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Viral Load Suppression Among HIV Infected Adults On Antiretroviral Treatment In Rural Settings Of The Centre Region Of Cameroon: A Retrospective Cohort Study

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Abstract

The Joint United Nations Program on HIV/AIDS (UNAIDS) set ambitious targets known as the 95-95-95 goals, aiming for 95% of people living with HIV to know their status, 95% of those diagnosed to be on sustained ART, and 95% of those on ART to have viral suppression by 2030. This underscores the significance of viral load (VL) monitoring and suppression as crucial components of the HIV care continuum towards reaching epidemic control. This study was meant to explore viral load suppression among HIV-infected adults on ART in the rural areas of the Centre Region of Cameroon. We conducted a retrospective cohort study on all HIV-infected adults who were initiated on ART between June 2020 and May 2021 in ten rural ART clinics. Patients' medical records were reviewed for data collection. Of the 2 591 HIV-infected adults on ART whose medical files were reviewed, 1 727 (66.7%) had documented viral load (VL) results at 12 months post-ART initiation giving a viral load coverage of 66.7%. Among the 1,727 documented VL, the proportion of participants that achieved viral suppression (viral load <1000 copies/mL) was 1 654, representing 95.8%. Occupation at initiation (aOR: 0.416, 95% CI: 0.196–0.885, p=0.023) and disclosure of HIV status to partners (cOR: 0.557, 95% CI: 0.317–0.978, p=0.042) emerged as significant predictors of VL suppression. Findings from this study show that as HIV care continues to evolve, interventions tailored to individual needs and context-specific challenges should be prioritized to optimize treatment outcomes.

Keywords*: Antiretroviral Therapy Initiation, Cameroon, Treatment Outcomes, Viral Load Suppression.*

Introduction

The Human Immunodeficiency Virus (HIV) continues to be a global health problem, particularly in sub-Saharan Africa, where nearly two-thirds of the world's HIV-positive population resides [1]. The global response to the Human Immunodeficiency Virus (HIV)

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pandemic has witnessed significant strides in the scale-up of Antiretroviral Therapy (ART), contributing to improved morbidity and mortality outcomes among people living with HIV (PLHIV) [2]. However, despite these advancements, challenges persist, particularly in resource-limited settings in achieving and maintaining viral load suppression which is crucial not only for individual health but also for the broader public health agenda [3, 4].

The Joint United Nations Program on HIV/AIDS (UNAIDS) set ambitious targets in 2014, known as the 95-95-95 goals, aiming for 95% of PLHIV to know their status, 95% of those diagnosed to be on sustained ART, and 95% of those on ART to have viral suppression by 2030 [1]. Achieving 95% viral suppression among PLHIV through this global initiative is necessary to improve the quality of life of PLHIV and reduce the risk of HIV transmission within the population which is fundamental in reaching HIV epidemic control by 2030 [3,4]. This underscores the significance of viral load monitoring and suppression as crucial components of the HIV care continuum.

Cameroon, with a total population estimate of 27,874,766 people, the total number of PLHIV for 2022 of 494,476 (Spectrum, 2022) [5] and a national prevalence of 2.7% [6], continues to struggle with the dual burden of HIV prevalence and the associated complexities of ensuring optimal treatment outcomes including viral suppression [5]. The Cameroon National AIDS Control Committee (NACC) has been pivotal in shaping the country's HIV response, emphasizing the importance of routine viral load monitoring [7]. According to the National Guideline for HIV management in Cameroon, the first Viral Load (VL) determination for PLHIV is done after six months of treatment and then every 12 months if suppressed (< 1000 copies/ml) [8].

The Centre Region of Cameroon is one of the regions with an HIV prevalence (3.5%) above the national prevalence [5]. The region encompasses both urban and rural landscapes which offers a distinctive context for understanding the dynamics of HIV care. Urban centres have witnessed considerable progress in ART accessibility, but rural areas face unique challenges, including limited healthcare infrastructure and geographical barriers. While the Cameroon Population-based HIV Impact Assessment (CAMPHIA), a household-based national survey carried out between July 2017 and February 2018 put the national VL suppression rate at 80.0% among PLHIV ages 15-64 years, the suppression rate in Yaoundé (Centre Region) was at 43.1% [9]. However, recent data show that the VL suppression rate increased from 88% in 2021 to 93% in 2022 [5]. This retrospective cohort study seeks to contribute to the growing body of knowledge on HIV care in rural settings by determining viral load coverage and exploring viral load suppression among adult HIV patients on ART in the rural areas of the Centre Region of Cameroon. By determining viral load coverage and Viral Load suppression associated factors specific to this context, our findings aim to inform targeted interventions that can enhance treatment outcomes and contribute to the achievement of global HIV targets towards HIV epidemic control.

Materials and Methods

Study Setting

This retrospective cohort study was conducted among adults living with HIV followed up in ten district hospitals in the rural areas of the Centre region of Cameroon. Cameroon with an estimated total population of 27,874,766 is a country in Central Africa. It has 10 administrative regions with the Centre region having about 30 health districts for a total of 3,724,000 inhabitants with each district having a district hospital [10]. The region has an HIV prevalence of 3.5% which is above the national prevalence of 2.7% [11]. The Centre

region is subdivided into 10 divisions as shown on Figure 1. The study sites were distributed across the administrative divisions as follows: Obala District hospital (Lekié), Monatele District Hospital (Lekié), Ntui District Hospital (Mbam-et-Kim), Sa'a District hospital (Lekié), Nanga-Eboko District hospital (Haute-Sanaga), Bafia District Hospital (Mbam-et-Inoubou), Akonolinga District Hospital (Nyong-et-Mfoumou), Okola District Hospital (Lekié), Ngoumou District Hospital (Méfou-et-Akono), and Eseka District Hospital (Nyong-et-Kéllé).

Figure 1. Divisions of the Centre Region of Cameroon.

Study Design

We conducted a retrospective cohort study by reviewing the individual medical files of all HIV-infected adults who were enrolled on antiretroviral therapy between June 2020 to May 2021 and followed up in the HIV treatment Centres of the ten selected rural district hospitals in the Centre region of Cameroon. The ten district hospital treatment Centres were purposefully selected based on their rural locations and the technical support they receive from Georgetown Global Health implementing the TIDE Program funded by the US President's Emergency Plan for AIDS Relief Program (PEPFAR). The study sites were categorized in Tiers according to the number of PLHIV on treatment as Tier 1 health facilities: > 2 000 PLHIV on ART, Tier 2 health facilities: 1001 to 2000 PLHIV on ART, Tier 3 health facilities: 501 to 1000 PLHIV, and Tier 4 health facilities: 500 PLHIV on ART or less.

Study Population and Sampling

The target population for this study was HIV-infected adults (≥ 21 years) on ART attending ART clinics at any of the ten selected district hospital treatment centres and who initiated ART between June 2020 and May 2021 (n=2819). Data were captured on the socio-demographic, behavioural and clinical characteristics of the participants. The sampling was exhaustive as we reviewed all available medical files of HIV-infected adults attending ART clinics at the ten selected district hospital treatment centres and who were enrolled in ART between June 2020 and May 2021. We excluded medical files of patients younger than 21 years at the time of initiation on ART (n=151), those of adult patients transferred in from other treatment centres (n=42), and adult patients with missing medical files (n=35). Of the 2519 medical files reviewed, 1727 had documented viral load results in 12 months post-ART initiation while 864 did not have any

documented viral load result in 12 months post-ART initiation (Figure 2).

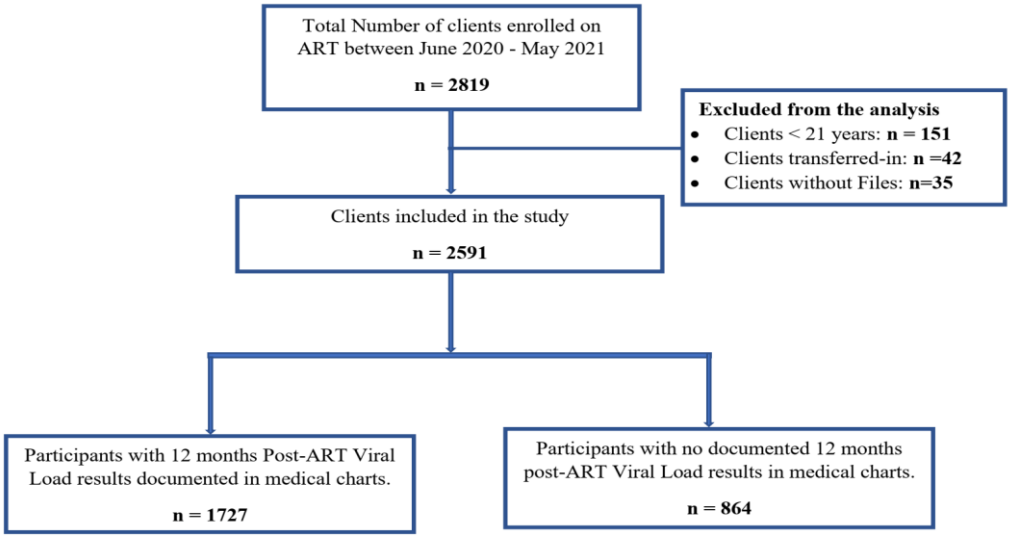

Figure 2. Flow diagram of HIV-infected adults enrolled on ART between June 2020 and May 2021 in ten rural ART clinics in the Centre Region of Cameroon

Definition of Study Variables

The main outcome (dependent) variable for this study was viral load suppression status. Viral suppression was defined as viral load result less than 1000 copies/mL 12 months after commencement of treatment while unsuppressed viral load was defined as viral load result ≥ 1000 copies/ml.

The independent variables in this study were categorized into Socio-demographic, behavioural and clinical characteristics of the participants.

Data Collection and Management

Data were collected with the aid of a data abstraction tool designed from patients' medical records to extract patients' demographic, behavioural and clinical data that are routinely collected during HIV case management. The medical files of adult patients (≥ 21 years) initiated on ART between June 2020 and May 2021 in the ten ART clinics were reviewed. Data collection was manually done by trained HIV case managers recruited from the selected health facilities who were familiar with HIV service tools and were trained on how to extract data using a structured abstraction tool. They were supervised by two supervisors (a trained data clerk and a trained M&E Officer) who reviewed the data abstraction forms daily. About 10% of the adult patients' medical files were randomly selected and redone by the research team in each study facility to ensure data quality. All discrepancies were addressed by the research team before data entry and analysis. Data collection went from May to June 2023. The data collected were entered on a designed Microsoft Excel sheet and saved in a file on a laptop only accessible to the researcher.

Statistical Analysis

Data analysis was done using Statistical Package for Social Sciences (SPSS) Version 26.0 (Chicago IL, USA) for descriptive and inferential statistics. Description statistics was used to summarize categorical variables into proportions and percentages and presented on tables and figures while continuous variables were summarized using means and standard deviations. Viral load coverage was calculated by dividing the number of patients who had a documented viral load result at 12 months post

ART initiation by the total number of patients enrolled in the study while Viral load suppression at 12 months post ART initiation was calculated by dividing the number of patients who had achieved viral suppression by the total number of patients with documented viral load results.

To determine the factors associated with viral load suppression among adult patients (≥ 21 years) on ART in the ten rural ART clinics of the Centre Region of Cameroon, we performed binary and multivariate logistic regression models to determine independent predictors of viral suppression among HIV-infected adults on ART in the study cohort and p-value <0.05 at 95% confidence interval was set as the cut-off point for any statistically significant association.

Ethical Considerations

We obtained ethical approval from the Centre Regional Ethics Committee for Human Health Research with reference number CE N0: 0003/CRERSHC/2023 and administrative approval from the Regional Delegation of Public Health of the Centre Region with reference N0: 0329/AUT/MINSANTE/SG/DRSPC/ST-CRERSHC. The data abstraction form used unique ART codes to identify participants making them anonymous. All information collected about a participant during the study was kept on a database protected by a password and was strictly confidential.

Results

Viral load Coverage

This corresponds to the proportion of patients with documented Viral Load results at 12 months post-ART initiation.

Of the 2 591 HIV-infected adults on ART whose medical files were reviewed in the 10 rural ART clinics in the Centre Region of Cameroon, 1 727 (66.7%) had documented viral load results at 12 months post-ART initiation while 864 (33.3%) did not have any documented viral load results (Figure 3). This gives a viral load coverage of 66.7% at 12 months post-ART initiation for all adult patients on ART in the study cohort.

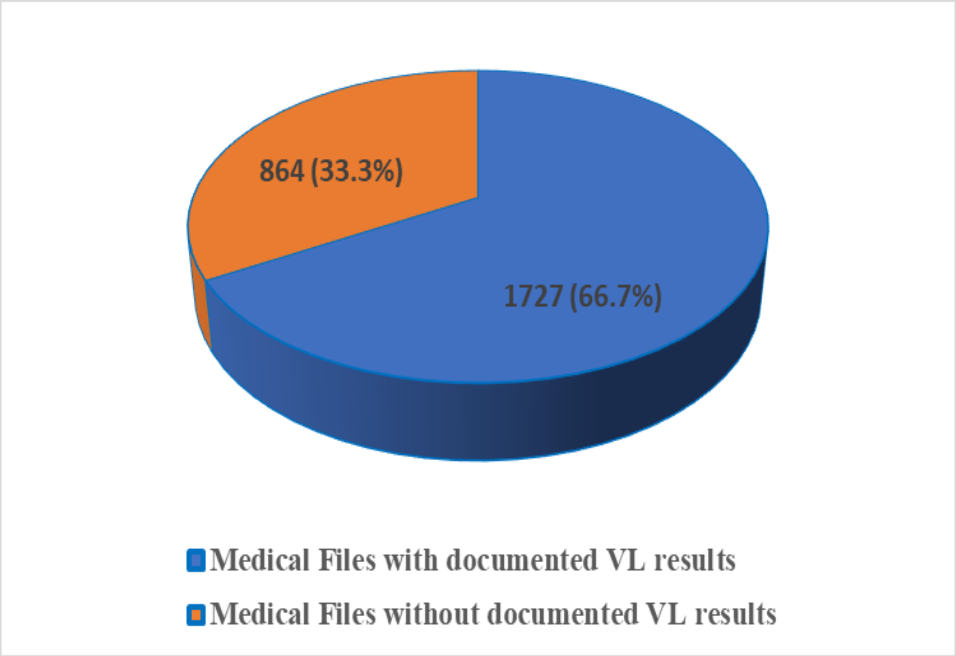

Figure 3. Proportion of patients with documented Viral Load results at 12 months post-Art initiation

Socio-Demographic Characteristics of Participants

The analysis included the 1,727 HIV-infected adults on ART who had documented viral load results 12 months after ART initiation (Table 1). The majority of the participants, 1092 (63.2%) were females, while 635 (36.8%) were males. The mean age at initiation was 38.7 years and the standard deviation was ± 11.2 years. The majority of the participants were between the ages of 31 and 40 (32.3%). Regarding distance, the vast majority of the participants, 1268 (73.4%), resided more than 5 km from the healthcare facility. The marital status at ART initiation varied, with the highest percentage being single individuals, 643 (37.2%). Concerning the educational level, the majority of participants, 698 (40.4%), had completed just primary education while a significant proportion of participants were farmers, 738 (42.7%).

Table 1. Baseline socio-demographic characteristics of the study participants with documented viral load results

Characteristics	Frequency (n=1727)	Percentage (%)
Gender		
Male	635	36.8
Female	1092	63.2
Age groups at initiation		
Mean ± SD	38.7 ± 11.2	
21 – 30 years	491	28.4
31 – 40 years	557	32.3
41 – 50 years	429	24.8
51 + years	250	14.5
Residence		
< or = 5 km	446	25.8
>5km	1268	73.4
Missing	13	0.8
Marital Status at initiation		
Single	643	37.2
Married (monogamy)	161	9.3
Married (polygamy)	51	3
Widow(er)	127	7.4
Divorced	33	1.9
Concubine	570	33
Missing	142	8.2
Highest Level of education at initiation		
Did not go to school	144	8.3
Primary	698	40.4
Secondary	455	26.3
High school	284	16.4

University and higher	66	3.8
Missing	80	4.6
Occupation at initiation		
Unemployed	169	9.8
Housewife	277	16
Farmer	738	42.7
Business	166	9.6
Student	23	1.3
Civil servant	23	1.3
Employed in the private sector	71	4.1
Others	194	11.2
Missing	66	3.8

Behavioural and Clinical Characteristics of Participants With Documented Viral Load Results

The behavioural and clinical characteristics of the 1 727 study participants who had documented viral load results (Table 2) showed that a significant proportion of participants, 964 (55.8%), did not inform their partners of their HIV status at initiation, while 842 (48.8%), chose not to disclose HIV status to family and/or friends. Moreover, the majority of the participants, 1499 (86.8%), initiated ART at WHO Clinical Stage 1 and the predominant ART regimen at initiation was TDF/3TC/DTG accounting for 1 247 (72.2%) of cases. In addition, the majority of participants, 1536 (88.9%), did not experience changes in their antiretroviral (ARV) regimen since initiation. Regarding the mode of entry into HIV care, 1 143 (66.2%) participants entered HIV care through community-based testing and 584 (33.8%) through facility-based testing. The distribution of participants across health facility tiers, showed that the majority of the participants, 816 (47.2%), were in Tier 1. The analysis of multi-month dispensation status at 12 months post-ART initiation revealed that the majority, 988 (57.2%), received multi-month dispensations spanning 3 to 6 months.

Table 2. Behavioural and Clinical Characteristics of Participants With Documented Viral Load Results

Characteristics	**Frequency (n=1727)**	**Percentage (%)**
Whether Partner was informed of HIV status at initiation		
No	964	55.8
Yes	613	35.5
Missing	150	8.7
Whether Client shared HIV status with Family and/or friend		
No	842	48.8
Yes	741	42.9
Missing	144	8.3

WHO HIV clinical stage at initiation		
Stage 1	1499	86.8
Stage 2	143	8.3
Stage 3	51	3
Stage 4	3	0.2
Missing	31	1.8
ART Regimen at initiation		
TDF/3TC/DTG	1247	72.2
TDF/3TC/EFV	473	27.4
Others	7	0.4
Whether ARV was changed since initiation		
No	1536	88.9
Yes	177	10.2
Missing	14	0.8
HIV Care entry modality		
Community-based testing	1143	66.2
Facility-based testing	584	33.8
Health facility Volume		
TIER 1	816	47.2
TIER 2	636	36.8
TIER 3	213	12.3
TIER 4	62	3.6
Multi-month dispensation status at 12-month post-ART initiation		
I month dispensation	311	18
2 months dispensation	392	22.7
Multi-months dispensations (3 – 6 months)	988	57.2
Missing	36	2.1

Prevalence Of Viral Suppression Among HIV Infected Adults On Antiretroviral Therapy

Of the 1 727 participants whose medical records had documented 12-months viral load results, the proportion of participants that achieved viral suppression (viral load < 1000 copies/mL) was 1 654, representing 95.8% (Figure 4).

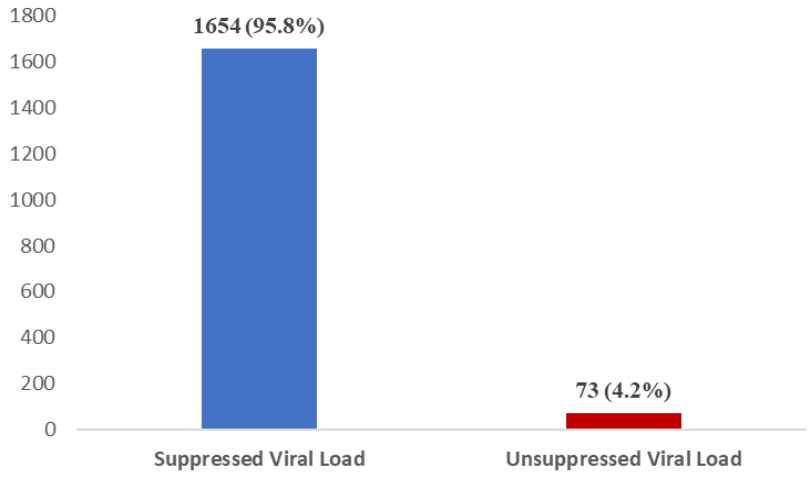

Figure 4. Proportion of HIV viral suppression among HIV infected adults on ART

Multivariate Logistic Regression Analysis of Socio-Demographic Factors Associated With Unsuppressed Viral Load

In the multivariate logistic regression model analysis, participants' socio-demographic characteristics such as gender, age groups, residence, marital status, and education level did not significantly predict unsuppressed viral load. However, occupation at initiation, specifically being a farmer, demonstrated a statistically significant association as farmers were 58.4% less likely to have unsuppressed viral load compared to participants that were unemployed (adjusted odds ratio [aOR]: 0.416, 95% Confidence Interval [CI]: 0.196–0.885, p-value = 0.023).

Table 3. Multivariate analysis of Socio-demographic factors associated with unsuppressed viral load

Characteristics	Viral Load suppression (n=1654)	Crude OR (cOR) (95% CI)	p-value	Adjusted OR (aOR) (95% CI)	p-value
Gender					
Male	608 (36.8)	Ref (1)		Ref (1)	
Female	1046 (63.2)	0.990 (0.609–1.609)	0.969	0.911 (0.532–1.559)	0.733
Age groups at initiation					
21 – 30 years	469 (28.4)	Ref (1)		Ref (1)	
31 – 40 years	534 (32.3)	0.918 (0.505–1.669)	0.780	0.894 (0.481–1.664)	0.725
41 – 50 years	412 (24.9)	0.880 (0.461–1.669)	0.697	0.842 (0.418–1.696)	0.631
51 + years	239 (14.4)	0.981 (0.468–2.057)	0.960	0.969 (0.398–2.360)	0.945
Residence*					
< or = 5 km	427 (25.8)	Ref (1)		Ref (1)	
>5km	1214 (73.4)	1.000 (0.586-1.706)	0.999	1.108 (0.638–1.925)	0.715

Marital Status at initiation*					
Single	620 (37.5)	Ref (1)		Ref (1)	
Married (monogamy)	157 (9.5)	0.687 (0.234-2.015.)	0.494	0.716 (0.233–2.200)	0.559
Married (polygamy)	49 (3.0)	1.100 (0.252–4.804)	0.899	1.175 (0.261–5.290)	0.834
Widow(er)	121 (7.3)	1.337 (0.533–3.352)	0.536	1.562 (0.540–4.518)	0.411
Divorced	30 (1.8)	2.696 (0.766–9.481)	0.122	2.742 (0.704–10.671)	0.146
Concubine	539 (32.6)	1.550 (0.893–2.691)	0.119	1.709 (0.965–3.026)	0.066
Highest Level of education at initiation*					
Did not go to school	139 (8.4)	Ref (1)		Ref (1)	
Primary	668 (40.4)	1.249 (0.476–3.275)	0.652	1.329 (0.494–3.575)	0.573
Secondary	436 (26.4)	1.211 (0.444–3.305)	0.708	1.316 (0.467–3.707)	0.604
High school	272 (16.4)	1.226 (0.424–3.551)	0.707	1.268 (0.422–3.808)	0.672
University and higher	62 (3.7)	1.794 (0.466–6.908)	0.396	1.883 (0.468–7.565)	0.373
Occupation at initiation*					
Unemployed	158 (9.6)	Ref (1)		Ref (1)	
Housewife	260 (15.7)	0.939 (0.429–2.056)	0.875	0.906 (0.408–2.010)	0.807
Farmer	716 (43.3)	0.441 (0.210–0.929)	**0.031**	0.416 (0.196–0.885)	**0.023**
Business	160 (9.7)	0.539 (0.194–1.492)	0.234	0.534 (0.192–1.486)	0.229
Student	21 (1.3)	1.368 (0.283–6.601)	0.696	1.454 (0.294–7.199)	0.646
Civil servant	22 (1.3)	0.653 (0.086–5.306)	0.690	0.679 (0.081–5.680)	0.721
Employed in the private sector	70 (4.2)	0.205 (0.026–1.620)	0.133	0.206 (0.026–1.644)	0.136
Others	186 (11.2)	0.618 (0.243–1.574)	0.313	0.586 (0.228–1.509)	0.268

* Variables with missing values excluded.

Bold values indicate that the p-value is statistically significant.

Multivariate Logistic Regression Analysis of Behavioral and Clinical Factors Associated With Unsuppressed Viral Load

The multivariate logistic regression analysis of behavioural and clinical factors associated with unsuppressed viral load among individuals in the study showed that only the behaviour of informing partners of HIV status (crude odds ratio (OR): 0.557, 95% CI: 0.317–0.978, p = 0.042) and the clinical factor of being on 2 months dispensations (crude odds ratio (OR): 3.315, 95% CI: 1.338–8.215I, p = 0.010) had significant associations with unsuppressed viral load in the crude model. Individuals whose partners were informed of their HIV status at initiation were 44% less likely to develop unsuppressed viral load compared to those whose partners were not informed while individuals on 2-month dispensations were 3.3 times more likely to develop unsuppressed viral load compared to those on single month dispensations. However, when adjusted for age and sex, statistical significance was not reached in the adjusted model. All the other factors did not show any statistically significant association with viral load suppression in the crude as well as the adjusted models as presented in Table 4.

Table 4. Multivariate analysis of behavioural and clinical factors associated with unsuppressed viral load

Characteristics	Viral Load suppression (n=1654)	Crude OR (cOR) (95% CI)	p-value	Adjusted OR (aOR) (95% CI)	p-value
Whether Partner was informed of HIV status at initiation*					
No	917 (55.4)	Ref (1)		Ref (1)	
Yes	596 (36.0)	0.557 (0.317–0.978)	**0.042**	0.564 (0.298–1.066)	0.078
Whether Client shared HIV status with Family and/or friend. *					
No	804 (48.6)	Ref (1)		Ref (1)	
Yes	712 (43.0)	0.862 (0.526–1.412)	0.555	1.042 (0.594–1.829)	0.885
WHO HIV clinical stage at initiation*					
Stage 1	1439 (87.0)	Ref (1)		Ref (1)	
Stage 2	136 (8.2)	1.234 (0.553–2.754)	0.607	0.827 (0.357-1.919)	0.659
Stage 3	48 (2.9)	1.499 (0.454–4.950)	0.507	1.180 (0.342-4.074)	0.794
Stage 4	3 (0.2)	0.000 (0.000)	0.999	0.000 (0.000)	0.999
ART Regimen at initiation					
TDF/3TC/DTG	1195 (72.2)	Ref (1)		Ref (1)	
TDF/3TC/EFV	452 (27.3)	1.068 (0.636–1.793)	0.804	0.967 (0.519-1.800)	0.915
Others	7 (0.4)	0.000 (0.000)	0.999	0.000 (0.000)	0.999
Whether ARV was changed since initiation*					
Yes	1465 (88.6)	Ref (1)		Ref (1)	
No	175 (10.6)	0.236 (0.057–1.970)	0.426	0.426 (0.092-1.972)	0.275

HIV Care entry modality*					
Community-based testing	1101 (66.6)	0.680 (0.423–1.094)	0.112	0.642 (0.386-1.067)	0.088
Facility-based testing	553 (33.4)	Ref (1)		Ref (1)	
Health facility Volume					
TIER 1	800 (48.4)	0.600 (0.135–2.671)	0.503	0.705 (0.151-3.286)	0.656
TIER 2	594 (35.9)	2.121 (0.501–8.981)	0.307	2.217 (0.500-9.823)	0.294
TIER 3	200 (12.1)	1.950 (0.428–8.884)	0.388	1.698 (0.362-7.957)	0.502
TIER 4	60 (3.6)	Ref (1)		Ref (1)	
Multi-month dispensation status at 12-month post-ART initiation					
I month dispensation	311 (18.0)	Ref (1)		Ref (1)	
2 months dispensation	392 (22.7)	3.315 (1.338–8.215)	**0.010**	1.670 (0.6281-4.439)	0.304
Multi-months dispensations (3 – 6 months)	988 (57.)	2.201 (0.925–5.234)	0.074	1.852 (0.750-4.571)	0.181

* Variables with missing values excluded.

Abbreviations: TDF: Tenofovir, 3TC: Lamivudine, EFV: Efavirenz, AZT: Zidovudine, DTG: dolutegravir

Bold values indicate that the p-value is statistically significant.

Discussion

The Joint United Nations Program on HIV/AIDS (UNAIDS) set ambitious targets known as the 95-95-95 goals, aiming for 95% of PLHIV to know their status, 95% of those diagnosed to be on sustained ART, and 95% of those on ART to have viral suppression by 2030 [1]. This underscores the significance of viral load (VL) monitoring and suppression as crucial components of the HIV care continuum towards reaching the 95-95-95 targets. This study was meant to explore viral load suppression among adult HIV patients on ART in the rural areas of the Centre Region of Cameroon. In the present study, viral load coverage was approximately 66.3% at 12 months post-ART initiation. This finding is less than the national coverage of 71% obtained in 2021. This discrepancy, despite the progress made in ARV coverage in Cameroon could be due to the difference in the study settings and the long turnaround time observed in viral load results especially for facilities in rural settings which are usually far off from reference laboratories where viral load exams are processed. Moreover, the prevalence of viral suppression at 12 months among participants with documented viral load results was 95.8%. This prevalence is consistent with the third 95 of the Joint United Nations Program on HIV/AIDS (UNAIDS) ambitious targets [1] and shows the progress made towards reaching HIV epidemic control in the rural settings of Cameroon. This finding is also higher than the 80% VL suppression rate obtained in the CAMPHIA study that was carried out between July 2017 and February 2018 [9]. The VL suppression rate is also higher than the 93% obtained in 2022 [5]. This improvement in VL suppression rate could be due to the amelioration in the quality of HIV services offered to clients by trained Psychosocial Support Agents in the various facilities as well as the improvement in patient literacy through the U=U (undetectable = untransmissible)

messaging. Other studies in Africa have reported viral suppression rate of 82% among PLHIV in Botswana [12] and 80.7% among those in Uganda [13].

Relative to the socio-demographic factors influencing viral suppression, our study examined the influence of gender on viral load suppression, with female participants exhibiting a non-significant trend towards lower odds of unsuppressed viral load compared to males. This finding aligns with a global meta-analysis that reported comparable outcomes among men and women in terms of viral load suppression, presenting the need to consider broader determinants of treatment success [14]. Contrastingly, another study in rural Uganda found that women receiving antiretroviral treatment were more likely to achieve viral suppression compared to males after six months of ART [15]. The difference in findings could be related to the differences in the contexts, duration on ART and study populations. This shows the importance of individualized care irrespective of gender.

The impact of age on viral load suppression in our study revealed no significant associations across different age groups at initiation. This aligns with results from a comprehensive analysis across multiple countries in sub-Saharan Africa, suggesting that age as an isolated factor may not significantly predict the virological response to treatment [16]. However, studies in Cameroon have demonstrated that younger age groups may face unique challenges, such as disclosure-related issues and stigma, impacting adherence and treatment success [17]. This reiterates the need for nuanced interventions tailored to diverse age groups.

Also, residence, specifically the distance from the health facility, did not show a significant association with viral load suppression. Our results are consistent with other studies in Cameroon that found no conclusive evidence linking geographical proximity to improved treatment outcomes [18]. However, a global study on community-based antiretroviral therapy programs in sub-Saharan Africa emphasized the potential benefits of decentralizing services to overcome barriers to retention [19]. The lack of significance in our study may be attributed to the difference in socio-cultural context influencing health-seeking behaviours.

Marital status at initiation demonstrated varying impacts on viral load suppression. While married individuals (monogamous) showed non-significant lower odds of unsuppressed viral load, those categorized as widowed, divorced, or in a concubine relationship exhibited non-significant trends towards higher odds of unsuppressed viral loads. A study in Cameroon found similar trends [20], highlighting the need for tailored support mechanisms for individuals with diverse marital statuses. Moreover, our study did not find a significant association between education level and viral load suppression, aligning with global evidence that emphasizes the need for comprehensive adherence support irrespective of educational background [20, 21].

Occupation at initiation was a significant predictor of viral load suppression, with farmers exhibiting statistically significant lower odds of unsuppressed viral load compared to the unemployed. This result aligns with a study conducted in Cameroon [20] and in a similar African setting [22], highlighting the impact of occupation on treatment outcomes. The unique challenges faced by different occupational groups, such as work-related stressors or scheduling conflicts, may contribute to these disparities. Our findings highlight the importance of tailoring interventions to address the specific needs of distinct occupational categories.

Concerning the behavioral and clinical factors influencing viral suppression, we found that individuals whose partners were informed of their HIV status had statistically significant lower odds of unsuppressed viral load compared to those who did not disclose,

suggesting a consistent pattern across diverse settings [21]. The results of our study align with findings from Cameroon [20] and United Kingdom [22], emphasizing the crucial role of partner disclosure in achieving viral load suppression. This underscores the need for tailored interventions that promote open communication within relationships to enhance treatment outcomes. Contrary to expectations, sharing HIV status with family and/or friends did not show a significant association with viral load suppression. This finding contradicts studies carried out in Cameroon [22] and Tanzania [23] suggesting that a strong support network positively influences adherence and health outcomes. The discrepancy in findings could be due to variations in the context, quality and nature of support received, emphasizing the need for nuanced investigations into the role of social support in HIV care.

In contrast to some studies in Africa, our study did not find a significant association between WHO HIV clinical stage at initiation or the specific ART regimen and viral load suppression [17, 24]. Regional variations in treatment guidelines and regimen availability could contribute to these differences, highlighting the importance of context-specific considerations in developing HIV care policies and practices. The lack of a significant association between changing ARV since initiation and viral load suppression challenges previous findings suggesting that regimen changes may impact treatment outcomes [25]. Our results, however, align with a study in Cameroon that highlights the importance of individualized care, where treatment decisions are made based on patient response and potential side effects [18].

Patients who were diagnosed through community-based HIV testing strategies demonstrated a trend towards lower odds of unsuppressed viral load compared to those diagnosed through facility-based testing. Though we did not find any study that assesses this relationship, the lack of statistical significance emphasizes the need for further exploration. Moreover, health facility volume, categorized by Tiers, did not show a significant association with viral load suppression. This contradicts studies suggesting that higher volume facilities may offer more comprehensive services and better patient outcomes than smaller volume health facilities [26]. The variability in facility characteristics and patient populations across tiers may contribute to these non-significant findings. The association between multi-month dispensation and viral load suppression revealed interesting nuances. While individuals with 2 months dispensation exhibited higher odds of unsuppressed viral load in the crude model, this association was not maintained in the adjusted model. Similarly, individuals with multi-month dispensations (3–6 months) showed a trend towards higher odds of unsuppressed viral load in the crude model, which did not reach statistical significance in the adjusted model. These results challenge assumptions that longer dispensation intervals necessarily translate to improved adherence and viral suppression [27].

While this study has provided some insights into viral suppression and associated factors among HIV-infected adults on ART in the rural settings of Cameroon, some limitations in our study warrant consideration. Firstly, our study was a respective cohort study whose sample may not be fully representative of the broader population given the study's geographical and institutional constraints. Future research with larger, diverse samples and prospective designs could provide a more comprehensive understanding of the factors influencing viral load suppression in this setting.

Conclusion

In conclusion, our study carried out in the context of Cameroon aligns with some global evidence but also reveals unique nuances in the influence of socio-demographic, behavioral and clinical factors on viral load suppression.

While partner disclosure and occupation emerged as significant predictors, other factors may have nuanced effects that require further exploration. As HIV care continues to evolve, interventions tailored to individual needs and context-specific challenges should be prioritized to optimize treatment outcomes.

Conflict of Interest

The authors declare that they have no conflicts of interest in this study.

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