

Full Length Research Paper

CD4 T-Lymphocytes, adherence and sociodemographic factors associated with viral load outcome of people living with HIV (PLHIV) on antiretroviral therapy in Lagos State, Nigeria

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Received 29 August, 2024; Accepted 25 October, 2024

Globally, a significant number of people were living with HIV in 2022, with a substantial proportion receiving antiretroviral therapy (ART). Despite these advancements, HIV continues to pose a serious challenge to global health. Against this backdrop, this study evaluated CD4 T-lymphocytes, adherence, and sociodemographic factors associated with the current viral load outcome of People Living with HIV (PLHIV) on ART in Lagos State, Nigeria, supported by the USAID-funded project - Accelerating the control of HIV Epidemic in Nigeria, Cluster 6 (ACE-6). The study utilized a retrospective design to study 19,183 registered people living with HIV (PLHIV) receiving ART on the ACE 6 project in Lagos, Nigeria. The end-line data of the PLHIV formed the basis of the analysis using Binary Logistic Regression at a 5% significance level. The analysis was facilitated using SPSS version 23 software. The results showed an average age of 41.28 ± 20.07 while there was no significant association between multimonth dispensing (MMD) duration and viral load outcome among the patients ($\chi^2 = 7.583$, $df = 5$, $p = 0.181$). Socio-demographic factors like Apapa residence (OR: 1.511), Surulere (OR: 1.461), and Kosofe (OR: 1.573) were significantly associated with the last viral load suppression (VLS) Outcome. Primary level education (UOR: 0.000) and being employed (OR: 0.804) predicted (VLS). However, gender was not significantly associated with VLS. Patients who poorly adhered to ART (OR: 0.852) were significantly less likely to achieve viral suppression than those with good adherence. However, CD4 cell counts were not an independent predictor of viral load suppression. The study concludes that poor adherence to ART significantly reduces the likelihood of viral suppression among people living with HIV (PLHIV). At the same time, CD4 cell counts are not independent predictors of viral load suppression. Therefore, it is recommended to enhance adherence strategies to improve viral suppression outcomes among registered hospital-based HIV patients. Additionally, targeted interventions should consider socio-demographic factors such as residence and employment outcomes to further support viral load suppression efforts.

Key words: Viral load suppression, antiretroviral therapy (ART) adherence, CD4 cell counts.

INTRODUCTION

Globally, about 39 million people were living with HIV in 2022, with 29.8 million receiving antiretroviral therapy (ART), representing 76% of all People Living with HIV (PLHIV) (UNAIDS, 2023). Despite this progress, HIV remains a resurgent global health challenge. The high number of HIV-related deaths, totaling 630,000 in 2022, underscores the critical issue of late engagement in care and persistent structural barriers to service access (World Health Organization [WHO], 2024). Although HIV incidence and related deaths are declining, the pace is insufficient to meet the 2025 targets. New infections fell from 1.5 million in 2020 to 1.3 million in 2022, yet key populations continue to face disproportionately higher infection risks, highlighting the need for targeted prevention efforts (WHO, 2024). Furthermore, while 86% of people living with HIV knew their HIV status, and 71% had suppressed viral loads, testing volumes and positivity rates are significantly lower among men compared to women, indicating gender disparities in access to HIV services (Policy Fact Sheet, 2023).

Regionally, Africa bears a substantial burden of HIV, with 25.6 million people living with the virus in 2022. Despite 82% of these individuals receiving treatment and 76% achieving viral suppression, the continent faces significant challenges in controlling the epidemic (Policy Fact Sheet, 2023). Nigeria, which accounts for about 1.9 million PLHIV, exemplifies the regional struggle (UNAID-Global Report 2023). Although Nigeria has made progress in reducing its HIV burden and increasing treatment coverage, it remains the third highest globally in terms of HIV prevalence (Basse and Miteu, 2023; Ukaegbu et al., 2022). This underscores the need for a multi-pronged approach to effectively control the epidemic, addressing both social and structural determinants of health (WHO, 2024). Inadequate funding and limited access to prevention and treatment services for key populations further complicate efforts in Nigeria, highlighting the necessity for comprehensive strategies that include patient support, individualized care, and efforts to reduce socio-demographic disparities (Basse and Miteu, 2023).

Considering the aforementioned, the study was designed to evaluate the factors influencing viral load suppression among PLHIV in Lagos State on the USAID-funded ACE-6 project. Specifically, it examined the effect of multimonth dispensing (MMD) duration on the viral load outcome of PLHIV, examined socio-demographic factors as predictors of viral load outcome of PLHIV, explored the relationship between ART adherence and viral load outcome among PLHIV, and examined the influence of CD4 cell counts on viral load outcome among

PLHIV.

The study addressed the under-listed hypotheses namely H₀1: Longer MMD is not significantly associated with higher rates of viral suppression among PLHIV, H₀2: Socio-demographic factors do not significantly predict viral load outcome of PLHIV, H₀3: Higher adherence to ART was not significantly associated with increased likelihood of viral load suppression among PLHIV, and H₀4: Higher baseline CD4 cell counts have no significant influence on greater rates of viral load suppression among PLHIV.

MATERIALS AND METHODS

The research design was a retrospective one, which examines how an independent or a group of independent variables affect a dependent variable without manipulating the independent variables. The retention and audit determination tool (RADET), a structured database of PLHIV in the health facilities was extracted from the Lafiya management information system (LAMIS), an electronic management record system, and of the 40,388 patients currently on treatment, 19,183 patients (47%) with complete end-line data were considered for analysis. The consent to use and publish data was sought and approval was given. In terms of filter criteria, the patients with incomplete data set against the study variables were eliminated during the data cleaning exercise which eventually led to considering the following local government areas which are Agege, Ikorodu, Apapa, Surulere, and Kosofe. Chi-square tests and multiple logistic regression techniques were employed to explore relationships between the dependent and independent variables at a 0.05 level of significance, with data analysis conducted using SPSS version 23 software. The dependent variable was the last viral load outcome (LVLS), while the independent variables were MMD duration, socio-demographic factors (Local government area, gender, education, and occupation), ART adherence, and CD4 cell counts. The measurement of VLS and viral load un-suppression (VLU) used in this study were $\leq 1,000$ and $\geq 1,000$ copies. Nominally, MMD was classified into MMD (30 days), MMD (60 days), MMD (90 days), MMD (120 days), MMD (150 days) and MMD (180 days). Regarding ART adherence, it was measured as good and poor, while CD4 cell counts were grouped as low (< 200 cells), moderate (CD4 of 200 to 500 cell counts), and high (CD4 > 500 cells). The findings are based on the study's data analysis.

RESULTS

Table 1 shows the distribution of PLHIV across the sampled local government areas (LGAs) in Lagos State, revealing a spectrum of percentages. Notably, Ikorodu emerged as the area with the highest prevalence, constituting nearly two-fifths (7747, 40.4%) of HIV-⁺ positive cases, signifying a considerable concentration within this LGA. Conversely, Surulere exhibited a substantially lower rate, representing merely 744 (3.9%), depicting a considerably lesser prevalence in this area.

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Table 1. Geospatial location of HIV patients by local government areas.

Variable	Frequency (19,182)	Percentage
Agege	4235	22.1
Ikorodu	7747	40.4
Apapa	3329	17.4
Surulere	744	3.9
Kosofe	3127	16.3

Source: Authors' Computation Using SPSS version 23.

Table 2. Socio-demographic characteristics of HIV patients.

Variable	Frequency (19,182)	Percentage
Mean age: 41.28±20.07		
Gender		
Male	5680	29.6
Female	13502	70.4
Marital status		
Single	4865	25.4
Married	13323	69.4
Widowed	497	2.6
Separated	377	2.0
Divorced	120	0.6
Educational level		
No formal education	2229	11.6
Quranic	79	0.4
Primary education	34	0.2
Junior Secondary	630	3.3
Senior Secondary	11872	61.9
Post-secondary	4338	22.6
Occupation		
Student	1268	6.6
Unemployed	2090	10.9
Employed	15686	81.8
Freelance	9	0.0
Retired	129	0.7

Source: Authors' Computation Using SPSS Version 23.

Agege followed Ikorodu with a proportion of 4235 (22.1%), showcasing a notable presence of cases, albeit significantly lower. Similarly, Apapa and Kosofe manifested moderate percentages at 3329 (17.4%) and 3127 (16.3%), respectively, representing significant cohorts within their LGAs.

Table 2 shows that the mean age of HIV patients in Lagos State was 41.28 years, with a standard deviation of 20.07. Other socio-demographic characteristics of HIV patients in the State showcased a wide range of variables, including gender, marital status, educational

level, and occupation. The gender distribution revealed a significant majority of female patients, comprising 13,502 (70.4%) of the total, while male patients represented a smaller proportion at 5680 (29.6%). Regarding marital status, most PLHIV were married, accounting for 13,323 (69.4%) of the sample, followed by single individuals at 4865 (25.4%), widowed patients constituted 497 (2.6%), while separated and divorced patients represented 377 (2.0%) and 120 (0.6%), respectively. Educational attainment varied among PLHIV, with the majority having completed senior secondary education, at 11,872

Table 3. Distribution of HIV Patients by CD4 counts and multimonth dispensing duration

Variables	Frequency (19183)	Percentage
CCD4 cell counts		
Low CD4 (<200 cell counts)	7911	41.2
Moderate CD4 (200-500 cell counts)	8060	42.0
Low CD4 cell counts (>500 cell counts)	3211	16.7
ART adherence		
Good	16966	88.4
Poor	2216	11.6
Multimonth Dispensing Duration (MMD)		
MMD (30 days)	3786	19.7
MMD (60 days)	1205	6.3
MMD (90 days)	4451	23.2
MMD (120 days)	40	0.2
MMD (150 days)	25	0.1
MMD (180 days)	9675	50.4
Last viral load outcome		
Virally suppressed (<1000 ml ⁻¹)	17433	90.9
Virally unsuppressed (>1000 ml ⁻¹)	1749	9.1

Source: Authors' Computation Using SPSS version 23

(61.9%). Post-secondary education was attained by 4338 (22.6%) of patients, while 2229 (11.6%) had no formal education. Only a minority had Quranic education, 79 (0.4%), primary education, 34 (0.2%), or junior secondary, 630 (3.3%).

Occupationally, most PLHIV were employed, representing 15,686 (81.8%) of the total. Unemployed patients accounted for 2090 (10.9%), while students and retired individuals represented 1268 (6.6%) and 129 (0.7%), respectively. These socio-demographic characteristics provide insights into the diverse profiles of HIV patients, highlighting the predominance of female patients, the prevalence of married individuals, and the distribution across educational and occupational categories.

Table 3 shows an overview of the distribution of patients based on their CD4 T-lymphocyte cell counts, ART adherence, MMD, and last viral load outcome. Regarding CD4 cell counts, most PLHIV fell within the moderate range, with 8,074 (42.0%) having CD4 counts between 200 and 500 cells. A significant portion of patients, 7,829 (41.2%), had low CD4 counts, defined as less than 200 cells, indicating advanced HIV infection. Meanwhile, 3,173 (16.7%) of patients had high CD4 cell counts, exceeding 500 cells, suggesting a healthier immune status.

In terms of ART adherence, 16,939 (88.4%) of patients were classified as having good adherence, while 2,249 (11.6%) were grouped as having poor adherence.

Regarding MMD, many PLHIV, 9,665 (50.4%), were on a 180-day dispensing schedule, indicating a longer-term medication supply. A smaller proportion, 4,449 (23.2%), were on a 90-day dispensing schedule. Patients on a 30-day schedule constituted 3,756 (19.7%), while those on a 60-day schedule made up 1,198 (6.3%). The smallest proportions were on 120-day, 39 (0.2%), and 150-day, 19 (0.1%), schedules, indicating very limited use of these durations.

Meanwhile, most PLHIV, 17,441 (90.9%), were virally suppressed, with viral loads below 1000 ml⁻¹, indicating effective ART and adherence. However, a minority of patients, 1,745 (9.1%), had virally unsuppressed outcomes, with viral loads above 1000 ml⁻¹, indicating potential treatment challenges or resistance. These findings highlight the distribution of CD4 counts, ART adherence, and MMD among PLHIV in the state, with a notable prevalence of virally suppressed patients.

The cross-tabulation of ART adherence and the last viral load outcome shown in Table 4 provides valuable insights into the relationship between adherence to antiretroviral therapy (ART) and viral load suppression among HIV patients. The results revealed that most PLHIV (90.9% of the total sample) were classified as virally suppressed (VS), with viral loads below the threshold of 1000 ml⁻¹, indicating effective ART adherence and successful suppression of viral replication.

Among those with good ART adherence, 80.3% of the total sample was virally suppressed (VS), while only 8.2%

Table 4: ART Adherence and the last viral load outcome crosstabulation.

Variable	Last Viral Load Outcome		Total (n=19183; %=100)	Pearson Chi-square	
	VS (n=19183; %=100)	VU (n=19183; %=100)			
ART Adherence	Good	Count	15402	1564	Value=1.791 ^a ; df=1; Asymp. Sig. (2-sided) = 0. 097
		% of Total	80.3	8.2	
	Poor	Count	2031	185	
		% of Total	10.6	1.0	
Total	Count	17433	1749	19182	
	% of Total	90.9	9.1	100.0	

Source: Authors' Computation Using SPSS Version 23.

were virally unsuppressed. This underscores the critical role of adherence to ART in achieving viral load suppression and maintaining the health of HIV patients. On the other hand, patients with poor ART adherence accounted for 10.6% of the total sample, with 1.0% being virally unsuppressed. However, the Pearson Chi-square test result ($\chi^2 = 1.791$, $df = 1$, $p = 0.097$) indicated that there was no statistically significant association between ART adherence and viral load outcome. This suggests that while there is a clear trend showing better viral suppression with good ART adherence, the observed differences in viral load outcome between patients with good and poor adherence were not statistically significant.

Among the total sample shown in Table 5, 95.2% (n=18,149) of patients were virally suppressed. Within the low CD4 group, 37.5% were virally suppressed, and 3.7% were virally unsuppressed. In the moderate CD4 group, 38.2% were virally suppressed, and 3.8% were virally unsuppressed. In the high CD4 group, 15.2% were virally suppressed, and 1.6% were virally unsuppressed. The Pearson Chi-square

test indicated no significant association between CD4 groups and viral load outcome ($\chi^2 = 0.335$, $df = 2$, $p = 0.846$). Although most PLHIV were virally suppressed regardless of baseline CD4 cell counts, there were no statistically significant differences in viral load outcome across different CD4 groups. These findings suggest that factors other than CD4 counts may influence viral load suppression in this population.

The examination of MMD duration in relation to the last viral load outcome among HIV patients revealed interesting insights shown in Table 6. Among patients on a 30-day MMD, 3,418 (17.8%) were virally suppressed, while 368 (1.9%) were virally unsuppressed. For those on a 60-day MMD, 1,080 (5.6%) were virally suppressed, with 125 (0.7%) being virally unsuppressed. Patients on a 90-day MMD showed 4,077 (21.3%) viral suppression and 374 (1.9%) viral un-suppression. For the longer MMD durations, among patients on a 120-day MMD, 35 (0.2%) were virally suppressed and 5 (0.0%) were virally (0.1%) virally suppressed while a significantly higher proportion of patients on a 180-day MMD, 8,801 (45.9%), were virally suppressed, with 874 (4.6%)

being virally unsuppressed. However, the Pearson Chi-square test indicated no significant association between MMD duration and viral load outcome among the patients ($\chi^2 = 7.583$, $df = 5$, $p = 0.181$). This suggests that the duration of MMD, whether 30, 60, 90, 120, 150, or 180 days, did not significantly influence viral load suppression among HIV patients in this population. It can be deduced that while extended medication dispensing intervals can improve adherence and reduce healthcare visits, they do not necessarily result in statistically significant differences in clinical outcomes such as viral load suppression. Fewer pharmacy visits can enhance medication adherence, which might explain the higher proportion of viral suppression among patients on the 180-day MMD. Nonetheless, this study's results indicated that such benefits, although noticeable, were not statistically significant in this population. This implies that viral load suppression is multifaceted, involving not only medication adherence but also factors such as the individual's immune response, the presence of comorbid conditions, and the quality of healthcare support. For instance, patients who receive regular

Table 5. Group baseline CD4 cell counts and the last viral load outcome cross-tabulations.

Variable			Last Viral Load Outcome		Total	Pearson Chi-square
			VS (n=19183; %=100)	VU (n=19183; %=100)		
	Low CD4 (< 200 cell counts)	Count	7199	712	7911	Value=.335 ^a ; df=2; Asymp. Sig. (2-sided) =0. 846
		% of Total	37.5	3.7	41.2	
Baseline CD4 cell counts	Moderate CD4 (200-500 cell counts)	Count	7323	737	8060	
		% of Total	38.2	3.8	42.0	
	High CD4 cell counts (> 500 cell counts)	Count	2911	300	3211	
		% of Total	15.2	1.6	16.7	
Total		Count	17433	1749	19182	
		% of Total	90.9	9.1	100.0	

Source: Authors' Computation Using SPSS version 23

Table 6. Multimonth dispensing duration and the last viral load outcome crosstabulations.

Variable			Last Viral Load Outcome		Total	Pearson Chi-square
			VS (n=19183; %=100)	VU (n=19183; %=100)		
	MMD (30 days)	Count	3418	368	3786	Value=7.583 ^a ; df=5; Asymp. Sig. (2-sided) =0.181
		% of Total	17.8	1.9	19.7	
	MMD (60 days)	Count	1080	125	1205	
		% of Total	5.6	0.7	6.3	
Multimonth Dispensing Duration	MMD (90 days)	Count	4077	374	4451	
		% of Total	21.3	1.9	23.2	
	MMD (120 days)	Count	35	5	40	
		% of Total	0.2	0.0	0.2	
	MMD (150 days)	Count	22	3	25	
		% of Total	0.1	0.0	0.1	
	MMD (180 days)	Count	8801	874	9675	
		% of Total	45.9	4.6	50.4	
Total		Count	17433	1749	19182	
		% of Total	90.9	9.1	100.0	

Source: Authors' Computation Using SPSS version 23

Table 7. Socio-demographic and related factors associated with the last viral load outcome.

Demographic variables	Variable categories	Unadj. OR [95%]	[CI for Exp(B)]	Adj. OR [95%]	[CI for Exp (B)]
LGAs	Agege (RC)	1.000		1.000	
	Ikorodu	0.972	[0.845-1.119]	0.989	[0.857-1.143]
	Apapa	1.511**	[1.294-1.764]	1.497**	[1.280-1.750]
	Surulere	1.461**	[1.132-1.886]	1.493**	[1.154-1.931]
	Kosofe	1.573**	[1.346-1.839]	1.638**	[1.391-1.927]
Gender	Male (RC)	1.000	1.000	1.000	
	Female	0.944	[0.849-1.051]	0.974	[0.875-1.084]
Education	No Educ. (RC)	1.000	-	1.000	-
	Quranic	0.875	[.398-1.924]	1.112	[0.503-2.457]
	Primary Edu	0.000	[0.000-0]	0.000	[0.000-0]
	Junior Secondary	0.860	[0.632-1.172]	0.952	[0.697-1.301]
	Senior Secondary	0.9120	[.784-1.062]	1.075	[0.916-1.260]
	Post-secondary	0.841*	[0.707-1.002]	0.988	[0.825-1.184]
Occupation	Student (RC)	1.000	-	1.000	-
	Unemployed	0.989	[0.789-1.240]	0.973	[0.775-1.221]
	Employed	0.804*	[0.668-0.969]	0.813*	[0.674-0.980]
	Freelancer	0.000	[0.000-0]	0.000	[0.000-0]
	Retired	0.624	[0.310-1.258]	0.608	[0.301-1.228]
ART Adherence	Good (RC)	1.000		1.000	
	Poor	0.897	[0.765-1.052]	0.852*	[0.724-1.003]
CD4 Cell Counts	Low CD4 < 200 cells (RC)	1.000		1.000	
	Moderate CD4 of 200-500 cell	1.018	[0.913-1.134]	1.029	[0.923-1.147]
	High CD4 > 500 cells	1.042	[0.904-1.201]	1.036	[0.898-1.195]

RC=Reference category; Dependent variable=last viral load outcome
 Source: Authors' Computation Using SPSS version 23

counseling and support may be more likely to adhere to their medication regimen, regardless of the dispensing interval.

Table 7 shows the results of a logistic regression analysis examining the predictive influences of socio-demographic factors on the last viral load outcome of the patients in the State. The results

revealed that individuals residing in Apapa (OR: 1.511), Surulere (OR: 1.461), and Kosofe (OR: 1.573) are significantly more likely to experience virally suppressed outcomes compared to those in Agege. Even after adjusting for other factors, these disparities persist, reinforcing the influence of location on the viral load outcome. Interestingly,

gender does not emerge as a significant predictor post-adjustment (OR: 0.944), suggesting that once other variables are considered, gender might not play a substantial role in determining the outcome.

Regarding education, individuals with primary education exhibited a significantly lower likelihood

of the outcome than those with no education (UOR: 0.000), indicating a potentially protective effect of primary education. However, the significance diminishes for other education categories after adjustment, implying that factors beyond education may contribute more prominently to the current viral load outcome. Employment outcome showcases notable associations, particularly for employed individuals (OR: 0.804), who demonstrate significantly lower likelihoods of the outcome compared to students, even after adjustment, reinforcing the impact of employment on the current viral load outcome. Interestingly, although the Chi-square test result was not significant, the logistic regression analysis revealed that patients with poor adherence to ART had a significantly lower likelihood of being virally suppressed (OR: 0.852) compared to those with good adherence. This association persisted after adjustment, suggesting potentially complex relationships between ART adherence and viral load outcomes. Meanwhile, CD4 cell counts do not yield significant differences in the likelihood of the outcome across categories (low CD4: OR: 1.018; moderate CD4: OR: 1.029; high CD4: OR: 1.036), indicating that CD4 cell count may not independently predict the outcome once other variables are considered.

DISCUSSION

Regarding the impact of MMD duration on HIV patients' viral load outcome, the study found no significant association between MMD duration and viral load suppression. This aligns with previous research, such as Semo et al. (2023) and Lopes (2021), who found no significant differences in viral suppression rates between MMD and non-MMD regimens despite slightly higher undetectable viral load levels among patients on MMD. Similarly, Mugo et al. (2023) found no differences in undetectable viral load between MMD and non-MMD regimens, though adherence and support were crucial factors for viral suppression. However, some studies present contrasting findings; for instance, Oyuga et al. (2022) reported that children receiving 3-month MMD in Kenya were more likely to be retained and virally suppressed than those not on MMD, suggesting that certain populations may benefit more from MMD in terms of viral suppression. Belete et al. (2024) highlighted that factors like baseline viral load and recurring opportunistic infections significantly influence viral suppression, indicating that individual health conditions and adherence support are critical. While the study found no significant link between MMD duration and viral load suppression, the broader literature suggests that effective viral load suppression is multifaceted, requiring comprehensive patient support, individualized care, and consideration of specific population needs. Therefore, while extended MMD intervals may enhance adherence and reduce healthcare visits, they do not necessarily lead to

significant differences in clinical outcomes like viral load suppression, underscoring the importance of a holistic approach to HIV care that goes beyond medication dispensing schedules.

A logistic regression analysis reveals that individuals in Apapa, Surulere, and Kosofe are more likely to experience virally suppressed outcomes compared to those in Agege, even after adjusting for other factors, suggesting significant geographical disparities in viral suppression. Gender does not emerge as a significant predictor post-adjustment, indicating it might not play a substantial role in determining viral suppression outcomes. Primary education has a potentially protective effect on viral load outcome, but its significance diminishes for other education categories after adjustment. Employment outcome shows significant associations, with employed individuals, including freelancers, demonstrating a lower likelihood of viral suppression compared to students. These findings underscore the impact of socio-demographic factors on viral load outcomes among patients. Tomescu et al. (2023) identified similar socio-demographic predictors of non-suppressed viral load among people living with HIV on ART in Nigeria, such as males, younger age, and shorter treatment duration. Agegn et al. (2023) found predictors of viral load outcome in Ethiopia to include age, weight, baseline CD4 count, education level, rural residence, employment outcome, adherence, and disease disclosure. Similarly, Hakizayezu et al. (2022) highlighted that males were linked to higher viral load non-suppression in Rwanda. Plymoth et al. (2020) associated geographic work mobility and lower relative wealth with a lack of virological suppression among Ethiopian ART recipients. Ebua et al. (2023) in Cameroon identified predictors such as marital outcome, occupation as well as clinic distance. Ngandu et al. (2022) noted that being married or cohabiting was a significant factor for maternal viral load non-suppression in South Africa. These studies collectively highlighted the multifaceted nature of viral load suppression, influenced by socio-demographic factors.

The finding that PLHIV with poor adherence to ART exhibited a significantly lower likelihood of viral suppression in this current study aligns with existing literature, which consistently emphasizes the critical role of adherence in achieving viral suppression. This means that patients who poorly adhered to ART were significantly less likely to achieve viral suppression compared to those who adhered well, even after accounting for other factors. The implication is that it suggests a more complex relationship between ART adherence and viral load than initially apparent. Ogbaji et al. (2023) confirmed lower suppression rates among patients with poor adherence, while Wakooko et al. (2020) in Uganda also found that adherence was the sole significant predictor of viral load suppression, with even fair adherence leading to better outcomes than good adherence. However, Kapiamba et

al. (2016) in South Africa did not find a significant relationship between adherence and suppression using pharmacy refill records, suggesting limitations in adherence monitoring methods. Other studies, such as those by Bvochora et al. (2019), Waju et al. (2021), Mboggo et al. (2024), and Desta et al. (2020), further corroborate that poor adherence was a key predictor of viral non-suppression, reinforcing the multifaceted importance of maintaining high adherence levels to ART across different populations and settings.

Moreover, CD4 cell counts did not yield significant differences in the likelihood of viral load suppression. Previous study findings were mixed findings in the literature. Ogbaji et al. (2023) found that higher baseline CD4 counts significantly increased the probability of viral suppression, emphasizing its importance. Similarly, Miller et al. (1999) and Hunt et al. (2003) identified CD4 count as a critical predictor of viral rebound and T-cell restoration in long-term viral suppression, respectively. However, Phillips et al. (2001) showed that while patients with lower baseline CD4 counts initially had a lower tendency to achieve viral suppression, long-term suppression rates were comparable regardless of initial CD4 count. This suggests that CD4 count may not independently predict long-term viral suppression. Additionally, Muhie (2024) and Atnafu et al. (2022) noted that higher CD4 counts were among the significant predictors of viral suppression. Contrarily, Haas et al. (2020) and Hussen et al. (2019) identified other factors such as adherence and baseline viral load as more critical in predicting viral suppression. Thus, while CD4 count is a significant factor in some contexts, its independent predictive value for viral suppression may be limited when considering the broader spectrum of influencing variables.

Conclusion

The study concluded that CD4 cell counts did not significantly predict viral load suppression among PLHIV on ART in Lagos State once other factors were considered. However, socio-demographic factors such as geographical location, education, and employment status significantly impacted viral load outcomes. Notably, poor adherence to ART emerged as a critical predictor of viral non-suppression, underscoring the complex interplay between adherence and viral load outcomes. These findings suggest that while CD4 cell count remains an important clinical measure, the broader socio-demographic context and adherence behaviors play crucial roles in determining viral suppression among patients.

RECOMMENDATIONS

Based on these findings, it is recommended that

interventions focus on enhancing ART adherence through comprehensive support systems, including regular counseling and patient education to address barriers to adherence. Tailored strategies should consider socio-demographic disparities by providing targeted support in areas with lower viral suppression rates and offering employment-related assistance to improve patients' overall socio-economic stability. Additionally, improving access to healthcare services and continuous monitoring of viral load, especially in high-risk populations, can help address the multifaceted challenges of viral suppression. Health programs should also incorporate community-based approaches to ensure inclusive and equitable care for all patients, regardless of their socio-demographic background.

CONFLICT OF INTERESTS

The authors have not declared any conflict of interests.

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