ECRONICON OPEN ACCESS

EC PHARMACOLOGY AND TOXICOLOGY
Research Article

Antiretroviral Treatment Failure and Associated Factors among Acquired Immunodeficiency Syndrome Patients Who Attend Follow Up in Saint Peter Specialized Hospital, Addis Ababa, Ethiopia from 2017-2019

Tigist Hailu[1], Walelegn Worku[2], Molla Taye[3]*, Robel Gemechu Haile[1] and Abel Worku Habtewold[1]

[1]St. Paul's Hospital Millennium Medical College, Addis Ababa, Ethiopia

[2]Institute of Public Health, College of Medicine and Health Sciences, The University of Gondar, Central Gondar, Ethiopia

[3]School of Medicine, College of Medicine and Health Sciences, The University of Gondar, Central Gondar, Ethiopia

***Corresponding Author:** Molla Taye, School of Medicine, College of Medicine and Health Sciences, The University of Gondar, Central Gondar, Gondar, Ethiopia.

Received: October 27, 2025; **Published:** December 31, 2025

Abstract

Introduction: Inadequate viral suppression resulting from failure to adhere closely to HIV/AIDS treatment causes a worsening of the disease, developing drug resistant viral strains and leads to death.

Objectives: The aim of this study was to assess the magnitude and associated factors of antiretroviral treatment failure among HIV/AIDS patients in Saint Peter specialized hospital, Addis Ababa, Ethiopia.

Methods: A cross-sectional study was conducted on 810 participants who attended their antiretroviral therapy follow up in Saint Peter Specialized Hospital from 2017-2019. Data were collected on sociodemographic, antiretroviral treatment, and clinical characteristics by interviewing participants and reviewing their medical records. The data were entered into Epi-info 7 and exported to Statistical Package for the Social Science version 23. Bivariable and multivariable analysis were calculated to identify associated factors with antiretroviral treatment failure using Statistical Package for the Social Science version 23.

Results: The prevalence of antiretroviral treatment failure was 24.3%. The 1st two weeks of initiation after HIV diagnosis (AOR = 0.15, 95% CI: 0.04, 0.51), initiation after 6 months of HIV diagnosis (AOR = 0.23, 95% CI: 0.07, 0.71), WHO clinical stage 2 (AOR = 0.36, 95% CI: 0.17, 0.79), WHO clinical stage 3 (AOR = 0.51, 95% CI: 0.27, 0.96), WHO clinical stage 4 (AOR = 0.32, 95% CI: 0.12, 0.88), twice daily medication intake (AOR = 3.11, 95% CI: 1.57, 6.17), fair ART adherence (AOR = 10.97, 95% CI: 5.08, 23.69), poor antiretroviral treatment adherence (AOR = 58.54, 95% CI: 30.74, 111.47), regimen types; Nevirapine base (AOR = 0.48, 95% CI 0.24, 0.96), (AOR = 0.41, 95% CI: 0.18, 0.93) and clients on 2nd line regimen (AOR = 1.66, 95% CI: 0.29, 0.94) were significantly associated with treatment failure/non-viral suppression.

Conclusion: In the present study, initiation of antiretroviral treatment in the first two weeks of diagnosis, initiation of antiretroviral treatment after six month of diagnosis, WHO stages 2, 3, 4 and twice medication intake were factors associated with treatment failure/non-viral suppression. The viral non suppression was high to meet the 3rd 90 of UNAIDS strategy. ART adherence was the major factor significantly associated for viral non suppression followed by 2nd line regimen.

Keywords: *Antiretroviral; Treatment Failure; Viral Load; Non-Viral Suppression; HIV/AIDs; Associated Factors*

Abbreviations

UNAIDS: United Nations Program on HIV/AIDS; AIDS: Acquired Immunodeficiency Syndrome; BMI: Body Mass Index; ART: Antiretroviral Therapy; CD4: Cluster of Differentiation 4; UAN: User Account Number; HIV: Human Immunodeficiency Virus; HIVDR: Human Immunodeficiency Virus Drug Resistance; MDR: Multi Drug Resistance; RNA: Ribonucleic Acid; VL: Viral Load; WHO: World Health Organization; EC: Ethiopian Calendar; COR: Crude Odds Ratio; AOR: Adjusted Odds Ratio

Introduction

Human immunodeficiency syndrome (HIV/AIDS) is one of the most devastating and advanced stage of HIV infection. HIV is a virus that attacks the human body's immune system, specifically attacks CD4 cells (T-cells). The HIV/AIDs has been a major health problem globally. HIV/AIDS occurs when the immune system is severely weakened and damaged and the body fails to fight off opportunistic infections. According to the World Health Organization's HIV/AIDS key facts, in 2020 and 2021, there were about 37.7 million people living with HIV worldwide. Again, at the end of 2020, about 1.5 million people were newly infected with HIV globally [1,2]. In addition, HIV/AIDs is the leading cause of morbidity and mortality. HIV/AIDs has been treated with antiretroviral therapy. HIV/AIDs viral load is a powerful predictor, which intensify the progression of the disease, as a consequence leading to the spreading of the disease, developing of drug resistant viral strains and death [3]. Effective antiretroviral therapy (ART) inhibits viral replication and reduces HIV viral load to low or undetectable levels within 4 - 6 months [4]. On the other hand, high viral load is associated with increased transmission and poor clinical outcomes [4]. However, the treatment failure occurs when antiretroviral drugs fails to suppress the virus [1,2]. Conventionally, retention in care and scale up ART medication access are a critical factor for persons living with HIV to achieve viral suppression [5]. concurrently, viral suppression has been associated with immunologic improvement and preservation and decreased risk of HIV transmission [6]. Inadequate viral suppression resulting from failure to adhere closely to treatment causes a worsening of the disease (immunological and clinical states) and leads to emergence of drug-resistant HIV strains. ART failure is defined as progression of HIV/AIDs disease, which leads to death. Moreover, virological failure was defined as detectable HIV ribonucleic acid (RNA) above1000 copies/ml and it is often associated with progressive increase of HIV viral load, decrease of CD4 T cell count, and progression of opportunistic disease [7-9].

Astonishingly, in 2019 there were 37.9 million people living with HIV/AIDS globally. Of which, 18.8 million were women, 17.4 million were men and 1.7 million were children <15 year of age. In the same year there were 1.7 million newly infected individuals and 0.8 million people died with HIV infection worldwide [10]. As reported by the WHO African region, approximately, 25.4 million people were living with HIV in Africa in 2020, as well as, the African region accounted for about 60% of the global new HIV infections. Likewise, 1.5 million people in Africa were newly infected with HIV in 2020. In addition, 480 000-1.0 million people in Africa died from HIV-related causes in 2020 [1,2]. To this end, sub-Saharan Africa is a region highly affected by HIV epidemic. Ethiopia is one of the Sub-Saharan African countries with the highest numbers of people affected by the problem. According to the Federal HIV/AIDS Prevention and Control Office's [11] (HAPCO) of Ethiopia report in October 2021, more than 11,000 new HIV infections occur in Ethiopia annually. Of these, younger people accounted for about 67% of the new HIV infected persons [11]. Similarly, in Ethiopia, there were 710,000 patients infected with HIV/AIDS in 2016. Around 404,405 HIV patients were on an ART and around 20,000 AIDS-related deaths were reported in the same year [9]. Basically, the prevalence of HIV among adults 15 - 64 years old in urban Ethiopia was 3.0%. In Ethiopia, the prevalence of HIV infection rate in 2016 in female and male were 4.1% and 1.9%, respectively [12]. Again, prevalence of viral load suppression among age groups 15 - 64 in urban Ethiopia was 70.1% in 2018. Likewise, the prevalence of viral load suppression in 15 - 64 years old female and male was 71.7% and 66.8%, respectively [12]. However, ART failure/non- viral suppression was not studied sufficiently in Ethiopia.

As a corollary, suboptimal viral suppression and CD4 response to ART are known to cause poor outcomes with the increase cost of treatment. Again, the other risk factor associated with increase in viral load and treatment failure is adherence. Another point to consider

is that without adequate adherence, antiretroviral agents are not maintained at sufficient concentrations to suppress HIV replication in infected cells and lower the plasma viral load. Moreover, poor adherence to ART also accelerates development of drug-resistant HIV [13-23].

Indeed, as of World Health Organization recommendation the viral load of individuals receiving ART must be measured every six months if the VL detection is available to detect viral replication and confirm ART failure. It is also important to highlight that ART failure or viral non suppression in patients who have been on ART for at least 6 months can be detected when viral RNA is >1000 copies per 1 ml of plasma.

Therefore, identifying ART failure and associated factors in clients with HIV/AIDs are very important to decrease the morbidity, mortality and death of patients.

Aim of the Study

The aim of this study was to assess the magnitude of ART failure and associated factors among HIV/AIDs clients in St. Peter Specialized Hospital, Addis Ababa, Ethiopia.

Materials and Methods

Study area

The study was conducted in St. Peter Specialized Hospital which is one of the Federal hospitals found in Addis Ababa, Ethiopia. Addis Ababa is the country's commercial, cultural and diplomatic hub. St. Peter Specialized Hospital was established in the 1960s. It has been the main center for tuberculosis for the past four decades. It started ART service in 2006 (1998 EC). More than 7,000 clients visited the ART clinic.

Study design

Institutional based cross-sectional study was conducted to assess the magnitude of ART failure among HIV/AIDs patients.

Source and study population

The source and study population was all ART clients who attend follow up in St. Peter Specialized Hospital more than one year on treatment from 2017- 2019 (2009-2011 EC). Those ART clients who were not on treatment for more than one year, those who were lost to follow up and those clients who had no annual viral load result registered on the log book were not included in the study.

Sample size and method

Based on a single proportion formula, with the assumption of population proportion 0.147 and sampling error 0.3 and by assuming 95% confidence interval, the sample size calculated was 535 and 10% non-response and design effect added and the final sample size was 810.

At the time of data collection, more than 31,000 clients visited the hospital. Of these, 2,318 were ART taking clients. Those clients who had followed up more than one year and had registered viral load on the log book from 2017- 2019 were included in the study. In addition, the method used in this study was carried out by following the World Health Organization's relevant guidelines and regulations.

Data collection procedures and techniques

The data was collected using standardized data abstraction form from viral load registering log book that records the point in time, the medical record number of clients and UAN, age, sex, ART regimen, base line and current CD4 counts, viral load results. The data for the

independent variable was collected from client charts. Data were collected by professional nurses who were trained on comprehensive ART and working in ART clinics for more than 6months. The associated factors/the independent variables such as adherence, WHO clinical staging, missing drug doses, chronic illness, clients BMI were collected from client charts. Missing data on the client's chart were collected from the smart care with the assistance of data clerks.

Data processing and analysis

The data were entered into Epi info version 7 and exported to SPSS version 23. Bivariable analyses was done to identify the associated variables. Likewise, multivariable analysis were carried out to detect the associated factors with treatment failure (viral non suppression). The findings were presented in the form of text, table and figure.

Data quality control

To collect quality data one day training was given for the data collectors. The training was on the objective of the study, the benefits for conducting the study and how to collect the required data from the log book, smart care and patient's chart. Data abstraction form was prepared by the principal investigator. The data abstraction forms were pretested in another specialized hospital to check its ability to capture the required data and corrections were made accordingly. Supervision was done on a daily basis by the principal investigator.

Ethical considerations

The study was approved by the Institutional Review Board of Addis Continental Institute of Public Health and St. Peter Specialized Hospital Research and Evidence Generation Directorate: The Office of Institutional Review Board. Also, waiver was obtained from these Institutional Review Boards to collect data by reviewing patient's charts, smart care and logbooks. The patient charts were assessed by the primary investigator and the data collector nurses only. The data collector nurses were staff members who were working in the ART clinic of St. Peter Specialized Hospital. Confidentiality was kept. In addition, the data was locked in a secured cabinet.

Results

A total of 810 clients participated in this study. Out of these, the majority (87.3%) of the clients were 25 years and above. Females were accounted for 56.8%. About 36.7% of the participants were married. Forty percent of the participants attended primary school. Ninety one and half percent of the participants were residents of Addis Ababa, Ethiopia. The socio-demographic characteristics are presented in table 1.

Variables	Frequency	Percentage
Age		
Child (0-14 years)	39	4.8%
Adolescents (15-24 years)	64	7.9%
Adults (> = 25 years of age)	707	87.3%
Sex		
Male	350	43.2%
Female	460	56.8%
Marital status		
Married	297	36.7%
Single	216	26.7%
Divorced	177	21.9%
Widowed	120	14.8%

Address		
Addis Ababa	741	91.5%
Out of AA	69	8.5%
Level of education		
No education	140	17.3%
Primary (1-6grade)	324	40.0%
Secondary and above	264	32.6%
Tertiary	82	10.1%

Table 1: *Socio-demographic characteristics of respondents who were taking ART medication at St. Peter Specialized Hospital, Addis Ababa, Ethiopia, 2020.*

Clinical characteristics of study participants

The magnitude of treatment failure was 24.3% (95% CI: 21.4, 27.5%). As shown in figure 1, one hundred ninety seven (24.3%) of participants had unsuppressed viral load.

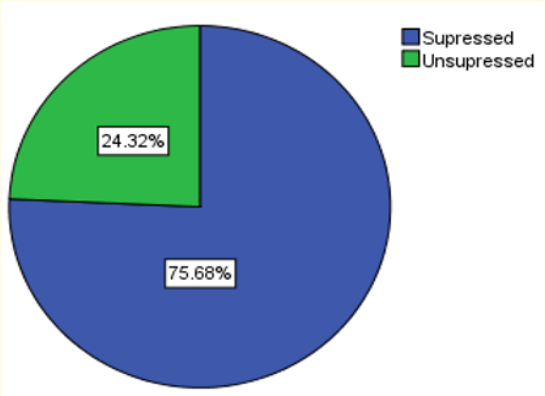

Figure 1: *Percentage of viral load status of study participant who take medication in ART clinic of St. Peter Specialized Hospital, Addis Ababa, Ethiopia, 2020.*

As indicated in table 2, some (3.3%) of participants were severely malnourished (BMI <16), and in WHO clinical stage 1 before the initiation of their ART. Similarly, 54.8% of participants were on WHO clinical stage 1 before initiation of their ART. More than half (56.4%) of the study participants had CD4 count <200 cells/mm^3 as baseline before initiation of ART medication. Besides, 16.2% of the study participants had poor adherence to their ART medication. About 65.4% of participants were initiated their ART within the 1st week of positive diagnosis. Again, 47.6% of HIV/AIDs patients were initiated on combined three drug regimens, 1E (Tenofovir + Lamivudine + Efavirenz); 1J (Tenofovir + Lamivudine + Dolutegravir), 4E (Tenofovir + Lamivudine + Efavirenz), 4J (Abacavir + Lamivudine + Dolutegravir), that is the combined of these three drugs could be summarized as (1E, 1J, 4E, 4J), while 63.1% of patients took their medication once daily.

Variables	Frequency	Percent
BMI		
Not malnourished (BMI >18)	599	74.0%
Moderate malnutrition (BMI 16-18.5)	184	22.7%
Severe malnutrition (BMI <16)	27	3.3%
WHO clinical staging		
Stage 1	444	54.8%
Stage 2	123	15.2%
Stage 3	183	22.6%
Stage 4	60	7.4%
Base line CD4 count		
<200 cells/mm^3	457	56.4%
200-300 cells/mm^3	153	18.9%
>350 cells/mm^3	200	24.7%
Adherence		
Good	636	78.5%
Fair	43	5.3%
Poor	131	16.2%
Time of initiation of ART medication		
Within the 1^{st} week	530	65.4%
Within the 1^{st} two weeks	63	7.8%
Within 6 months	168	20.7%
After 6 months	49	6.0%
Chronic illness		
No	730	90.1%
Yes	80	9.5%
Frequency of ART medication taken		
Once	511	63.1%
Twice	299	36.9%
Condom use		
No	37	4.6%
Yes	232	28.6%
Abstain	541	66.8%
ART regimen*		
1C, 1F, 4C	272	33.6%
1D, 4D, 1G	137	16.9%
2F, 2H, 2I, 2J	13	1.6%
1E, 1J, 4E, 4J	388	47.9%

Table 2: *Clinical characteristics of respondents who were taking ART medication in St. Peter Specialized Hospital, Addis Ababa, Ethiopia, 2020.*

**1C = Zidovudine + Lamivudine + Nevirapine, *1F = Tenofovir + Lamivudine + Nevirapine, *4C = Zidovudine + Lamivudine + Nevirapine, *1D = Zidovudine + Lamivudine + Nevirapine, *4D = Zidovudine + Lamivudine + Efavirenz, *1G = Abacavir + Lamivudine +Efavirenz, *2F = Zidovudine + Lamivudine + Atazanavir + Ritonavir, *2H = Tenofovir + Lamivudine +Atazanavir + Ritonavir, *2I = Abacavir + Lamivudine +lopinavir + Ritonavir, *2J = others, *1E = Tenofovir +Lamivudine + Efavirenz, *1J = Tenofovir + Lamivudine + Dolutegravir, *4E = Tenofovir + Lamivudine + Efavirenz, *4J = Abacavir + Lamivudine + Dolutegravir.*

Factors associated with treatment failure/non-viral suppression

According to both bivariable and multivariable analysis, time of initiation of ART, WHO clinical staging, frequency of ART drug doses, adherence of clients and the ART regimens were significantly associated with the dependent variable. Details are indicated in table 3. The clients who were initiated on ART within the 1st two weeks of positive diagnoses had 15% less chance of developing high viral load with the odds of (AOR = 0.15, 95% CI: 0.04,0.51). And individuals who were initiated after 6 months of being tested positive were 23% less likely to develop high viral load with (AOR = 0.23, 95% CI: 0.07,0.71) than those who started within the 1st week of positive diagnosis (Table 3).

Among individuals who were classified based on WHO clinical staging, those who were on stage 2 were 36% less likely to develop high viral load with (AOR = 0.36, 95% CI: 0.17,0.79), those who were on stage 3 had 51% less chance of developing high viral load with the odds of (AOR = 0.51, 95% CI: 0.27, 0.96) and individuals who were classified as stage 4 were 32% less likely to develop high viral load with (AOR = 0.32, 95% CI: 0.12, 0.88) than those individuals who were on stage 1. As the viral clinical staging increases, the probability of high viral load increases (Table 3).

Of the clients who took their ART medication twice per day were 3.11 times more likely to develop high viral load with (AOR = 3.11, 95% CI: 1.57, 6.17) than clients who took their medication once daily.

The clients with fair adherence and poor adherence were 10.97 times with the odds of (AOR = 10.97, 95% CI: 5.08, 23.69) and 58.54 times with (AOR = 58.54, 95% CI: 30.74, 111.47) were more likely to develop high viral load, respectively than those individuals with good adherence.

In addition, the ART drug regimen showed that those clients who took 1C (Zidovudine + Lamivudine + Nevirapine), 1F (Tenofovir + Lamivudine + Nevirapine), 4C (Zidovudine + Lamivudine + Nevirapine) and those who were on 1D (Zidovudine + Lamivudine + Efavirenz), 4D (Zidovudine + Lamivudine + Efavirenz), 1G (Abacavir + Lamivudine + Efavirenz) were 48% (AOR = 0.48, 95% CI: 0.24, 0.96) and 41% (AOR = 0.41, 95% CI: 0.18, 0.93) less likely to develop high viral load than those who were taking 1E (Tenofovir + Lamivudine + Efavirenz), 1J (Tenofovir + Lamivudine + Dolutegravir), 4E (Tenofovir + Lamivudine + Efavirenz) and 4J (Abacavir + Lamivudine + Dolutegravir), respectively and those clients who were on 2nd line regimen 2F (Zidovudine + Lamivudine + Atazanavir + Ritonavir), 2H (Tenofovir + Lamivudine, Atazanavir + Ritonavir), 2I (Abacavir + Lamivudine + Lopinavir/Ritonavir), and 2J (Others) were 1.66 times (AOR = 1.66, 95% CI: 0.29, 0.94) more likely to develop high viral load than those individuals who were on 1E, 1J, 4E and 4J (Table 3).

Variables	Viral load		COR	AOR	P-Value
	Suppressed	Unsuppressed			
BMI					
Not Malnourished (>18.5)	478	121	1	1	
Moderate Malnutrition (16-18.5)	117	67	0.50 (0.22-1.16)	1.42 (0.83-2.45)	0.2
Severe Malnutrition (<16	18	9	1.15 (0.49-2.69)	1.34 (0.38-4.67)	0.65
Duration of ART					
With the 1st week of confirmation	389	141	1	1	
With the 1st two weeks of confirmation	57	6	0.29 (0.12-0.69)	0.15 (0.04-0.51)	0.002
Within 6 months of confirmation	127	41	0.89 (0.59-1.33)	0.91 (0.51-1.61)	0.74
After 6 months of confirmation	40	9	0.62 (0.29-1.31)	0.23 (0.07-0.71)	0.01

Base line CD4 count					
<200 cells/mm^3	336	121	1.59 (1.05-2.39)	1.32 (0.69-2.52)	0.39
200-350 cells/mm^3	114	39	1.51 (0.91-2.51)	1.49 (0.74-3.02)	0.26
>350 cells/mm^3	163	37	1	1	
WHO clinical staging					
Stage 1	343	101	1	1	
Stage 2	102	21	0.69 (0.42-1.18)	0.36 (0.17-0.79)	0.01
Stage 3	127	56	1.49 (1.01-2.20)	0.51 (0.27-0.96)	0.04
Stage 4	41	19	1.57 (0.88-2.83)	0.32 (0.12-0.88)	0.03
ARV doses per Day					
Once	417	94	1	1	
Twice	96	103	2.33 (1.68-3.23)	3.11 (1.51-6.17)	0.001
Condom Use					
No	20	17	2.44 (1.24-4.78)	1.69 (0.60-4.71)	0.32
Yes	192	40	0.59 (0.40-0.88)	0.79 (0.43-1.48)	0.47
Abstain	401	140	1	1	
Chronic illness					
No	555	175	1	1	
Yes	58	22	1.20 (0.72-2.02)	1.20 (0.55-2.62)	0.64
Level of Adherence					
Good	574	62	1	1	
Fair	19	24	0.02 (0.01-0.03)	10.97 (5.08-23.69)	0.00
Poor	20	111	0.23 (0.12-0.49)	58.54 (30.74-111.47)	0.00
ART Regimen					
1C, 1F, 4C	201	71	1.19 (0.83 -1.70)	0.48 (0.24-0.96)	0.04
1D, 4D, 1G	106	31	0.98 (0.62-1.56)	0.41 (0.18-0.93)	0.03
2F, 2H, 2I, 2J	7	6	2.88 (0.94-8.79)	1.66 (0.29-0.94)	0.57
1E, 1J, 4E, 4J	299	81	1	1	

Table 3: *Bivariable and multivariable analysis of clinical characteristics of respondents who were taking ART in St. Peter Specialized Hospital, Addis Ababa, Ethiopia, 2020.*

**1C: Zidovudine + Lamivudine + Nevirapine, *1F: Tenofovir + Lamivudine + Nevirapine, *4C: Zidovudine + Lamivudine + Nevirapine *1D: Zidovudine + Lamivudine + Nevirapine, *4D: Zidovudine + Lamivudine + Efavirenz, *1G: Abacavir + Lamivudine +Efavirenz *2F = Zidovudine + Lamivudine + Atazanavir + Ritonavir, *2H = Tenofovir + Lamivudine +Atazanavir + Ritonavir, *2I = Abacavir + Lamivudine +lopinavir + Ritonavir, *2J = others, *1E = Tenofovir +Lamivudine + Efavirenz, *1J = Tenofovir + Lamivudine + Dolutegravir, *4E = Tenofovir + Lamivudine + Efavirenz, *4J = Abacavir + Lamivudine + Dolutegravir, *COR: Crude Odds Ratio, *AOR: Adjusted Odds Ratio.*

Age, sex, marital status, address and level of education were not associated with antiretroviral treatment failure (Table 4).

Variables	Viral load		COR	AOR	P-Value
	Suppressed	Unsuppressed			
Sex					
Male	260	90	1.14 (0.83-1.58)	1.14 (0.71-1.84)	0.56
Female	353	107	1	1	
Age					
Child (0-14)	28	11	1.39 (0.68-2.85)	0.49 (0.14-1.78)	0.26
Adolescent (15-24)	34	30	3.12 (1.85-5.25)	1.79 (0.73-4.37)	0.20
Adult (> = 25)	551	156	1	1	
Marital Status					
Married	238	59	1	1	
Single	145	71	1.98 (1.32-2.95)	1.04 (0.51-2.18)	0.92
Divorced	127	50	1.59 (1.03-2.45)	1.20 (0.61-2.38)	0.59
Widowed	103	17	0.67 (0.37-1.19)	0.85 (0.36-2.01)	0.72
Address					
Addis Ababa	556	185	1	1	
Out of Addis Ababa	57	12	0.63 (0.33-1.20)	0.75 (0.30-1.88)	0.54
Level of Education					
No Education	113	27	1.16 (0.57-2.37)	1.09 (0.39-3.05)	0.86
Primary	232	92	1.93 (1.03-3.59)	1.94 (0.79-4.80)	0.15
Secondary	200	64	1.55 (0.82-2.95)	1.89 (0.77-4.65)	0.17
Tertiary	68	14	1	1	

Table 4: *Bivariable and multivariable analysis of clinical characteristics of respondents who are taking ART in St. Peter Specialized Hospital, Addis Ababa, Ethiopia, 2020.*

**COR: Crude Odds Ratio, *AOR: Adjusted Odds Ratio.*

Discussion

This study showed that the magnitude of HIV/AIDS (antiviral) treatment failure was 24.3%. The present study also indicated that the time of ART medication started after clients tested positive (initiation of ART within the 1st two weeks and after six months of being tested positive), WHO clinical staging (stage 2, 3 and 4), the frequency in which clients taking their medication (which was twice per day), poor adherence to ART medications and the ART regimen (nevirapine based treatment) and 2nd line ART) were significantly associated.

Although, Ethiopia adopted the global 90-90-90 HIV prevention targets by 2020 which is part of strategies designed to eliminate HIV/AIDS epidemics by 2030. According to this target plan, by 2020, 90% of all people living with HIV would know their HIV status, 90% of all people with diagnosed HIV infection would receive sustained antiretroviral therapy and 90% of all people receiving antiretroviral therapy would have viral suppression [20]. Hence, Ethiopia has to do much to meet UNAIDS strategic plan.

However, the present study indicated that the magnitude of non-viral suppression (treatment failure) was a bit lower to meet the 3rd 90 of the UNAIDS strategic plan. In addition, in this study only 75.7% of the total ART clients in St. Peter Specialized Hospital had suppressed viral load status. Similarly, a retrospective study conducted in Northern Ethiopia on adolescents and adults showed that viral non suppression was 26.39% [24], which is closer to this study's findings. In contrast, a study conducted in University of Gondar Specialized Hospital indicated that less virologic failure (14.7%) than this study [9]. This difference could be due to that client's immunologic and nutritional status differences.

Furthermore, this study reveals that clients who start ART medication within the 1st two weeks of positive diagnosis have less chance of developing viral non suppression. In fact, most of the time clients who start ART medication early tend to have viral suppression and better treatment outcome. This could be due to the fact that when clients enroll into care early, they would get the adherence counseling early which helps them to stay in care and stick to their medication and appointments. This study findings was supported by a study conducted in New York City [25]. Another a systematic review study carried out in San Francisco suggested that early initiation of ART can reduce the risk of progression to AIDS or death [26]. Again, a retrospective study conducted in Taiwan indicated that rapid ART initiation within 7 days of HIV diagnosis was associated with a shorter time to suppression of HIV replication [27]. However, a study done in Vietnam showed that people might not start ART medication early due to fear of discrimination and subsequently this leads to delayed testing and entry to care [28]. Nevertheless, the above studies discussed showed that clients who start ART medication early are at less risk of virologic failure (treatment failure) and would have good treatment outcome. Unfortunately, in Ethiopia people with HIV are diagnosed and start ART medication after the disease has progressed.

In addition, the present study indicated that clients with higher clinical stages (stage 2, 3, and 4) had viral non suppression results. Similarly, WHO clinical staging indicates that as clinical staging increases patients start to develop stage defining illnesses, which leads them to have low CD4 count and high viral load. Concurrently, a study carried out in Ethiopia suggested that advanced clinical staging (stage 3 and 4) leads to high viral load and HIV treatment failure [29].

Moreover, this study observes that participants who take their medication twice daily were more likely to develop high viral load than their reference group. This may be due to the fact that taking medications twice daily could be inconvenient with their workplaces and residence, as a result they might be disappointed in taking medications twice daily every day. This leads to missing doses and inadequacy of ART medication, faster viral replication and high viral load. Likewise, a cross sectional study conducted in Southern Brazil indicated that the greater number of ART doses to be taken per day, the more difficult was treatment adaptation and a reason for missing doses [7]. Hence, a responsible body should plan to solve such problems.

As the findings of this study indicate, clients with fair adherence and poor adherence had more chance of developing unsuppressed viral load than their reference group. This might be due to missing ART doses that would lead to suboptimal concentration of the medication in the serum, which then leads to fast viral replication and high viral load. Similarly, those studies conducted in Rwanda [30], India [22] and New York [25] supported this study.

In this study, the ART drug regimen showed a significant association with antiretroviral treatment failure. Beyond what has been said, clients who were on Nevirapine base were less likely to develop unsuppressed viral load. This might be due to the fact that clients who start on 1st line ART drug regimen have better outcomes than those 2nd line regimen. However, comparing with the 1st line drug regiment which was the reference group in this study revealed that clients had a lesser chance of developing viral non suppression. This might be due to the fact that clients were strictly adherent to the ART medication. On the other hand, those clients who were on the 2nd line ART medication were more likely to develop high viral load than their reference group. This findings was supported by a study done in Brazil [31,32].

Conclusion

The viral non suppression was higher to meet the 3rd 90 of UNAIDS strategy. Fair adherence and poor adherence were significantly associated with a high chance of developing high viral load and antiretroviral treatment failure. And also, clients who were on 2nd line regimen had a high chance of viral non suppression and treatment failure. However, socio-demographic status of clients was not significantly associated with viral non suppression.

Acknowledgment

We would like to thank Addis Continental Institute of Public Health for allowing us to conduct this study. Our gratitude goes to St Peter Specialized Hospital ART clinic staff and the hospital's research department staff for helping us throughout the study and data collection. This study obtained fund from Addis Continental Institute of Public Health for data collection only. The authors declare that they have not received funds for the publication of this manuscript. The funders had no role in study design, data collection and analysis, decision to publish, or preparation of the manuscript.

Bibliography

1. WHO Key fact HIV (2021).
2. WHO Key fact HIV (2020).
3. Chhim K., *et al*. "Factors associated with viral non-suppression among adolescents living with HIV in Cambodia: a cross-sectional study". *AIDS Research and Therapy* 15.1 (2018): 20.
4. Kazooba P., *et al*. "Virological failure on first-line antiretroviral therapy; associated factors and a pragmatic approach for switching to second line therapy-evidence from a prospective cohort study in rural South-Western Uganda, 2004-2011". *Pan African Medical Journal* 29 (2018): 191.
5. Cyrus-Cameron E., *et al*. "Disparity in retention in care and viral suppression for black Caribbean-born immigrants living with HIV in Florida". *International Journal of Environmental Research and Public Health* 14.3 (2017): 285.
6. Sheehan D., *et al*. "Retention in HIV care and viral suppression: individual- and neighborhood-level predictors of racial/ethnic differences, Florida, 2015". *AIDS Patient Care and STDs* 31.4 (2017): 167-175.
7. Pinheiro CAT., *et al*. "Factors associated with adherence to antiretroviral therapy in HIV/AIDS patients: A cross-sectional study in Southern Brazil". *Brazilian Journal of Medical and Biological Research* 35.10 (2002): 1173-1181.
8. Haguihara T., *et al*. "Factors associated with mortality in HIV patients failing antiretroviral therapy, in Salvador, Brazil". *The Brazilian Journal of Infectious Diseases* 23.3 (2019): 160-163.
9. Manaye G., *et al*. "Prevalence and associated factors of treatment failure among HIV/AIDS patients on HAART attending University of Gondar Referral Hospital Northwest Ethiopia". *BMC Immunology* 19.1 (2018): 37.
10. WHO Global Health Observatory. "Tables for Health Statistics by country, Annex 2, WHO region and Globally-Monitoring Health for the SDGs". Geneva, Switzerland: WHO (2019).
11. Federal Democratic Republic of Ethiopia's HIV/AIDS Prevention and Control Offices (HAPCO) report in October, Addis Ababa, Ethiopia (2021).

12. "Ethiopia Population-Based HIV Impact Assessment EPHIA 2017-2018". In: EPHI, Addis Ababa, Ethiopia: Federal Ministry of Health (FMOH)/ the Ethiopia Public Health Institute (EPHI) (2018).

13. Ahmed SI., *et al*. "Factors associated with poor CD4 and viral load outcomes in patients with HIV/AIDS". *Journal of Medical Virology* 88.5 (2015): 790-797.

14. Raimondo M., *et al*. "HIV-positive individuals on ART and with viral load suppressed in 12 Infectious Diseases Clinics in Italy: successes and disparities in the HIV Continuum of Care". *AIDS Research and Human Retroviruses* 33.6 (2017): 575-582.

15. Chesney M. "Factors affecting adherence to antiretroviral therapy". *Clinical Infectious Diseases* 30.2 (2000): S171-S176.

16. Quoc Dat V., *et al*. "Viral load suppression and acquired HIV drug resistance in adults receiving antiretroviral therapy in Viet Nam: results from a nationally representative survey". *Western Pacific Surveillance and Response Journal: WPSAR* 9 (2018): 16-24.

17. Bezabih YM., *et al*. "Factors associated with first-line antiretroviral treatment failure in adult HIV-positive patients: a case-control study from Ethiopia". *BMC Infectious Diseases* 19.1 (2019): 537.

18. Biressaw S., *et al*. "Adherence to antiretroviral therapy and associated factors among HIV infected children in Ethiopia: Unannounced home-based pill count versus caregivers' report". *BMC Pediatrics* 13 (2013): 132.

19. Becerra J., *et al*. "Recent insights into the HIV/AIDS pandemic". *Microbial Cell* 3.9 (2016): 450-474.

20. Girum T., *et al*. "Trend of HIV/AIDS for the last 26 years and predicting achievement of the 90-90-90 HIV prevention targets by 2020 in Ethiopia: a time series analysis". *BMC Infectious Diseases* 18.1 (2018): 320.

21. Umar E., *et al*. "Virological non-suppression and its correlates among adolescents and young people living with HIV in Southern Malawi". *AIDS and Behavior* 23.2 (2019): 513-522.

22. Karade S., *et al*. "Cross-sectional study of virological failure and multinucleoside reverse transcriptase inhibitor resistance at 12 months of antiretroviral therapy in Western India". *Medicine* 95.37 (2016): e4886.

23. Eshleman S., *et al*. "Virologic outcomes in early antiretroviral treatment: HPTN 052". *HIV Clinical Trials* 18.3 (2017): 100-109.

24. Desta A., *et al*. "HIV virological non-suppression and factors associated with non-suppression among adolescents and adults on antiretroviral therapy in northern Ethiopia: a retrospective study". *BMC Infectious Diseases* 20.1 (2020): 4.

25. Robertson M., *et al*. "Linkage and retention in care and the time to HIV viral suppression and viral rebound - New York City". *AIDS Care* 27.2 (2015): 260-267.

26. Anglemyer A., *et al*. "Early initiation of antiretroviral therapy in HIV-infected adults and adolescents: A systematic review". *AIDS (London, England)* 28.2 (2014): S105-S118.

27. Huang Y-C., *et al*. "Short-term outcomes of rapid initiation of antiretroviral therapy among HIV-positive patients: real-world experience from a single-centre retrospective cohort in Taiwan". *BMJ Open* 9.9 (2019): e033246.

28. Rangarajan S., *et al*. "Factors associated with HIV viral load suppression on antiretroviral therapy in Vietnam". *Journal of Virus Eradication* 2.2 (2016): 94-101.

29. Endalamaw A., *et al*. "HIV/AIDS treatment failure and associated factors in Ethiopia: meta-analysis". *BMC Public Health* 20.1 (2020): 82.

30. Elul B., *et al*. "High levels of adherence and viral suppression in a nationally representative sample of HIV-infected adults on antiretroviral therapy for 6, 12 and 18 months in Rwanda". *PLOS ONE* 8.1 (2013): e53586.

31. Ahmed M., *et al*. "Predictors of virological treatment failure among adult HIV patients on first-line antiretroviral therapy in Woldia and Dessie hospitals, Northeast Ethiopia: a case-control study". *BMC Infectious Diseases* 19.1 (2019): 305.

32. Silveira M., *et al*. "Long-term immune and virological response in HIV-infected patients receiving antiretroviral therapy". *Journal of Clinical Pharmacy and Therapeutics* 41.6 (2016): 689-694.

Volume 13 Issue 12 December 2025