4.113	0.341
6-11 months on ART	-	-	-	0.002
12-23 months on ART	0.404	0.048	3.436	0.407
>24 months on ART	0.131	0.017	1.006	0.051

Discussion

The goal of HIV programs is to achieve sustainable viral load suppression for all HIV positive persons who are on ART. In this study's unsuppressed viral load was defined using the WHO standard definition of >1000copies/ml. Predictors and facilitators of HVL were found in patient-related factors (socio-demographic and socio-economic factors), psychological factors (substance use, stigma, discrimination, cultural and religious beliefs), Treatment factors (side effects of ARV and ARV adherence), and system or program factor (public health interventions). The study indicated that gender was neither a predictor nor a facilitator of HVL. This is consistent with studies carried in Ethiopia

[13] which found gender to have no difference with viral suppression. Age, marital status, and occupation of clients on ART were found to be predictors of high viral load. This finding is supported by studies conducted in Ethiopia [14], Vietnam [15], and Mozambique [16]. On the other hand, this finding was contrary to a study in Eastern Uganda that found age to show no difference with viral load suppression [17]. Those cohabiting were four times more likely to be virally unsuppressed than unmarried, and the employed (salary jobs) are more likely to be unsuppressed than the not employed. These were consistent with studies carried out in the USA [18], and Thailand [19] and studies carried out by Maulsby [20], "a scoping review of employment and HIV". These results are also

supported by two studies in Mozambique [16] and [21], and in Guangxi, a similar relationship was found [22].

The study found out that level of education was neither a predictor nor a facilitator of viral suppression. This is contrary to studies carried out in Ethiopia [13]. The study also found out that back and forth switch of the client regimen was a predictor to high viral. The WHO clinical stage at which a client was initiated on ART was found to be the facilitator of HVL, especially clients initiated at WHO clinical stages 3 and 4.

The study brought out the fact that respondents who live at a distance beyond 2km from clinic 184(65.2%) are more likely to be virally unsuppressed than those who lives within 1-2km perimeter. Though the distance to the clinic, according to the study, was not significant to viral suppression ($P>0.43$), it was greatly significant with adherence to medication ($P<0.001$). This was consistent with studies carried out in Uganda [23], in Kenya, Nigeria and Tanzania [24]. The social conditions surrounding a patient on ART and the availability of food were found to be determinant of adherence and, thus viral suppression. In the study, a robust and independent association occurred between food insecurity and HIV viral suppression. According to the study, patients living with family members ($P<0.03$) and those who lack food ($P<0.001$) are more likely to be virally unsuppressed. Living with family members exposes clients on ART who has not discloses their HIV status to their family members to stigma and discrimination which often lead to the patients' missing doses or even abandoning treatment. These findings were consistent with studies in Ethiopia and Cameroon [25, 26].

Substance use (alcohol, smoking and injecting drugs) were all not significant with the outcome variable ($P>0.05$). Alcohol and smoking in the other hand showed a significant relationship with adherence at $P<0.001$ level. This indicates that though substance use has a direct effect on adherence to medication, it has

no direct impact on viral suppression. Therefore, substance use is a facilitator of HVL. This is consistent with a study carried out in Latin America [27] and California [28].

Side-effects can be experienced by anyone taking anti-retroviral drugs, even people with undetectable viral load with no symptoms of HIV infection. The study indicated that ARV side effects is both significant to viral suppression and adherence to medication. The study observed that those respondents who report ARV side effects within the last six months of medication had 27% chance of becoming virally unsuppressed and a 100% chance of having adherence issues. This is consistent with studies carried out in South Africa [29].

Poverty was seen as a factor of poor adherence, which affected VLS. The study records 99% of participants lived in houses with a mud walls, 74% had mud floors, and 53% had Thatched roofs houses. This level poverty is the cause of not picking up medication on time couple with the poor road network in the region and difficult terrain. This is consistent with studies in Vietnam on factors associated with high viral load [30].

After researching on this topic, the researcher suggests further research on:

1. Factors affecting poor retention in the region.
2. ARV drug resistance in PLWH.

Equation

Sample Size Determination

Since the proportion of HIV positive patients with HVL in the region was not known, by default, a 50% proportion was considered. A representative sample for proportion was computed using Cochran equation [31].

$$N = \frac{Z^2 P (1 - P)}{d^2}$$

Where n = sample size.

Z = standard normal variant (1.96) at 95% confidence interval.

P = a rough approximation of the predictors of HVL (50%) = 0.5.

(Since no available research has been done in this region).

d= sampling error that can be tolerated (5%) = 0.05.

$$n = \frac{(1.96)^2 (0.5)(1 - 0.5)}{(0.05)^2}$$

= 385 *Participants*

Hence the minimum sample size of 385 Participants was required for the study.

Conclusion

The study observed that the key independent predictors for high viral load were Age, marital status (cohabiting), occupation, adherence, lack of food, and inadequate EAC session. These results reinforce the need to develop strategies regarding these predictors to optimize adherence, improve nutritional assessment and clinical management of patients with high viral load, more commitment to sustaining treatment outcomes, and closer follow-up with focused interventions for patients on ARV treatment who are at higher risk of unsuppressed viral loads.

Identifying these predictors and facilitators and systematically addressing them will have a replica effect of attaining HIV epidemic control in the region and the Country in general. Therefore, the study recommends that, more efforts should be focused on strengthening optimize strategies to those who are at risk of having HVL. Capacity building of health workers, community health care workers and the PLWH on HIV management will have an impact of improving adherence and thereby improving viral load suppression. Similarly, further studies should be carried out in all the health facilities with HIV treatment units in the East region is recommended as this will try to answer the discrepancy between the ministry of health data and that from the current and other similar studies.

Conflict of Interest

No conflict of interest.

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