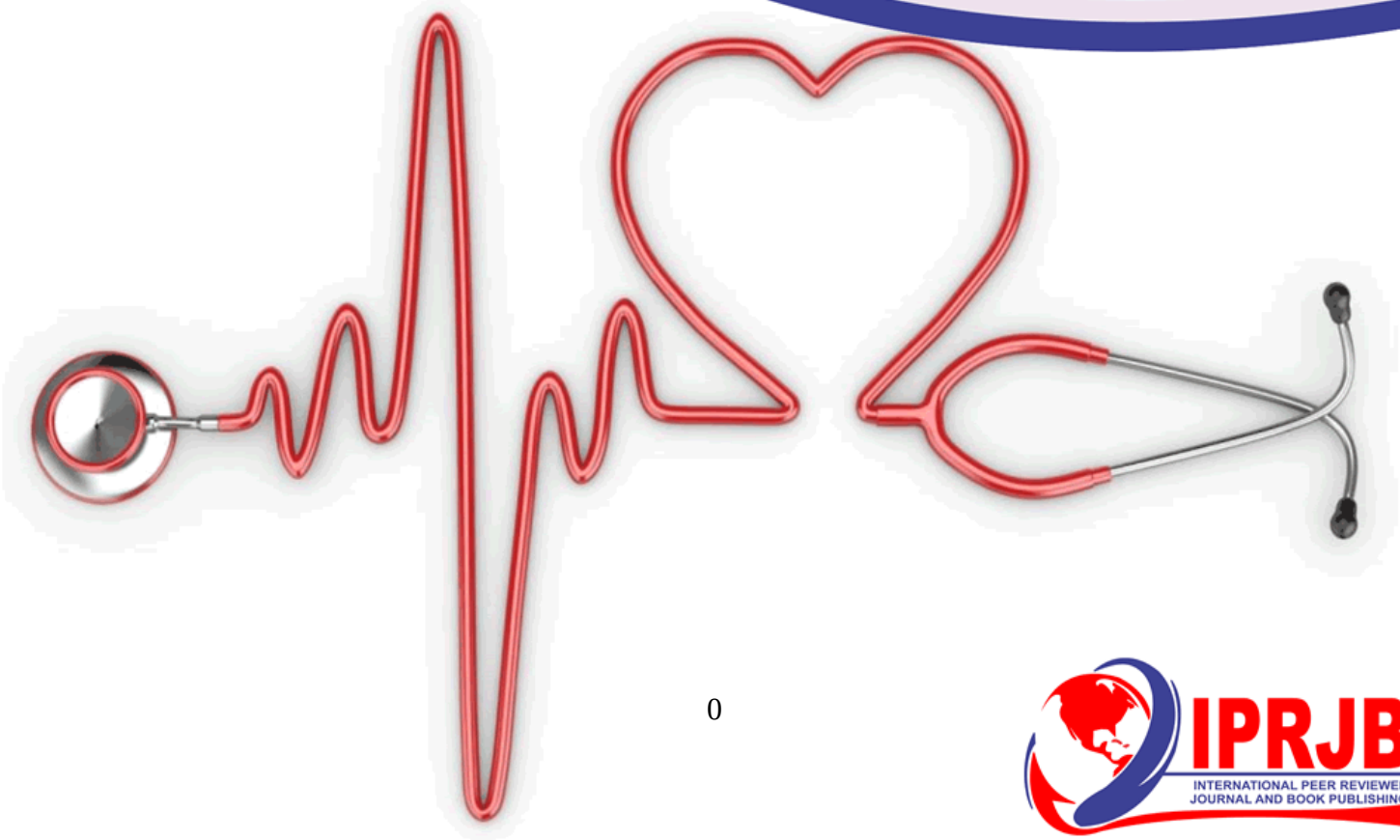
Journal of
Health, Medicine and Nursing
(JHMN)

FACTORS INFLUENCING ANTIRETROVIRAL TREATMENT FAILURE AMONG ADULT HIV PATIENTS ON TREATMENT AT BOMU HOSPITAL –MOMBASA COUNTY

Mussa Mwamzuka, Professor Simon Karanja and Dr Aabid A. Ahmed



IPRJB
INTERNATIONAL PEER REVIEWED JOURNAL AND BOOK PUBLISHING

Journal of Health, Medicine and Nursing
ISSN 2520-4025 (Online)
Vol.3, Issue 3 No.1, pp 1 - 15, 2018
www.iprjb.org

FACTORS INFLUENCING ANTIRETROVIRAL TREATMENT FAILURE AMONG ADULT HIV PATIENTS ON TREATMENT AT BOMU HOSPITAL –MOMBASA COUNTY

[1*] Mussa Mwamzuka
[1]Post Graduate Student: Jomo Kenyatta University of Agriculture and Technology
*Corresponding Author's E-mail: musa.mwamzuka@gmail.com

[2]Professor Simon Karanja
Lecturer: Jomo Kenyatta University of Agriculture and Technology
E-mail: skaranja@jkuat.ac.ke

[3]Dr Aabid Ahmed M.B.Ch.B., Msc.CRA., PhD
Chief Executive Officer: Bomu Hospital
E-mail: Aabid.ahmed@bomuhospital.org

Abstract

Purpose: To determine factors that influence ARV treatment failure among adult clients on follow up Bomu Hospital, Mombasa County.

Materials and Methods: The study was a cross sectional at initial patient recruitment and retrospective for patient level data. 299 study participants were selected from a total of 18 425 active on ART. Convenient sampling technique was used to select the adult population for study and thereafter it was categorized into two groups. Semi-structured interview schedules were used to obtain demographic information and patients' views on various dimensions of ART services at the hospital.

Results: Using Chi square test of independence (Fisher exact test) it was found that there was significant association at 5% level of significance between viral suppression and some of the social demographic factors namely marital status and age groups. Using multiple logistic regression model to determine which social demographic and social economic factors affect viral suppression, it was found that age groups and marital status are statistical significant at 10% and 5% respectively. The results showed that there was no significant relationship between period of treatment, co infections and viral suppression. There was positive significant relationship between the viral suppression and current CD4 count. The viral suppression was higher among those with high CD4 count.

Unique contribution to theory, practice and policy: Antiretroviral treatment success requires a multidimensional approach to achieve a complete viral suppression**.** These multidisciplinary team approaches that include doctors, nurses, pharmacists, counselors and family members must be available to coordinate some of the adherence-related activities. This also increases the likelihood that patients will find someone on the care team to whom they can comfortably relate and from whom they can get needed information about their medications

Key words: *Co-morbidities, ARV treatment, socioeconomic, CD4 counts and viral loads*

1.0 INTRODUCTION

HIV continues to be a major global public health issue, having claimed more than 39 million lives so far. In 2013, 1.5 (1.4–1.7) million people died from HIV-related causes globally. There were approximately 35.0 (33.2–37.2) million people living with HIV at the end of 2013 with 2.1 (1.9–2.4) million people becoming newly infected with HIV I globally. Sub-Saharan Africa is the most affected region, with 24.7 (23.5–26.1) million people living with HIV in 2013. In addition, Sub-Saharan Africa accounts for almost 70% of the global total of new HIV infections.

HIV infection is usually diagnosed through blood tests detecting the presence or absence of HIV antibodies. There is no cure for HIV infection. However, effective treatment with antiretroviral (ARV) drugs can control the virus so that people with HIV can enjoy healthy and productive lives. In 2013, 12.9 million people living with HIV were receiving antiretroviral therapy (ART) globally, of which 11.7 million were receiving ART in low- and middle-income countries. The 11.7 million people on ART represent 36% (34–38%) of the 32.6 (30.8–34.7) million people living with HIV in low- and middle-income countries. Pediatric coverage is still lagging in low- and middle-income countries. In 2013 less than 1 in 4 children living with HIV had access to ART, compared to over 1 in 3 adults (WHO, 2015).

Kenyan HIV prevalence in the general population reached a peak of 10.5% in 1995-96, after which it declined by about 40% to reach approximately 6.7% in 2003. Since then, the epidemic has remained relatively stable, with the prevalence ranging from 6.7% in 2003 to 5.6% in 2012. The stabilization of the prevalence is largely attributed to the scale up of HIV treatment and care, while the reduction of new infections has been marginal. The major concern is how to significantly reduce infections while scaling up treatment and care (KASF 2014/2015 – 2018/2019). The new UNAIDS strategy 2011–2015 aims to advance global progress in achieving country set targets for universal access to HIV prevention, treatment, care and support and to halt and reverse the spread of HIV and contribute to the achievement of the Millennium Development Goals (MDGs) by 2015.

Substantial progress has been made over the last several years in the number of people receiving antiretroviral drugs for HIV/AIDS treatment. By the end of 2011, approximately 34 million people were living with HIV globally, with almost 97% coming from low and middle income countries, (UNAIDS, 2012). In the same year, more than 8 million HIV- infected individuals in low and middle income countries were receiving antiretroviral therapy (ART), up from just 400,000 in 2003,(UNAIDS, 2012). In Kenya, approximately 10,000 HIV infected individuals were on ART in 2003. By the end of 2011, more than 400,000 individuals had initiated ART in the country, (NACC and NASCOP, 2012). This increase in number of people with access to ART has resulted in substantial decline in HIV incidence, morbidity and mortality (Bendavid and Bhattacharya, 2009; Jahn A; *et al.*, 2008; and UNAIDS; 2011).

Use of effective antiretroviral therapy (ART) has led to major improvement in the health of HIV-infected populations (Palella et *al.*, 2006). The development of potent antiretroviral therapy in the form of Highly Active Antiretroviral Therapy (HAART) has substantially reduced AIDS-related morbidity and mortality (Luc *et al.*, 2004). For most people treated to date, ART has been based on a combination of drugs from two of the three original classes; non-nucleoside reverse transcriptase inhibitors (NNRTIs); nucleoside reverse transcriptase inhibitors (N(t)RTIs); and protease inhibitors (PIs). The key indicators of the degree of success of the national ART programme include the proportion of patients on therapy that achieve HIV viral load suppression

to lower than detectable levels and the proportion of patients that attain a CD4 count more than 350 cells/ mm(Paul S Albert, 1999) .

Formerly, the natural history of HIV infection was invariably unidirectional, progressively leading to acquired immunodeficiency syndrome (AIDS) and death, and the efficacy of therapy was determined by its ability to delay this fast progression(Paredes *et al.*, 2000). The treatment of HIV infection started with the use of one antiretroviral drug (mono therapy) and then dual therapy and it was only in 1996 that it was realized that a combination of three antiretroviral drugs (triple therapy) could achieve an undetectable viral load.

Today, the clinical prognosis of HIV infection has radically changed because of the widespread use of HAART (Paredes *et al.*, 2000). Partly because most studies link plasma HIV -1 RNA levels with risk of clinical progression, the positivist goal of antiretroviral therapy is now to reduce and maintain HIV – 1RNA levels below the lowest detectable level (Hirsch *et al*., 2000). As the duration of infection increases, however, the mortality rate among HIV-infected patient's increases compared with the general population (Yazdan Y, 2009). This long-term excess mortality is likely to persist because antiretroviral therapy -related toxicity, non-adherence, and drug resistance, which may lead to treatment failure, are likely to increase with time on combination with antiretroviral therapy.

Failure of therapy is usually defined in terms of lack of sufficient suppression of viral replication (Paredes *et al.*, 2000). There are three kinds of treatment failure namely: virological failure, immunological failure and clinical failure. Increasing numbers of patients have experienced multiple episodes of virological failure, with those who initiated therapy with mono or dual nucleoside therapy before the HAART era, at particularly high risk (Bansi *et al.*, 2010). Studies have shown that the lowest HIV-1 RNA levels achievable are required to obtain durable virological responses. Durability of virological and immunological responses should be understood as the major goal to improve the clinical prognosis of patients (Paredes et *al.*, 2000). Evaluating the proportion of patients who have experienced treatment failure is important for understanding the likely durability of ART success.

In Kenya, ARVs are offered for free in all government health facilities, some faith based hospitals and selected private facilities working closely with the government and other nongovernmental organizations such as Bomu Hospital. After 10 years of provision of ART at the Bomu Hospital, it is useful to evaluate and analyze the data available for relationships and trends of patients failing treatment in order to make informed and useful policy and operational decisions to improve and strengthen existing ART systems. Of potential importance may be the factors that influence the poor outcome of therapy in patients on ART.

1.2 Statement of the Problem

Despite recent declines in global HIV/AIDS mortality, HIV/AIDS was still the fifth leading cause of global DALYs in 2010. (Katrina F, 2013). The distribution of HIV/AIDS burden is not equal across demographics and regions. In 2010, HIV/AIDS was ranked as the leading DALY cause for ages 30–44 years in both sexes and for 21 countries that fall into four distinctive blocks: Eastern and Southern Africa, Central Africa, the Caribbean and Thailand. Although a majority of the DALYs caused by HIV/AIDS are in high-burden countries, 20% of the global HIV/AIDS burden in 2010 was in countries where HIV/AIDS did not make the top 10 leading causes of burden (Katrina F, 2013).

Studies have shown that although people living with HIV/AIDS have low life expectancy than people with no HIV infection, the introduction of antiretroviral treatment of the infection has seen of people living HIV/AIDS increase over the years to almost the level of the general population (Ashford, 2006). Other studies have also shown that since the introduction of ART, mortality rates among PLWHA have become much closer to the general mortality rates (Campsmith *et al.,* 2003; Krishnan et al., 2008; Nakagawa *et al*., 2012; Mills *et al*., 2011; 2012). However little has been reported on the causes of antiretroviral treatment failure which are site or region specific or even among clients with good adherence.

While these studies have shown improved clinical outcomes of PLWHA, information about the different factors that influence antiretroviral treatment failure and how chronic management of HIV/AIDS has affected their lives is rare. Persons infected with HIV are not only concerned with the treatment ability to extend life but also with the quality of the life they are able to lead (Delate and Coons, 2001).

In Kenya, it is not known how long people living with HIV/AIDS can expect to live and what proportion of this life is lived in good health. With inequalities recorded across Kenyan population in almost all health indicators, it is not known if the same pattern can be expected for health adjusted life expectancy among HIV/AIDS patients and what factors explain differences in treatment outcomes among clients put on antiretroviral therapy. Reasons for continued health losses to HIV when ART is widely available are poorly understood. The care cascade describes the series of engagements with the health system through which people with HIV must pass to benefit fully from ART, beginning with HIV testing, and ending with regular monitoring of patients in a state of sustained viral suppression.

The focus of this study was to determine antiretroviral treatment outcome among PLWHA and thereby understand the possible factors that could contribute to treatment failure even among those clients with good adherence. Reasons for continued health losses to HIV when ART is widely available are poorly understood. The care cascade describes the series of engagements with the health system through which people with HIV must pass to benefit fully from ART, beginning with HIV testing, and ending with regular monitoring of patients in a state of sustained viral suppression.

The continued search for different drug combinations, preferential change in first line drugs and identification of novel drugs has been a boon for an effective viral suppression. However, the success of the drug treatment is achieved at the cost of life threatening adverse drug effects, drug-drug interactions and an inconvenience of lifelong therapy. Since the disease has stepped into its third decade, there are several treatment-experienced patients living either with drug toxicity or facing the threat of treatment failure due to a multi-drug resistance. Moreover, there is likelihood of newly infected untreated patients harboring HIV mutants that are already resistant to commonly used ARV drugs. (Johnson VA *et al.*, 2008). Thus, there are many critical issues associated with the use of ARV drugs that need to be addressed.

1.1.1 Challenges with the Use of ARV Drugs

The critical issues associated with ART are related to the characteristic features of the virus (HIV), ARV drugs and HIV positive patients. These factors are a major challenge for an effective long term treatment.

HIV related factors

HIV, a retrovirus, multiplies at a rate of approximately 10 copies per day. At such a high rate of replication, the virus often commits mistakes and results into mutants. (Williams KJ and Loeb LA, 1992) High mutation rate leads to development of multiple strains and threatens the development of drug resistance. Once infected, the virus becomes an integral part of host cell and survives the full life span of infected host cell, (Perelson *et al.*, 1996) especially in T-lymphocytes and urogenital secretions. Surprisingly, despite complete plasma viral load suppression for 6-12 months, the virus remains detectable in seminal fluid and more often than not, these are drug resistant variants (Finzi *et al.*, 1997).

The existence of virus in potential 'reservoirs' and the subsequent replication may cause relapse following cessation of ART, necessitating lifelong treatment (Siliciano *et al.*, 2003).Different treatment strategies have been tried for the persistent forms, but to date, no clinical or virological benefit has been reported (Kulkosky J and Bray S, 2006). Increasing reports of multi-drug resistant (MDR) virus in treatment-experienced patients are also being encountered (Martinez and Wainberg MA, 2008).

ARV related factors

Attempts to eradicate the virus from the 'reservoir' have failed despite intensifying the ARV treatment, implying that drugs cannot reach in adequate concentration in the latent reservoir cells. (Kulkosky J and Bray S, 2006). Each class of ARV drugs has the potential to cause toxicities, many of which are shared by drugs likely to be used concomitantly in HIV positive patients. This complicates the treatment, causes difficulty in causality assessment and may require treatment withdrawal in serious life threatening reactions.

Long term use of HAART has been reported to produce morphologic and metabolic abnormality syndrome, especially hypertriglyceridemia (HTG) (Carr *et al.*, 1999). This in turn has increased the risk of cardiovascular (CVS) and cerebrovascular diseases in patients receiving ART (Bozzette *et al.*, 2003). Clinically significant drug-drug interactions frequently seen in patients on ART can adversely affect the patient care and complicate ART. Interactions have been observed in 14% to 26% of HIV infected patients in USA and Netherlands. (Shah *et al.*, 2007, De Maat et *al.*, 2004). The therapeutic risk of interactions is due to potent induction or inhibition of cytochrome P450 (CYP450) isoenzyme, which also metabolizes a number of other medications.

On the other hand, the evaluation of the potential interactions during clinical trials is mostly incomplete and becomes evident only during drug therapy. Further, the drugs belonging to same class also differ in their potential to cause the interactions. For example, first licensed integrase inhibitor, raltegravir is predominantly metabolized by UGT1A1- medicated glucoronidation with little potential to interact with CYP450 enzymes, whereas elvitegravir is largely metabolized by CYP3A4 (Mathias *et al.*, 2008). Moreover, ritonavir boosting effect is due to inhibition of CP450 3A4 enzyme, but it also inhibits other CYP isoenzymes and is an inducer of several liver enzymes, resulting into complicated pharmacokinetic interactions with other drugs. The drug treatment of co-existing medical disease (s) and opportunistic infections can also complicate the ART. The use of over the counter drugs and herbal drugs may potentially compromise the management (Ladenheim *et al.*, 2008).

Reduction of the plasma viremia to undetectable levels strongly correlates with strict adherence to ARV regimen that includes taking multiple drugs twice or thrice a day for rest of life. The

recommended practice to combine three or more drugs from different classes of ART results in high pill count that, along with toxicities, may cause inconvenience to the patient and poor adherence (Paterson *et al.,* 2000). All classes of ARVs demonstrate the *in vivo* resistance. However, the rate of development of drug resistance differs amongst them. Non-thymidine-containing NRTI/NtRTI combination regimens and NNRTIs have a low genetic barrier to resistance; thereby, they require fewer critical mutations to render the treatment ineffective (Johnson *et al.*, 2008).

Drug resistance is not only associated with rapid virologic failure but also present the daunting task in designing an effective treatment regimen. The limited availability of ARV drugs and safe alternatives in resource poor countries further add to the problem. The lack of monitoring for adverse events and poor access to therapeutic drug monitoring facilities also interfere with effective ART management (Johnson *et al.*, 2008).

Host related factors

Patients with pre-existing risk factors like obesity, fatty liver, psychiatric disorders, and abnormal liver and renal functions are more likely to develop ADRs and require a close monitoring. Presence of co-existing diseases like tuberculosis, anemia, diabetes mellitus and hyperlipidemia further complicate therapy, affect compliance, increase chances of drug interactions and overlapping toxicity. Clinical manifestations of intercurrent illness like hepatitis A and malaria may often present as ARV drug toxicity and challenge the treatment. Hence, it becomes difficult to differentiate between complications of HIV disease and ARV toxicity as these may present with similar signs and symptoms.

The success of HAART has increased the life expectancy of HIV patients. This has resulted into increased number of patients over 50 years, living with HIV (Nguyen N and Holodniy, 2008). It is likely that these elderly patients are exposed to broad range of concomitant medications along with ARV regimens. However, the choice of these medications may not be always straightforward. The metabolic side effects of these ART increase the risk of CVS disease. (Bozzette *et al.*, 2003) The selection of antihypertensive and antihyperlipidemic agents needs extra care, and the most appropriate drug may not always be a first line agent.

Many ARVs are contraindicated or may require dose modification or adjustment in special group of patients like pregnant women and children. Treatment of HIV-1 infected young pediatric patients is a daunting task due to limited approval of appropriate pediatric drugs, dosage formulations and fixed dose combinations. The safety and correct dosing of key ARVs have not been established in young children, and appropriate child adapted formulations do not exist. A pre-treatment counseling of patient and family members regarding the disease, strict adherence to drug treatment, regular follow-up, changing the life style and dietary measures are essential elements for successful treatment. All these require deep understanding and co-operation from HIV patients that may be challenging in developing countries.

Current antiretroviral drugs are highly effective, but drug resistance, drug-drug interactions, long term adverse events and compliance continue to be a challenge. New agents in conventional classes have revived the hopes for treatment-naïve and experienced patients. Promising new agents offer new choices as second line treatment options for treatment-experienced patients. However, an impact of their long term use on drug safety and drug-drug interactions is yet to be assessed. Several agents in entirely novel classes are under an investigation. However, none of

the new agents have shown to eradicate the virus and is free from adverse events. Hence, there is a need for continuing search for novel drugs and to optimally utilize the available drugs to combat multi-drug resistant strains and eliminate virus replication.

2.0 MATERIALS AND METHODS

The study was a cross sectional at initial patient recruitment and retrospective for patient level data. 299 study participants were selected from a total of 18 425 active on ART. Convenient sampling technique was used to select the adult population for study and thereafter it was categorized into two groups. Semi-structured interview schedules were used to obtain demographic information and patients' views on various dimensions of ART services at the hospital. All statistical analysis was performed using data analyzed using the Statistical Program for Social Scientist (SPSS) version 20 as an appropriate statistical tool for the largely descriptive nature of the study. Descriptive statistics included means, medians and proportions as appropriate for evaluation of baseline characteristics of subjects. Fisher's exact tests and unpaired t-tests was performed to compare clinical and laboratory characteristics according to viral load screening status. Multiple logistic regression attempts was used to determine the factors which could predict treatment failure

3.0 RESULTS

3.1 Socioeconomic and sociodemographic patterns

In this study a onetime viral load of greater than or equal to 1000 copies/ml was used to indicate treatment failure after a minimum period of one year of antiretroviral therapy. Study participants who failed to suppress the virus below 1000 copies /ml were classified as not responding to antiretroviral treatment. The mean age recorded was 41 years. These had an HIV infection for a period ranging from one year to 26 years. The highest study participant was on ARV use for 26 years. The laboratory tests routinely done are CD4, haemoglobin estimation, serum creatinine. WHO disease staging was done on each clinic visit in order to understand the disease progression which ranged from stage 1 to 4. This is summarized in table 1.

Table 1 Participants descriptive

Descriptive Statistics				
	N	Minimum	Maximum	Mean
Age in Years	300	18	72	41.88
Income	196	0	100,000	13,183.95
Duration of HIV Infection in Years	300	1	26	6.84
Years on ARV use	300	1	16	6.31
CurrentCD4	299	2	2787	492.03
Current Viral load	299	200	684518	20300.71
HB results	300	6.3	18.4	12.484
Serum Creatinine	299	30.6	409.1	68.302
Current WHO staging	298	1	4	1.48

3.1.1 Viral suppression and gender

Out of the total number of 299 patients, 69 (23.1%) were not responding to treatment while 230(76.9%) responded to treatment. This was further categorized as 47(23.7%) and 151(76.3%) females not responding and responding respectively. Among males 22(21.8%) did not respond

while 79(78.2%) responded well to treatment. There is no association between gender and complete viral suppression whereas each has an equal chance, p value 0.144 and odd ratio of 1.118. This is summarized by table 2

Table 2 Viral suppression among males and females.

Sex	Viral Response		Total	Chi square	P value	Odds ratio
	Not Responding (%)	Responding (%)				
Females	47(23.7%)	151 (76.3%)	198			
Males	22 (21.8%)	79 (78.2%)	101	0.144	0.704	1.118
Total	**69 (23.1%)**	**230(76.9%)**	**299**			

3.1.2 Viral suppression and herbal usage

It was seen that some patients used herbal treatments together with the ARVs either for their opportunistic infections or as a result of claims by herbalists to provide complete cure of HIV/AIDS. Different types of herbal medications were used by the study participants. These herbal drugs were very indigenous and were generally classified as herbal drugs. The use of herbal drugs together with the ARVs had no association as shown in table 3.

Table 3: Viral suppression and the use of herbal drugs together with ARVs

Herbal Drugs	Viral Response		Total	Chi square	P value	Odds ratio
	Not Responding (%)	Responding (%)				
Not Using (No)	58(21.9%)	207 (78.1%)	265	1.859	0.173	0.586
Using(Yes)	11 (32.4%)	23 (67.6%)	34			
Total	**69 (23.1%)**	**230(76.9%)**	**299**			

3.1.3 Viral suppression and alcohol consumption

The study findings indicated that 284 study participants were not on alcohol use during their course of antiretroviral treatment. 15 study participants out of 299 (15%) were on alcohol use during the period antiretroviral treatment. 11 (73.3%) had a complete viral suppression among those on alcohol use while 4 (26.7%) failed to achieve viral suppression. The results are shown in table 4.

Table 4 Use of alcohol and viral suppression.

Alcohol consumption	Viral Response		Total	Chi square	P value	Odds ratio
	Not Responding(%)	Responding (%)				
Not Using(No)	65(22.9%)	219(77.1%)	284	0.115	0.735	0.816
Using(Yes)	4 (26.7%)	11 (73.3%)	15			
Total	**69 (23.1%)**	**230(76.9%)**	**299**			

3.1.4 Viral suppression among age groups

Patients above 18 years of age who met the inclusion criteria were recruited in the study. The age groups were categorized as per table 5. A good viral suppression was seen among the elderly

population. The age groups 41-50 and 51-60 had a good viral suppression of 80.7% and 88.2% respectively.

Table 5: Viral suppression among age groups

Age Groups in Years	Viral Response		Total	Chi square	P value
	Not Responding (%)	Responding (%)			
Less than 20	1(50%)	1(50%)	2		
21-30	14(36.8%)	24(63.2%)	38		
31-40	25(24.5%)	77(75.5%)	102		
41-50	27(19.3)	113(80.7%)	140		
51-60	2(11.8%)	15(88.2%)	17	7.350	0.119
Total	**69 (23.1%)**	**230(76.9%)**	**299**		

3.1.5 Viral suppression and marital status

Respondents less than 18 years were excluded from this study since they are outside the minimum legal age of marriage in Kenya. Study participants were classified to be divorced, married, widowed or were still single. Table 6 summarizes the viral suppression responses among these different classes.

Table 6: Viral suppression and marital status

Age Groups in Years	Viral Response		Total	Chi square	P value
	Not Responding (%)	Responding (%)			
Divorced	16(40%)	24(50%)	40		
Married	31(18.7%)	135(81.3%)	166		
Single	15(34.9%)	28(65.1%)	43	13.963	.003
Widowed	7(14.0%)	43(80.7%)	50		
Total	**69 (23.1%)**	**230(76.9%)**	**299**		

3.1.6 Viral suppression and occupation

On employment status it was seen that majority of the study participants 106, were self employed. One student was enrolled in the study with a 100% poor viral response. Table 7 summarizes viral suppression and occupation.

Table 7 Viral Suppression and employment levels

Employment status	Viral Response		Total	Chi square	P value
	Not Responding (%)	Responding (%)			
Employed	21(21.9%)	75(78.1%)	96		
Self employed	27(25.5%)	79(74.5%)	106		
Student	1(100%)	0(0%)	1		
Unemployed	20(20.8%)	76(79.2%)	96	4.026	.259
Total	**69 (23.1%)**	**230(76.9%)**	**299**		

3.1.7 Viral suppression and smoking

The results show that 10 study participants were smokers in their course of antiretroviral treatment. 4 (40%) had a poor viral suppression while 6(60%) had a complete viral suppression. as per table 8

Table 8 Viral suppression and smoking

Smoking	Viral Response		Total	Chi square	P value	Odd ratio
	Not Responding (%)	Responding (%)				
Smoking	4(40.0%)	6(60.0%)	10			
Not Smoking	65(22.5%)	224(77.5%)	289			
Total	**69 (23.1%)**	**230(76.9%)**	**299**	1.669	.196	.435

3.1.8 Viral suppression and salary

The level of income earning has a direct impact of the economic well being of any individual. The results show that the economic well being as well as a complete viral suppression was realized among the study participants with higher earnings. Study participants with salaries over Ksh 40,000 had 100% viral suppression. Table 9 summarizes the findings.

Table 9 Viral suppression and salary

Salary in Ksh	Viral Response		Total	Chi square	P value
	Not Responding (%)	Responding (%)			
Less than 10,000	31(26.3%)	87(73.7%)	118		
10,001 – 20,000	7(17.5%)	33(82.5%)	40		
20,001 - 30,000	4(20.0%)	16(80.0%)	20		
30,001 - 40,000	4(50.0%)	4(50.0%)	8		
40,000 – 50, 000	0(0%)	4(100%)	4		
50,000 – 60,000	0(0%)	2(100%)	2	6.303	.278
Total	**46 (23.1%)**	**146(76.0%)**	**192**		

Using Chi square test of independence (Fisher exact test) it was found that there are significant association at 5% level of significance between viral suppression and some of the sociodemographic factors namely marital status and age groups as supported by the Table 4.10 and Table 10 respectively.

Table 10 Association between marital status and viral suppression

Chi-Square Tests

	Value	Df	Asymp. Sig. (2-sided)
Pearson Chi-Square	11.227[a]	5	.047
Likelihood Ratio	10.327	5	.066
Linear-by-Linear Association	6.788	1	.009
N of Valid Cases	299		

a. 5 cells (41.7%) have expected count less than 5. The minimum expected count is .46.

Table 11 Association between age groups and viral suppression

Chi-Square Tests

	Value	Df	Asymp. Sig. (2-sided)
Pearson Chi-Square	13.963[a]	3	.003
Likelihood Ratio	13.238	3	.004
N of Valid Cases	299		

a. 0 cells (0.0%) have expected count less than 5. The minimum expected count is 9.23.

Using multiple logistic regression model to determine which socio demographic and socio economic factors affect viral suppression, it was found that age groups and marital status are statistical significant at 10% and 5% respectively. The elderly tends to respond more compared to the young and the married people tend to respond more compared to other segment of marital status. Using the results in the table below, the logistic regression can be fit as

$$y = \frac{e^{0.212x_1 + 0.011x_2}}{1 + e^{0.212x_1 + 0.011x_2}} \quad \text{..... (4.1)}$$

Where x_1 is the age group and x_2 is the marital status. Using the above model the probability of a patient responding can be estimated given their age group and marital status keeping other factors constant.

Table 12: Variables in the equation

Variables in the Equation

		B	S.E.	Wald	Df	Sig.	Exp(B)
Step 1[a]	AGE_GROUPS	.212	.118	3.243	1	.072	1.236
	Smoking(1)	1.152	.763	2.277	1	.131	3.164
	Alcohol use(1)	-.340	.698	.237	1	.626	.712
	Herbal drugs(1)	.442	.422	1.097	1	.295	1.555
	Marital			11.047	3	.011	
	Marital(1)	-1.242	.531	5.479	1	.019	.289
	Marital(2)	-.105	.468	.051	1	.822	.900
	Marital(3)	-.845	.548	2.376	1	.123	.429
	Constant	-.379	1.070	.126	1	.723	.684

a. Variable(s) entered on step 1: AGE_GROUPS, Smoking, Alcohol use, Herbal drugs, Marital.

4.2 Relationship between the duration of treatment and treatment failure

Using Pearson correlation on the years on antiretroviral use and viral suppression, it was seen that there was no correlation. The results show that there is no significant relationship between period of treatment and ARV failure as per table 4.13.

Table 13 Correlation between years on ARV use and viral suppression

Correlations

		Years on ARV use	viral response
Years on ARV use	Pearson Correlation	1	.078
	Sig. (2-tailed)		.180
	N	300	299
viral response	Pearson Correlation	.078	1
	Sig. (2-tailed)	.180	
	N	299	299

$R^2 = 0.006084$
(This implies 0.61% of the variation in Viral Response is explained by the relationship between years on ARV use and viral response. other factors contribute 99.39%)

4.3 Co infections and antiretroviral treatment

There was no association between viral suppression among the study participants with or without co infections in there course of ARVs treatment, chi square 0.145, p value 0.703. Study participants had an equal chance of getting co infection even with complete viral suppression, odds ratio of 1.111 as shown in Table 14.

Table 14 Co infections and viral suppression

Chi-Square Tests

	Value	Df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)	Odds Ratio
Pearson Chi-Square	.145[a]	1	.703			
Continuity Correction[b]	.059	1	.807			
Likelihood Ratio	.145	1	.703			1.111
Fisher's Exact Test				.783	.403	
Linear-by-Linear Association	.145	1	.703			
N of Valid Cases	299					

a. 0 cells (0.0%) have expected count less than 5. The minimum expected count is 31.62.

b. Computed only for a 2x2 table

4.4 Relationship between treatment failure and CD4 cell count

A Pearson correlation between viral suppression and CD4 is significant at p value 0.01 level (2-tailed). There is positive significant relationship between the viral suppression and current CD4

cell count. The viral suppression is higher among those with high CD4 cell counts .This is given by table 15

Table 15 Correlation between viral response and CD4

Correlations

		viral response	Current CD4
viral response	Pearson Correlation	1	.422**
	Sig. (2-tailed)		.000
	N	299	299
Current CD4	Pearson Correlation	.422**	1
	Sig. (2-tailed)	.000	
	N	299	299

**. Correlation is significant at the 0.01 level (2-tailed).

Using independent t test it can be shown that there is significant difference in means in CD4 cells between the two groups; the responsive and non responsive. Table 4.16 presents these results.

Table 16 Independent t test in CD4s between responsive and non responsive

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
		F	Sig.	T	Df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
									Lower	Upper
Current CD4	Equal variances Assumed	7.025	.008	8.016	297	.000	346.909	43.278	261.738	432.079
	Equal variances not Assumed			10.310	185.712	.000	346.909	33.647	280.529	413.288

5.0 CONCLUSIONS AND RECOMMENDATIONS

5.1 Conclusions

The study concluded that Measurement of drug resistance patterns was not done for these patients but this could have given a deep insight of the likely resistance drugs seen among the patients with poor or incomplete viral suppression.

5.2 Recommendations

The study concluded that antiretroviral treatment success requires a multidimensional approach to achieve a complete viral suppression**.** These multidisciplinary team approaches that include

doctors, nurses, pharmacists, counselors and family members must be available to coordinate some of the adherence-related activities. This also increases the likelihood that patients will find someone on the care team to whom they can comfortably relate and from whom they can get needed information about their medications.

References

Ashford, L. 2006. How HIV and AIDS affect populations. Population Reference Bureau.

Bansi L, Sabin C, Delpech V. Trends over calendar time in antiretroviral treatment success and failure in HIV clinic populations. *HIV Medicine* (2010) 11:432 – 438

Bendavid E, Bhattacharya J: The President's emergency plan for AIDS relief in Africa: an evaluation of outcomes. Ann intern Med 2009, 150(10): 688-695.

Campsmith, M. L., Nakashima, A. K., & Davidson, A. J. 2003. Self-reported health-related quality of life in persons with HIV infection: results from a multi-site interview project. BiomedCentral, 1:12.

Delate, T., and Coons, S. J. 2001. The Use of 2 Health-Related Quality-of-Life Measures in a Sample of Persons Infected with Human Immunodeficiency Virus. Clinical Infectious Diseases; 32: 47-52.

Finzi D, Blank son J, Siliciano JD, Margolick JB, Chadwick K, Pierson T, Smith K, Lisziewicz J, Lori F, Flexner C, Quinn TC, Chaisson RE, Rosenberg E, Walker B, Gange S, Gallant J, and Siliciano RF: Latent infection of CD4+ T cells provides a mechanism for lifelong persistence of HIV-1, even in patients on effective combination therapy. *Nat Med* 1999**,** 5(5)**:**512517.

Hirsch MS, Conway B, D'Aquila RT. Antiretroviral drug resistance testing in adults with HIV infection: Implications for clinical management. *JAMA*. 1998; 279: 1984-1991.

Jahn A, Floyd S, Crampin Ac. Population– level effect on HIV on adult mortality and early evidence of reversal after introduction of antiretroviral therapy in Malawi. *Lancet* 2008, 371(9624):1603-1611.

Katrina F. Ortblad; Rafael Lozano; Christopher J.L. Murray. AIDS. 2013;27(13):2003-2017. © 2013

Mills, E. J., Bakanda, C., Birungi, J., Chan, K., et al. 2011. Life expectancy of persons receiving combination antiretroviral therapy in low-income countries: a cohort analysis from Uganda. Ann Intern Med, 155(4), 209-216.

Mills, E. J., Bakanda, C., Birungi, J., Chan, K., et al. 2011. Life expectancy of persons receiving combination antiretroviral therapy in low-income countries: a cohort analysis from Uganda. Ann Intern Med, 155(4), 209-216.

Nakagawa, F., Lodwick, R. K., Smith, C. J., et al., 2012. Projected life expectancy of people with HIV according to timing of diagnosis. AIDS. 2012 Jan 28;26(3):335-43.

Palella FJ, Delaney KM, Moorman AC. Declining morbidity and mortality among patients with advanced human immunodeficiency virus infection. *New England Medical Journal*. (1998); 338 (13): 853–860

Paredes R, Mocroft A, Kirk O. Predictors of virological success and ensuing failure in HIV-positive patients starting Highly Active Antiretroviral Therapy in Europe. *Arch Intern Med*. (2000) 160:1123-1132

WHO, UNAIDS, UNICEF: Towards universal access: scaling up priority HIV/AIDS interventions in the health sector. Progress report 2009. *Geneva* 2009.

WHO: Antiretroviral therapy for HIV infection in adults and adolescents: Recommendations for a public health approach, 2010 revision. Accessed 18 October 2012

WHO: Rapid advice: antiretroviral therapy for HIV infection in adults and adolescents, November 2009. Accessed 18 October 2012.

Yazdan Y. Multidrug resistance: a clinical approach. Current Opinion HIV in AIDS (2009); 4: 499-506

Acknowledgements

This research was supported by the Centers for Disease Control and Prevention Co-operative agreement 5U2GPS002063-04. Its contents are solely the responsibility of the authors and do not represent the official views of the CDC