



# Viral Load Suppression and Associated Factors Among High Viral Load Antiretroviral Treatment Client at Public Health Facilities of Nekemte Town, Nekemte, Ethiopia, 2020

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**Abstract:** Purpose: A key goal of anti-retro viral treatment is to achieve and maintain durable viral load suppression. Viral load is the concentration of HIV RNA in the blood. Viral load suppressed clients have low HIV transmission to sexual partner and important in HIV/AIDS epidemic control. Challenges in providing rapid and comprehensive care to patient with high viral load lead to poor or limited response among PLHIV with viremia. Viral load suppression at different Africa countries is low when compared to globally given target. Person with high viral load have recurrent opportunistic infection and higher transmission of HIV/AIDS. So the aim of this study to assess viral load suppression and associated factors among high viral load ART clients at public health facilities of Nekemte town. Patient and Methods: an institutional based cross sectional study was conducted among 418 proportionally selected high viral load ART clients (VL  $\geq$  1000copies/ml) from July 3, 2017 to September 26, 2019. Study participants were selected through simple random sampling technique. The association between dependent and independent variable was tested by binary logistic regression and those candidate with P value  $<$  0.2 was selected and multiple binary logistic regression was conducted to identify the independent predictors of viral load suppression and AOR with its 95% CI and value of P  $<$  0.05 was declared as statistical significance. Result: Of 418 high viral loads ART clients, 64% had suppressed viral load result. The probability of viral load suppression was higher among 1<sup>st</sup> line ARV regimen (AOR=3.86, 95% CI: 1.04-3.11), annual viral load test (AOR=6.1, 95 CI: 3.4-10.6), and CD4 count  $\geq$  200 (AOR=3.64, 95% CI: 1.98-6.7). The probability of viral load suppression was lower among clients with history of hospitalization (AOR=0.43, 95% CI: 0.21-0.89) and receiving CPT (AOR=0.56, 95% CI: 0.32-0.97). Conclusion: This study showed that viral load suppression was near to the WHO target (70%). Clients with CD4 cell count  $\geq$  200, discontinued CPT, 1<sup>st</sup> line ARV regimen, annual viral load test had higher probability of viral load suppression while clients with bedridden functional status and history of hospitalization had lower probability of viral load suppression. Clients on 2<sup>nd</sup> line had low viral load suppression as compared to 1<sup>st</sup> line and enhanced adherence counseling had no association in viral load suppression which need further research.

**Keywords:** Enhance Adherence Counseling, Viral Load, High Viral Load, Viral Load Suppression, Nekemte Town, Ethiopia

## 1. Introduction

The concentration of HIV Ribonucleic acid in the blood, referred to as “viral load”, is a valuable indicator of a patient’s response to antiretroviral therapy and risk for clinical

progression. Viral load is a more sensitive and reliable means of determining treatment failure compared to clinical and/or immunological criteria [1]. WHO recommends that, if the viral load is high, Enhance adherence counseling to be carried out [2]. Enhanced adherence support intervention put

in place to support patients with a high viral load with the aim of viral load suppression [3]. Most high viral load test results are due to adherence issues, and much research had shown that adherence interventions can significantly improve viral load suppression [2]. Despite major progress in HIV epidemic control to pose serious public health treat in all region coverage of service is inadequate and rate of expansion is too slow to achieve global target [4] and national program on introduction of target viral load testing in 2010 for suspected case to confirm treatment failure, delay detection of treatment failure this leads to HIV drug resistance [5]. In December 2013, the UNAIDS program a new narrative on HIV treatment and a new, ambitious, but achievable target given held in all regions of the world. By 2020, 90% of all people receiving antiretroviral therapy will have viral suppression [6].

Identifying and managing treatment failure are a basic challenge for national treatment program. Sustainable treatment failure is related to difficulty to delivering quality care, the emergence of drug resistant viruses which limits the treatment option and increases the threat of morbidity and mortality [7]. Barrier to realizing this goal is poor or limited responses among PLHIV with viremia [8]. The consequence of high viral load is risk of recurrent Opportunistic Infections and increase morbidity and mortality, increased risk of transmission of infection, poor prevention and control of the epidemic, risk of resistance to ART and need to change to more expensive regimens [9]. In East Shewa Zone, Ethiopia it was shown that only 72% of people on treatment having suppressed viral load [10]. This finding showed gap in viral load suppression after ART treatment as compared to global target given 90% [6]. Different African country including Ethiopia study showed that low viral load suppression as compared to target given (90%) by UNAIDS and low viral load suppression after EAC. Viral load suppressed clients have low transmission of HIV to sexual partner and lead to HIV/AIDS epidemic control. The finding of this study also provided relevant information in planning and interventions of appropriate strategies and contributed as one source for those who interested in carrying out further research.

## 2. Methods

### 2.1. Study Setting

Nekemte town is located in East Wollega Zone of Oromia region; 331 Km from West of Addis Abeba. There are four health facility at Nekemte town, those are Nekemte specialized hospital, Wollega university referral hospital, Nekemte health center and Cheleleki health center. The study was conducted at public health facility of Nekemte town from March 30, 2020 to April 20, 2020.

### 2.2. Study Design

Institutional based cross sectional study.

### 2.3. Source and Study Population

All HIV infected people with high viral load ( $VL \geq$

1000copies/ml) result after 6 month on ART between July 3, 2017 to September 26, 2019 at public health facility of Nekemte town consider as source population and selected high viral load ART clients at public health facility of Nekemte town which fulfill inclusion criteria consider us study population.

### 2.4. Inclusion and Exclusion Criteria

All HIV infected people with documented viral load result ( $VL \geq 1000$  copies/ml) with complete information included and transfer of patients from other health facility and incomplete charts or records was excluded.

### 2.5. Sample Size and Sampling Procedure

The sample size was calculated by using single population proportion formulas and by considering a study done at Harare, Zimbabwe, 45.2% had viral load suppression with 95% CI and p-value=0.05 [11]. The final sample size including non-response rate of 10% was 418. All four public health facilities were included in the study and the total sample size was allocated proportionally among each health facilities based on the number of patients with a viral load count of greater than 1000 copies/ml. The study participants were selected through simple random sampling technique from a high viral load registration book.

### 2.6. Data Collection Tools and Procedure

Data extraction tool adapted by reviewing difference literature. The data extraction tool was prepared in English and not needed any translation. Medical record and registers of those high viral loads ART patients at public health facility of Nekemte town was used as a source of data. Six BSc degree nurses as data collectors and two ART data managers as supervisor were participated in the data collection process. Those population of interest (HVL ART clients) are Searched from smart care, ART register, VL log book and EAC register. The data was collected by reviewing clients chart. When there was incomplete data, the data collectors have tried to get from different data sources (high viral load register and smart care).

### 2.7. Data Quality Management

Data quality was assured through designing a proper data collection materials, training was given for data collectors before data extraction started and pretest was done. The overall activities were controlled by the principal investigator of the study. The necessary modifications and corrections were made on the checklist before administered into the study area.

### 2.8. Data Management and Analysis

The collected data was sorted, coded and entered to SPSS version 20.0 for cleaning and data analysis. Frequencies and summary statistics were used to describe the study population in relation to socio-demographic and other relevant variables. To see the multi col linearity effect variance inflation factor is used.

Bi variable analysis was conducted to select candidate variable for multi variable analysis. Variables with  $p \leq 0.20$  in bi variable analysis were considered as candidates for multivariate logistic regression. A value of  $p < 0.05$  was declared as statistical significance.

### 2.9. Ethical Consideration

To conduct this research ethical approval was secured from Wollega University Research Ethics Review Committee (WURERC). In addition, letter of support from Nekemte town health office was taken before commencing the data collection process. Even though most of the data were collected from the patient chart and follow-up card, the recorded data were not

accessed by a third person except by the investigators in order to kept confidentiality.

## 3. Result

### 3.1. Socio- Demographic Characteristics

A total of 418 high viral load clients were included in the study, of which 55.7% are females. The mean age groups of the study population were  $29 \pm 12$ SD. Majority of the high viral load ART clients or 83.3% were age greater than or equal to 15 years. Secondary education covered 18.7%, married clients covered 48.1%. See Table 1.

**Table 1.** Socio- Demographic status of high viral load ART clients of public health facilities of Nekemte town from July 3, 2017 to september26, 2019.

Characteristics		Frequency	Percent
Sex of the clients	Male	185	44.3
	Female	233	55.7
Age of high viral load	Age < 15 year	70	16.7
	Age $\geq$ 15 years	348	83.3
Religion of the clients	Protestant	164	39.2
	Orthodox	140	33.5
	Muslim	43	10.3
Educational status	Other	71	17
	No formal education	74	17.7
	Primary (1-8)	149	35.6
	Secondary (9-10)	78	18.7
Marital status	More than secondary	34	8.1
	Other	83	19.9
	Never married	36	8.6
	Married	201	48.1
Past opportunistic illness	Divorced/Separated	45	10.8
	Widowed	42	10.0
	Other	94	22.5
EAC session 1	Yes	85	20.3
	No	333	79.7
EAC session 3	Yes	287	68.7
	No	131	31.3
Viral load suppression	Yes	281	67.2
	No	137	32.8
Therapeutic regimen during HVL	Yes	267	63.9
	No	151	36.1
Reason for viral load sent	1 <sup>st</sup> line	398	95.2
	2 <sup>nd</sup> line	20	4.8
Therapeutic regimen during HVL	Initial	213	51.0
	Annual	205	49
Therapeutic regimen during HVL	1 <sup>st</sup> line	398	95.2
	2 <sup>nd</sup> line	20	4.8

### 3.2. Clinical and Social Characteristics

From those high viral loads ART clients only 20% had past opportunistic illness. Minimum base line weight was 7kg while maximum baseline weight was 65kg. Minimum baseline CD4 was 3 and maximum baseline CD4 was 1500. Half of initiated ART with eligible criteria of  $CD4 < 200$  copies/ml. Functional status of working and appropriate covered 82% during initiating ART. During ART initiation

Efavirenz and Nevirapin based ARV regimen covered 46% and 44% respectively. First line therapeutic regimen covered 95% of high viral load ART clients. Forty four percent (44%) of high viral load ART clients of ARV dose are taken once per day, 62% of high viral load ART clients received CPT during initial high viral load time and 39.5% of those high viral load clients initial viral load result was  $< 5000$  copies/ml. Minimum month on ART during high viral load was 6 and maximum month on ART was 155 with mean

month on ART of 73±37. Half of high viral load reason for viral load sent was initial. From total high viral load ART clients 287 (68.7%) have received Enhance adherence counseling once and 282 (67.2%) completed Enhance adherence counseling. From 2<sup>nd</sup> viral load sent 56.5%

suppressed, from 3<sup>rd</sup> viral load sent 30% suppressed while from 4<sup>th</sup> viral load sent 50% are suppressed. From total high viral load 267 (64%) were viral load suppressed result. From those not suppressed only 74% shifted to 2<sup>nd</sup> or 3<sup>rd</sup> line ARV drug. See Table 2.

**Table 2.** Bi variable analysis of high viral load ART clients at public health facilities of Nekemte town from July 3, 2017 to September 26, 2019.

Characteristics		viral load suppressed		COR	P-value
		Yes=N (%)	No=N (%)		
History of hospitalization	Yes	28 (48.3)	30 (51.7%)	1	0.009
	No	239 (66.4%)	121 (33.6%)	2.116 (1.21, 3.703)	
How many ARV dose do you take per day	Once	130 (70.7%)	54 (29.3%)	1.7 (1.13, 2.6)	0.011
	Twice	137 (58.5%)	97 (41.5%)	1	
CPT status	Receiving	148 (57.1%)	111 (42.9%)	1	0
	Discontinued	119 (74.8%)	40 (25.2%)	2.2 (1.4, 3.4)	
Therapeutic regimen during HVL result	1 <sup>st</sup> line	259 (65.1%)	139 (34.9%)	2.8 (1.1, 7)	0.023
	2 <sup>nd</sup> line	8 (40%)	12 (60%)	1	
Reason for VL test	Initial	103 (48.4%)	110 (51.6%)	1	0
	Annual	164 (80.2%)	41 (19.8%)	4.3 (2.8, 6.7)	
Age for two group	Age < 15	36 (51.4%)	34 (48.6%)	1	0.019
	Age ≥ 15	231 (66.4%)	117 (33.6%)	1.86 (1.1, 3.1)	
Base line cd4	Cd4 < 200	112 (58.6%)	79 (41.4%)	1	0.049
	Cd4 ≥ 200	155 (68.3%)	72 (31.7%)	1.5 (1.001, 2.233)	
ARV regimen type during high viral type	Efavirenz, DTG	74 (31.8%)	159 (68.2%)	1.53 (1.0, 2.3)	0.038
	Nevirapin based	77 (41.6%)	108 (58.4%)	1	
Cd4 count during high viral load time	Cd4 < 200	35 (36.8%)	60 (63.2%)	1	0
	Cd4 ≥ 200	232 (71.8%)	91 (28.2%)	4.4 (2.7, 7.1)	
Enhance adherence counselling session 3	Yes	170 (60.5%)	111 (39.5%)	1	0.04
	No	97 (70.8%)	40 (29.2%)	1.58 (1.02, 2.4)	
Initial VL result	VL < 5000	118 (71.5%)	47 (28.5%)	1.7 (1.1, 2.7)	0.009
	VL ≥ 5000	149 (58.9%)	104 (41.1%)	1	

### 3.3. Viral load Suppression Status of High Viral Load ART Clients

Viral load suppression at public health facilities of Nekemte town showed that 64% those high viral loads ART clients suppressed after follow up, of which 61% suppressed with Enhance adherence counseling while 71% suppressed without Enhance adherence counseling. clients that are on ART ≥ 12 month on ART of high viral load clients have 65.2% viral load suppression as compared to < 12 month on ART that was 33.3% only suppressed their viral load result. Viral load suppression on high viral load of age greater than or equal to 15 year was 66.4% while age less than 15 years was 51.4% of those high viral load clients have viral load suppression test result after follow up.

### 3.4. A bi Variable Analysis Results of Patient Characteristics with Viral Load Suppression

Baseline BMI ≥ 18.5kg/m<sup>2</sup>, once per day ARV dose taking, clients that not taking CPT during high viral load, therapeutic regimen of 1<sup>st</sup> line, ARV regimen of EFV based and DTG based, month on ART ≥ 12 month, CD4 cell count ≥ 200 during initial high viral load result, annual viral load test done and viral load result < 5000 copies/ml were significantly association with viral load suppression. See Table 2.

### 3.5. Factor Predicting the Achievement of Viral Load Suppression of High Viral Load ART Clients

Histories of hospitalization of high viral load ART clients are associated with viral load suppression. Those high viral load ART clients history of hospitalized are lower probability of viral load suppression as compared to high viral load clients that not hospitalized with (AOR=0.428, 95% CI: 0.21-0.89). clients that did receiving Cotrimoxazole preventive therapy are association with viral load suppression. clients that did receiving Cotrimoxazole preventive therapy are lower probability of viral load as compared to high viral load clients that not receiving Cotrimoxazole preventive therapy (AOR=0.56, 95% CI: 0.32- 0.97). Therapeutic regimens of 1<sup>st</sup> line were associated with viral load suppression which was 3.9 times more likely to suppress viral load as compared to 2<sup>nd</sup> line high viral load clients (AOR=3.86, 95% CI: 1.066-13.99). CD4 cell count ≥ 200 during high viral load time was associated with viral load suppression which was 3.6 times more likely to suppress their viral load as compared to CD4 cell count < 200 of high viral load clients (AOR=3.64, 95% of CI: 1.98- 6.7). Annual viral load test was associated with viral load suppression which was six times more likely to suppress their viral load suppression as compared to initial viral load (AOR=6.1, 95% CI: 3.4, 10.6). See Table 3.

**Table 3.** Multi variable analysis of high viral load ART clients at public health facilities of Nekemte town from July 3, 2017 to September 26, 2019.

Characteristics	VL suppression		P-Value	AOR 95% CI
	Yes=N (%)	No=N (%)		
Occupation of clients				
Farmer	5 (71.4%)	2 (28.6%)	0.694	1.4 (0.22-9.5)
Housewife	13 (65%)	7 (35%)	0.993	0.99 (0.33-3.02)
Merchant	6 (75%)	2 (25%)	0.475	1.9 (0.316-11.8)
Government employee	11 (84.6%)	2 (15.4%)	0.130	3.9 (0.67-23.3)
NGO employee	1 (50%)	1 (50%)	0.55	0.38 (0.02-9.2)
Daily labourer	15 (79%)	4 (21%)	0.105	2.9 (0.8-10.8)
Jobless	9 (41%)	13 (59%)	0.028	0.314 (0.11-0.88)*
Other	52 (60.5%)	34 (39.5%)	0.015	5.97 (1.4, 25-16)
Not in the universe	155 (64.3%)	86 (35.7%)		1
History of hospitalization				
Yes	28 (48.3%)	30 (51.7%)	0.024	0.428 (0.21-0.89)
No	239 (66.4%)	121 (33.6%)		1
CPT status during baseline				
Receiving	148 (57.1%)	111 (42.9%)	0.036	0.56 (0.32-0.97)
Discontinued	119 (74.8%)	40 (25.2%)		1
Therapeutic regimen during high viral load				
1 <sup>st</sup> line	259 (65.1%)	139 (34.9%)	0.040	3.86 (1.066-13.99)
2 <sup>nd</sup> line	8 (40%)	12 (60%)		1
Cd4 cell count during high viral load				
< 200	35 (36.8%)	60 (63.2%)		1
> 200	232 (71.8%)	91 (28.2%)	0.00	3.644 (1.98-6.7)
Reason for VL test				
Initial	103 (48.4%)	110 (51.6%)		1
Annual	164 (80.2%)	41 (19.8%)	0.00	6.10 (3.4-10.6)
Enhance adherence counselling				
Yes	170 (60.5%)	110 (39.5%)	0.854	0.81 (0.12, 5.91)
No	97 (70.8%)	40 (29.2%)		1
Functional status				
Working	199 (66.8%)	99 (33.2%)	0.321	0.35 (0.04, 2.7)
Ambulatory	34 (58.6%)	24 (41.4%)	0.195	0.26 (0.035, 1.98)
Bedridden	1 (20%)	4 (80%)	0.042	0.039 (0.02, 0.88)*
Appropriate	28 (57.1%)	21 (42.9%)	0.348	0.42 (0.06, 2.6)
Delay	5 (62.5%)	3 (37.5%)		1
3 <sup>rd</sup> viral test result				
TND	23 (100%)	0		8.4 (3.4, 20.5)
HVL	8 (19%)	34 (81%)	0.000	1

## 4. Discussion

The study results showed that 64% of those high viral loads ART clients were suppressed after first high viral load test result and this result is similar with retrospective research done at North Wollo Zone public hospital in 2019 done on viral load suppression after EAC and its predictor [12], target given by WHO which is 70% [13] and it is much higher than viral suppression rates reported in Zimbabwe in 2019 [11] and HIV viral suppression rate following EAC done at Uganda in 2018 [14]. The study found that CD4 cell count  $\geq 200$  have four times higher than CD4 cell count  $< 200$  in viral load suppression is was near with study done with HIV virologically non suppression and associated factor done in Northern Ethiopia [15], magnitude of viral load failure and associated factor done at Debra Mark referral hospital, 2018 [16] and study done on factor associated with HIV viral load suppression in Vietnam [17] and study done at Uganda on viral failure in patient with HAART [18]. This study showed annual viral load test was six times higher than initial viral

load test done in viral load suppression and it was similar to study done at northern Ethiopia (Tigray) on HIV viral load non suppression [15], and study done at Rwanda [19]. History of hospitalization are lower probability of viral load suppression as compared to high viral load clients that not hospitalized and this is similar with study done at Debre Markos hospital, 2013 [20]. Clients that has no job have lower probability of viral load suppression and it is similar with study done on immunological failure and its predictor [20]. Receiving CPT during high viral load were associated with lower probability of viral load suppression, it is similar with study done on Predictors of Time to Viral Load Suppression of Adult PLWHIV on ART in Arba Minch General Hospital, 2019 [21] and Incidence and predictors of viral load failure among adult HIV patients on first-line Antiretroviral therapy in Amhara regional referral hospitals, 2020 [22].

## 5. Conclusion

From total 418 high viral load ART clients 64% had

suppressed viral load test result after follow up. CD4 cell count  $\geq 200$ , discontinued CPT, 3<sup>rd</sup> viral load test result, 1<sup>st</sup> line ARV regimen, annual viral load test were higher probability of viral load suppression while clients having history of hospitalization, no job and bedridden functional status had lower probability of viral load suppression. Viral load suppression for clients on 2<sup>nd</sup> line is low as compared to 1<sup>st</sup> line ARV regimen and need to do further research to dig out the reason for low probability in viral load suppression.

## Abbreviations

ART, Antiretroviral Therapy; CPT, Cotrimoxazole Preventive Therapy; EAC, Enhance Adherence Counseling; VL, Viral Load

## Author Contribution

All authors made substantial contributions to conception and design, acquisition of data, or analysis and interpretation of data; took part in drafting the article or revising it critically for important intellectual content; agreed to submit to the current journal; gave final approval of the version to be published; and agree to be accountable for all aspects of the work.

## Disclosure

The authors declare that they have no competing interests.

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