Human Immunodeficiency Virus Viral Load Suppression and Associated Factors Among Client on Anti-Retroviral Therapy in Asella Teaching and Referral Hospital, Ethiopia

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Abstract: The aim of therapy following treatment failure is to attain and maintain Virological suppressions via the three 90 target by the year 2020 to accelerate reaching epidemic control of those on Anti-Retroviral Therapy (ART) shall be virally suppressed. Objective: The purposed of this study to evaluate Human Immunodeficiency Virus (HIV) on High viral load suppression and factors associated among client on ART in Asella Teaching and Referral Hospital, Arsi Zone, Oromia Regional State, Ethiopia, 2019. Methods: Institution based cross sectional study was done by chart review. A total of 430 study subjects were selected with complete information included in the analysis. The collected data was entered in to Epi info Version 7 software then cleaned data was exported to SPSS version 21 for analysis. All independent variables with at p-value<0.2 in the crude analysis were involved in the multiple logistic regression analysis with 95% CI computed. A P-value<0.05 has considered statistically significant. Result: A total of 430 people living with HIV enrolled in this study was, 356 (82.8%) had not suppressed viral load with the corresponding 95% confidence interval was (79.2, 86.3). People living with HIV enrolled with '"baseline Hgb < 10g/dl [AOR=1.834, 95% CI (1.407, 2.710)], patients having poor adherence [AOR=15.204, 95% CI (8.087, 28.58)] and patients enrolled to care who use substance [AOR=1.6, 95% CI (1.021, 3.118)] were at risky to get high viral load. Conclusion: The findings of this study strongly showed that on treatment viral load suppression rates 17.2% patients had suppressed viral load < 1000 RNAcopies/mL. This proportion falls short of the UNAIDS' 90% target for on treatment viral suppression. Poor adherence, Hgb level < 10g/dl and substance use were factors that decreases rates of viral load suppression. Therefore, the Human Immunodeficiency Virus (HIV) treatment program can maintain and potentially improve virological treatment outcomes by improving access to targeted viral load testing.

Keywords: Anti-Retroviral Therapy Asella Referral & Teaching Hospital, Associated Factors, Viral Load Suppression

1. Introduction

Acquired immunodeficiency syndrome (AIDS) is a long-lasting illness & it has been a risk to humankind. United Nation AIDS has established the three 90 target by the year 2020 to hasten reaching widespread control, which is '90% of PLHIV identify their status, 90% of those that know their status shall be advocate on ART &90% of those on ART shall be virally suppressed' [1].

Nationally, there are 391,844 people on Ante-retroviral treatment, showing coverage of 52.8% among the eligible. On the other hand, among the total People Living with HIV (PLHIV), and estimated of 62% know that they are HIV positive, which compared to the ambitious target of ensuring 90% PLHIV know their HIV positives, requires a lot of strong, joint effort [2].

Currently, there are a projected 37 million people living with HIV/AIDS who are entitled for ART global. Of which 70% of

them alive in Sub-Saharan African countries that made it greatly exaggerated by HIV/AIDS than any other counties of the world and out of 1.2 million losses because of AIDS in the world, again 66% ensued in Sub-Saharan Africa [3].

The RNA viral load of human immunodeficiency virus (HIV) is primarily castoff to define the grade of HIV septicity. The aim of therapy subsequent action disappointment is to attain and uphold Virological suppression. Immunological catastrophe is distinct as: fall of CD4 count to pre-therapy base line, 50% descent from the on management ultimate value, or obstinate CD4 planes below 100cells/mm^3 [4].

Expressive aspects that can assistance to forecast treatment disappointment will relief to recognize customers that are at difficult hazard of management catastrophe so as to variation regimen for those who previously have disastrous regimen and adjournment though exploiting follow in those have prospective miscarriage. Repetitive patient attend need to be addressed as part of the repetitive scientific track and need to have a great catalogue of suspension. Studies demonstrate that only a few patients amid those who truly had action miscarriage were perceived at the ART centres [5].

Extremely energetic antiretroviral therapy (HAART) condenses death and illness amid human immunodeficiency virus (HIV)-affected individuals [6]. Proper HAART, vaccinations and prophylactic antimicrobials for HIV-infected personages have been verified to significantly to monitor viral load suppression properly and reduce mortality and prevent hospitalizations [7].

There are numerous danger influences designated in several scholarships and world health Organization (WHO) procedures [8]. To address the gaps detail in the literature specifically, this research intended to evaluate the level and related aspects of viral load suppression among HIV infected patients on HAART.

2. Research Method

2.1. Study Design and Setting

Institutional based cross-sectional study was done amongst patients on HAART with HIV-positive for more than 6 months from June 30, 2019 to November 30, 2019. The survey was conducted in Asella Referral& Teaching Hospital, South -East Ethiopia. The town is located of 175km South east of Addis Ababa City. Based on EDHS 2016 Ethiopian census report and followed the annual population growth rate, the total population of Asella was estimated 108,307. The Town has one governmental hospital, 2 private hospitals, 18 private medium clinics, 2 health Center & 3 NGOs clinics. In the town eternally registered HIV positive clients/patients to long-lasting HIV care were from annual report DHIS2 of Asella Referral Hospital was 3845 clients.

2.2. Sampling Size and Procedures

Before this study the prevalence of High Viral load Suppression of related topic was not conducted and available. So, apply 50% of assumption for similar population proportion.

d= Margin of error 5% with 95% confidence level.

Z α/2 = 1.96 (level of significance)

$$N = \frac{z^2\alpha/2 \times p(1-p)}{d^2} = \frac{1.96^2 \times 0.5(1-0.5)}{(0.05)^2} = 384$$

Finally the maximum sample size calculation considered non response rate 12% of the total sample size was 430.

All High Viral loads in Asella referral& teaching Hospital provided on ART service by considering lottery method were selected with simple random sampling involved in the study.
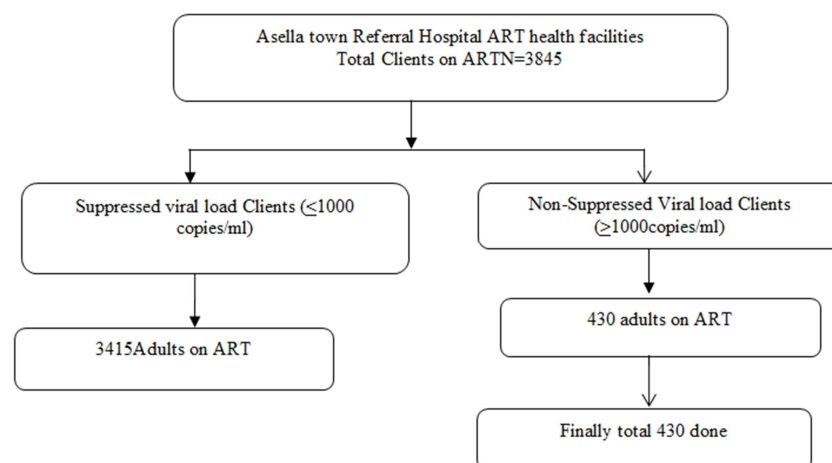

Figure 1. Schematic presentation of sampling procedure.

Operational definitions

Viral load Suppression: -A viral load test measures the number of HIV viral particles per milliliter of blood. Number of virus is less than 1000copies/ml known as low viral load indicates that treatment is effective.

Non-viral load Suppression:-Non viral load is number of

viral count greater than 1000copies/ml in the blood test measure in an individual on care point to either that the prescription is not being taken properly or that the virus is becoming resilient to the treatment.

Highly Active Anti-Retroviral Therapy (HAART):- is a combination of three or more Antiretroviral medicines used

to slow the rate at which HIV makes copies of itself (multiplies) in the body.

ART adherence:-is the regular & sustainable lifelong use of HIV medications to suppress viral multiplication.

2.3. Study Participants and Data Collection

Totally accessible figure on patient cataloging was tested and a correct data extraction tool was organized. Then, data was take out from patients' registering book by four BSc health professionals, who had ART training and have been working in HIV care clinic. The data clerks had helped them by identifying patient cards that would enroll on ART from June 2016 to June 2019 in the register /electronic data base by using Medical Record Number (MRN) and unique ART number. Those HIV/AIDS infected customers with high viral load (>1000copy/ml) receiving Antiretroviral Therapy (ART) in Asella Referral& Teaching Hospital was source of study subjects.

2.4. Data Quality and Statistical Analysis

The quality of data was ensured in the point of data collection tool, data collected and data entry. Pre-test undertaken on the format out-side of the study health facilities before the actual data collection started and correction had made on the formats. Intensive training was given one and half days for the data collectors on the objective of the study and contents of the format. Data collection has done by well experienced ART nurses' and the supervisor was examined the completeness; concordance and correctness of completed data and for incompleteness and/or inconsistency data, correction have made by turned back to patient cards. For data exploration, the collected data was entered in to Epi-info Version 7 software and after cleaned exported to SPSS version 21 for analysis. Socio-demographic characteristics and other relevant variables in the study were described by percentages and number distributions of the respondents. To identify the association between dependent and independent factors were used logistic regression. At p-value less than 0.2 of independent variables in the crude analysis had included in the multiple logistic regression analyzed. Finally, the adjusted odds ratio with the corresponding 95% confidence intervals had computed with P-value less than 0.05 was considered as statistically significant.

2.5. Ethical Approval

The study was carried out after getting permission from the ethical board of Arsi University, College of Health science. Ethical clearance had obtained from Arsi University Department of Public Health communicated through formal letter to obtain permission. Further inscribed authorization to conduct the study on medical records of patients had obtained from Asella referral and teaching Hospital. Being data abstraction personal identifiers were excluded. Obtaining informed consents from the participant was not applicable because of secondary data was used, but the confidentiality of information has maintained by not recording their name from the chart and keeping the data anonymous.

3. Results and Discussions

3.1. Socio-Demographic Characteristics of the Respondents

This study attempted to provide insight into the magnitude and associated factors with high viral load suppression amongst people living with HIV who were enrolled in Asella referral and teaching Hospital from 2016. In registration 430 clients of PLHIV who were enrolled from 2016 to 2019 were reviewed. The mean age was 33.6± SD 8.11 years and more than four out of ten, 175 (40.7%) of them were belonging to in the age group 35-44 years; while more than two-third 287 (66.7%) were males. More than half, 228 (53%) of PLHIV were orthodox Christians in religion. Regarding on the educational status, 255 (59.7%) of study participants were attended only primary education and more than one-fourth, 114 (26.5%) were daily laborer. In addition more than half, 222 (51.6%) of participants were currently or formerly married greater than, 338 (78.6%), PLHIV were released their HIV status to their parents, Wife/Husband, Brothers/sisters, relatives. Almost seven out of ten, 299 (69.5%) of respondents were urban inhabitants and more than three- fourth of, 327 (76%) respondents were living in not more than two rooms. Likewise; More than two out of ten, 93 (21.6%) were substance users (Table 1).

Table 1. *Socio demographic characteristics of people living with HIV enrolled in chronic care in Asella Teaching &Referral Hospital, south-East, Ethiopia, 2019.*

Variables (n=430)	Frequency	Percentage (%)
Age		
15-25	80	18.6
26-34	141	32.8
35-44	175	40.7
=>45	34	7.9
Sex		
Male	287	66.7
Female	143	33.3
Religion		
Protestant	118	27.4
Orthodox	228	53.0
Muslim	77	17.9
Others	7	1.6
Educational status		
Unable to read and write	70	16.3
Elementary school	255	59.3
Secondary school	89	20.7
College and above	16	3.7
Occupational status		
Farmer	51	11.9
Full time house wife	44	10.2
Merchant	18	4.2
Governmental employee	38	8.8
Student	52	12.1
Daily laborer	114	26.5
Jobless	93	21.6
Others	20	4.7

Variables (n=430)	Frequency	Percentage (%)
Marital status		
Single	161	37.4
Married	222	51.6
Divorced	31	7.2
Widowed	16	3.7
Disclosure Status		
Disclosed	338	78.6
Not Disclosed	92	21.4
Disclosed to (N=338)		
Wife/Husband	175	40.7
Own child	9	2.1
Parents	105	24.4
Brothers/Sisters	21	4.9
Relatives	28	6.5
Residence		
Urban	299	69.5
Rural	131	30.5
Family size		
1-3	307	71.4
4-5	108	25.1
=>>5	15	3.5
No of rooms		
<3	327	76.0
>=3	103	24.0
Substance use		
Yes	93	21.6
No	337	78.4
Substance used (N=93)		
Cigarette	10	10.7
Khaut	68	73.1
Alcohol	15	16.2

3.2. Clinical and Immunological Characteristic

Of the total 430 study participants 336 (78.1%) had a baseline WHO clinical stage I and more than three-fourth of 336 (78.1%) of study subjects were enrolled with occupied functional status. The average baseline CD4 cell counts of respondents at enrollment, 261 (60.7%) were less than 200cell/ ml. Majority 353 (82.1%) of the participants were enrolled with BMI $\geq$18.5. Among Study subjects 73 (17%) respondents had a baseline Hgb<10. At the time of follow up the great numbers 420 (97.7%) of the study subjects provided with CPT but only 388 (90.2%) of the study subjects received IPT.

The preliminary regimen regularly prescribed for the study subjects were a grouping of TDF, 3TC and EFV 187 (43.5%) followed with AZT, 3TC and NVP 173 (40.2%). More than five-sixth of participants changed their initial regimen, 371 (86.3%) patients transferred to second line. Most of the drug changes was made following clinical failure, 252 (67.9%) while 13 (3.5%) changes was following drug side effect (Table 2).

Table 2. Clinical and immunological characteristic of people living with HIV enrolled in chronic care in Asella Teaching and Referral Hospital, south-East, Ethiopia, 2019.

Variables (n=430)	Frequency	Percentage (%)
Baseline Functional status		
Working	336	78.1
Ambulatory	85	19.8
Bedridden	9	2.1
WHO clinical stage		

Variables (n=430)	Frequency	Percentage (%)
Stage I	332	77.2
Stage II	45	10.5
Stage III	53	12.3
IPT use initiated		
Yes	388	90.2
No	42	9.8
CPT use		
Yes	420	97.7
No	10	2.3
Any opportunistic infection		
No	297	69.1
Yes	133	30.9
Initial ART regimen		
1E=TDF-3TC-EFV	187	43.5
1F=TDF-3TC-NVP	3	.7
1C=AZT-3TC-NVP	173	40.2
1D=AZT-3TC-EFV	58	13.5
2ndline regimens (2e/2f/2g/2h/2i)	9	2.1
Regimen change during follow up		
Not changed	54	12.6
To first line	5	1.2
To 2ndline	371	86.3
Reason for switch first regimen (N=371)		
Toxicity/side effect	13	3.5
Clinical failure	252	67.9
Immunological failure	61	16.4
Virological failure	45	12.2
Hgb level at base line		
>10	357	83.0
<10	73	17.0
Base line CD4 count		
<200	261	60.7
>200	169	39.3
Base line BMI		
>18.5	353	82.1
16-18.5	57	13.3
<16	20	4.7

3.3. Patient History and Tuberculosis Incidence Rate

Out of the study participants 23 (5.7%) of these had history of previous TB treatment whereas, 32 (7.4%) of participants had close contacts with TB patients. Of the study participants within the follow up period, 45 (10.5%) TB cases were observed and the mean of TB incidence period was 19.04± SD 8.33 month. Among the TB cases, 42 were new case while only 3 were Re-treatment. Of these, 23 (51.1%) were smear positive, 18 (40%) smear negative pulmonary and 4 (8.9%) were Extra-pulmonary TB. Total of ART enrolled, 34 (7.9%) of the TB cases occurred within less than two year of follow up. Those of active TB cases more than three-fourth, 35 (77.8%) were confirmed by Sputum microscopic exam (Table 3).

Table 3. TB related information of people living with HIV enrolled in chronic care in Asella Teaching and Referral Hospital, south-East, Ethiopia, 2019.

Variables (n=430)	Frequency	Percentage (%)
History of previous TB		
Yes	23	5.7
No	407	94.3
closed contacts with TB patients		
Yes	32	7.4
No	398	92.6

Variables (n=430)	Frequency	Percentage (%)
TB diagnosed		
Positive	45	10.5
Negative	385	89.5
TB case definition		
New	42	9.8
Re-treatment (relapse, failure, default)	3	0.7
TB investigation/diagnosed were done by		
Sputum microscopic exam.	35	77.8
x-ray	4	8.9
Gene x-pert	6	13.3
Types of TB/Sputum result		
Smear positive pulmonary TB	23	51.1
Smear Negative pulmonary TB	18	40
Extra pulmonary TB	4	8.9
Status of the patient at the end of follow up		
Active	4	0.9
Incidence of TB developed		
<24	34	7.9
>24	11	2.6

3.4. Magnitude of High Viral Load (>1000copies/ml in the Blood)

Among 430 PLHIV enrolled in this study, after three consecutive routine viral loads testing on similar samples, in this study the rate of viral load among clients living with HIV was considerably high, 356 (82.8%) of study subjects had not suppressed viral load with the corresponding 95% confidence interval was (79.2, 86.3). the rate of viral load suppression in this finding was 17.2 %.

Therefore; the outcome of this study revealed that among high viral load patients, the rate of suppressed HIV viral load suppression among people living with HIV in this study was 17.2 %, (HIV RNA copies <1000 copies/ml). This shows the non-suppression rate is still being 82.8% of PLHIV remains high viral load, which is very far from the 90% target to be achieved in 2020 [9]. This investigated level of viral suppression falls extremely short of the UNAIDS's 90–90–90 global targets [9].

A study conducted in Zambia, stated that the proportion of clients with viral suppression at 12 months ranged from 27 to 89% [10]. This re-suppression rate is much lower than a recent. Retrospective Cohort study conducted amongst high viral load HIV Sero-positive people in North Wollo Zone Public Hospitals, Northeast Ethiopia, proportion of Viral Load Suppression was, 66.4 % [11]. The most significantly, the current finding was far apart from WHO recommendations that suspected virological failure (viral load count>1,000 copies/ml at the first test) should be addressed by enhanced adherence counseling as well as repeat measurement before consideration of treatment switch to a second-line drug [12]. Thus, enhanced adherence counseling interventions can preserve the first-line treatment regimen. This can decrease health care costs and the transmission of resistant strains from the newly infected people.

Additional review that included 11 cohort studies also stated viral suppression rates between 28 and 78% [13-15] and discrepancies with this study. The observed difference could be because of socio behavioral and immunological characteristics of ART clients. These variations of the virological non suppression rate might be due to the study design differences which were based on self-report of the patients on ART care or made differences in the quality of care in service delivery in the case of counseling and adherence support activities among the different study settings [16].

3.5. Adherence

The adherence rate of the study subjects was, just five out of six, 357 (83%) was poor. The major reason for poor adherence was, 166 (38.6%) lost, 129 (30%) feeling better, 61 (14.2%) pill burden and 27 (6.3%) alcohols /drug use. (Figure 2).
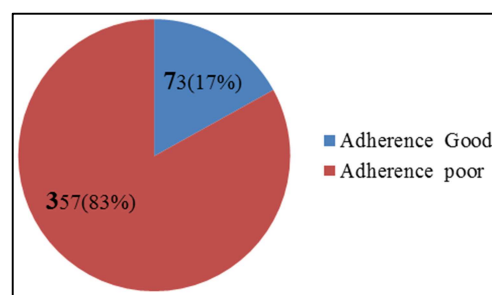

Figure 2. *Adherence of people living with HIV enrolled in chronic care in Asella referral Hospital, south-East, Ethiopia, 2019.*

3.6. Significantly Associated Factors with Impaired Virological Suppression

In the multivariable logistic regression analyzed, three of the most contributing factors remained to be significantly and independently associated with High viral load (Hemoglobin level, Adherence and substance use). The study subjects living with HIV enrolled with baseline Hgb < 10g/dl were almost two times more to develop high viral load at certain time than those having Hgb above 10g/dl [AOR=1.834, 95% CI (1.407, 2.710)]. HIV patients having poor adherence were fifteen times higher risky to get high viral load at any time than those with having good adherence [AOR=15.204, 95%CI (8.087, 28.58)]. Similarly, Patients enrolled to care who use substance was 1.6 times more likely develop high viral load compared with their counter parts, [AOR=1.6, 95% CI (1.021, 3.118)] (table 4).

HIV patients having poor adherence were fifteen times higher risky to get high viral load at any time than those with having good adherence. Different research, viral load suppression status and associated factors among patient on antiretroviral treatment in Ethiopia, revealed poor adherence were significantly associated with impaired virological suppression including others states. [17-19]. The study conducted among patients on highly active antiretroviral therapy in University of Gondar Referral Hospital, Northwest Ethiopia revealed that, clients with poor medication adherence were 16 times as likely to develop virological failure as patients with good adherence [10, 20].

Adherence to ART is a key basis of dealing the consequence. HIV-infected patients also need almost perfect

levels of adherence to attain long-lasting non-detectable VL with suboptimal adherence to ART being the most common cause of virological failure [21, 22].

It is obvious that individuals missing 3 doses of ART per month are associated with an increased risk of drug resistance and reduced immunity [23, 24]. In this study the finding only 3.7% of study subjects were able to reach college and above. This might be a clue of the awareness of the significance of ART, and hypothetically the prominence of adherence. It is also imaginable that is a replication of proper instruction and psychotherapy, which may also strengthen adherence. Poor behavior literacy and conception of the benefits of ART as a therapeutic mediation negatively affects adherence [25].

Table 4. *Bivariate and multiple logistic regression analyses people living with HIV enrolled in chronic care in Asella Teaching and Referral Hospital, south-East, Ethiopia, 2019 (*-show association on bivariate analysis**- statistical significant).*

Variables (n=430)	Viral load		COR (95%CI)	AOR (95%CI)	P- value
	Suppressed	Non-suppressed			
Hgb level at base line					
>10	54	303	1	1	
<10	20	53	2.117 (1.173,3.821)*	1.834 (1.407,2.710)**	0.021
Base line BMI					
>18.5	60	293	1	1	
16-18.5	11	46	0.856 (0.419,1.749)	0.972 (0.420,2.253)	0.948
<16	3	17	1.160 (0.330,4.084)	2.477 (0.548,11.185)	0.238
Adherence					
Good	42	31	1	1	
Poor	32	325	13.76 (7.63,24.805)*	15.204 (8.087,28.58)**	0.0001
Substance use					
Yes	21	72	1.563 (0.886,2.757)	1.6 (1.021,3.118)**	0.016
No	53	284	1	1	
TB diagnosed					
Positive	7	67	1.144 (0.490,2.671)	1.594 (0.569,4.463)	0.375
Negative	38	318	1	1	
Base line CD4 count					
<200	46	215	0.928 (0.544,1.554)	1.037 (0.568,1.893)	0.905
>200	28	141	1	1	
Disclosure Status					
Disclosed	54	284	1	1	
Not Disclosed	20	72	0.685 (0.385,1.216)	0.548 (0.279,1.076)	0.081

The study subjects living with HIV joined with baseline Hgb < 10g/dl were almost two times more to develop high viral load at certain time than those having Hgb above 10g/dl. Researches' revealed that, Hemoglobin was expressively associated with progression to AIDS/death after starting ART. Starting ART was associated with an increase in hemoglobin levels. Lower hemoglobin values, particularly the latest measured, were associated with an increased risk of disease progression [26, 27].

Clients registered to care who used substance was 1.6 times more likely develop high viral load compared with their counter parts. Alcohol intake is public in persons with HIV infection and has been interrelated to several adverse health outcomes in this population. It could affect HIV viral suppression via both behavioral (e.g. ART adherence) and biological (eg. immune dysfunction) mechanisms [28-30]. Likewise, a very recent study that conducted among unsuppressed HIV viral load persons in Maryland USA, among study subjects who were alcohol addicted, 8.5% were unsuppressed viral load, substance use is associated with adherence over time to ART reduce viral load suppression [31].

In HIV-infected people undertaking treatment, concurrent alcohol abuse often renders treatment ineffective because of clients commonly fail to adhere to the strict treatment regimens essential to achieve control of the infection. Moreover, alcohol may interact with ART medications and exacerbate adverse effects of these medications [32].

In addition, HIV-positive smokers have expressively poorer immunologic response, greater hazard of virological rebound and more regular immunologic failure as compared to their nonsmoking counterparts [33, 34]. People with HIV who are smoking more likely to suffer from numerous complications from HIV treatment and long-term effects of HIV disease and concomitant treatments [35].

Limitation

The retrospective nature of the study only permitted a review of records available in patients' folders but did not allow for the comprehensive assessment of potential factors that could be associated with viral suppression.

4. Conclusion

The outcome of this study strongly showed that, among high viral load study subjects living with HIV was 17.2% of clients had suppressed viral load < 1000 RNA copies/mL. However, this proportion indicated that extremely less of the UNAIDS' 90% target for on-treatment viral suppression. The results of this study also specified that, poor adherence to treatment, Hgb level < 10g/dl and substance use were positively and expressively associated with viral load suppression.

Hence, inclusive managing and follow up of clients on ART and the programs start testing for resistance as well as having viral load could help to reduce the problem in advance. Following this the HIV treatment programme can maintain and potentially improve virological treatment outcomes by improving access to targeted viral load testing, including a routine viral load for all clients on ART after 12 months of treatment were recommended.

Abbreviation

AIDS: Acquired Immune Deficiency Syndrome; AOR: Adjusted odd ratio; ART: Anti-Retroviral Therapy; COR: Crude odd ratio; CD4: Cluster of Differentiation Cell Count CI: Confidence interval; HAART: Highly Active Antiretroviral Therapy; PLHIV: People Living with HIV; UNAIDS: Joint United Nation Program on HIV/AIDS.

Competing Interest

We declare that we have no competing interests.

Authors' Contribution

AG contributed in the generation of the study topic, preparation of proposal, organized of data collection process and preparation draft data analysis and interpretation. GW& SWM contributed in reviewing the proposal, data analysis and interpretation and development of the manuscript and critical review of final manuscript. All authors read and approved the final manuscript.

Data Availability

The datasets generated or analyzed during the current study are not publicly available due privacy issue and restricted institutionally to be disclosed but are available from the corresponding author on reasonable request.

Acknowledgements

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