Prevalence and factors associated with viral load suppression among people living with hi in Mwanza, Tanzania

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PREVALENCE AND FACTORS ASSOCIATED WITH VIRAL LOAD SUPPRESSION AMONG PEOPLE LIVING WITH HIV IN MWANZA, TANZANIA

By

Deogratius Joseph

A Dissertation Submitted in (Partial) Fulfillment of the Requirements for the Degree of Master of Public Health of

Muhimbili University of Health and Allied Sciences
October, 2019

CERTIFICATION

The undersigned certify that she has read and hereby recommend for acceptance by Muhimbili University of Health and Allied Sciences a dissertation entitled: **"Prevalence and factors associated with viral load suppression among People living with HIV in Mwanza, Tanzania",** in (partial) fulfillment of the requirements for the degree of Master of Public Health of the Muhimbili University of Health and Allied Sciences.

_____

Dr. Marycelina Mubi

(Supervisor)

_____

Date

DECLARATION AND COPYRIGHT

I, **Deogratius Joseph,** declare that this **dissertation** is my own original work and that it has not been presented and will not be presented to any other University for a similar or any other degree award.

Signature: …… **Date:** ……..….

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I am grateful to all of those with whom I have had the pleasure to work with during this study especially the study participants and facilities staff that were involved in recruiting clients for the study.

DEDICATION

This thesis is dedicated to all PLHIV and the dedicated health care workers tirelessly working on making sure that they are healthy.

To my lovely wife, Sofia, and my daughters Arabella, Airis and Abrielle who have been my constant source of support and encouragement during the challenges of postgraduate school and life. I am truly thankful for having you in my life.

This work is also dedicated to my mother Christine, my sister Sophia and brother Lawrence who have always loved me unconditionally and whose good examples have taught me to work hard for the things that I aspire to achieve.

ABSTRACT

Background: Viral load is the quantification of Human Immunodeficiency Virus (HIV) in blood of an infected person. Viral load testing helps in assessing the effectiveness of treatment in People Living with HIV (PLHIV) to prevent them from developing AIDS. Clients with viral load of <1000copies/ml are considered suppressed. According to the Tanzania HIV Impact Survey (THIS) report, only 9% of clients eligible for HVL were tested for viral load in year 2016 and among those tested the overall viral suppression was 51.9%, and the suppression rate for Mwanza was 49.6%.There have been efforts done by the Government and different stakeholders to ensure that VL suppression of 95% and above is achieved country wide. The current prevalence of VL suppression is unknown, and factors associated with suppression have not been established for Mwanza, Tanzania.

Objective: The objective of the study was to determine the current prevalence of viral load suppression and the factors associated with viral suppression in Mwanza region, North West Tanzania.

Materials and Methods: This was an epidemiological study, with secondary data analysis and quantitative cross sectional study. The study population was generated from a large national routine care and treatment clinic (CTC) database at Ukerewe DC and Mwanza CC. Study participants were recruited using systematic random sampling. Information on viral load testing and test results were obtained from the CTC database, while factors associated with viral load suppression were obtained through individual interviews with clients. Data was analyzed using STATA version 14 program. Frequencies and percentages for testing and suppression rates were determined and logistic regression models were used to determine the strength and direction ofassociation between independent variables and viral load suppression.

Results: A total of 6206 eligible clients were extracted from selected facilities CTC2 data base from January 2016 to December 2018. 415 clients were interviewed from the eligible clients. The overall viral load testing rate was 67%. Database analysis showed that as years progressed the percentage of HVL eligible clients who were tested increased from 18% in

2016 to 86% in 2018. However, the testing frequency is still low, with the majority of clients (80.2%) having been tested only once, and only 2.3% of clients tested more than 2 times. In the cross sectional study, 88% of clients were tested for HVL, and among them, 94% had viral suppression. In multivariate analysis, only four factors: treatment regimen used, adherence level reported, pills burden and active TB infection/other infection were found to be significant predictors of viral load suppression.

Conclusions: Test coverage has increased significantly from the national coverage of 7.3% reported in 2016 to 88%. The observed viral suppression of 94% is closing the gap to reach 95%, the third UNAIDS 2030 goal. Non-adherence to medication contributes to clients not attaining viral suppression. Clients with TB/other infections have a challenge of attaining suppression, as are clients on the second line regimens and clients using two or more pills a day.

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LIST OF ABBREVIATIONS

ABC	Abacavir / Lamivudin
AIDS	Acquired Immune Deficiency Syndrome
ART	Antiretroviral Therapy
ARV	Antiretroviral
BMC	Bugando Medical Centre
CAP/CTM	Cobas Ampli Prep / CobasTaqMan
cART	Combination Antiretroviral Treatment
CC	City Council
CD4	Cluster of differentiation 4
CDC	Centers for Disease Control and Prevention
CT	Care and treatment
CTC	Care and Treatment Centre
DBS	Dried blood spot
DC	District Council
EAC	Enhanced Adherence counseling
HAART	Highly Active Antiretroviral Therapy
HF	Health Facility
HIV RNA	HIV Ribonucleic Acid/ Plasma Viral Load
HIV	Human immunodeficiency virus
HVL	HIV Viral Load
IPs	Implementing Partners
NACP	National AIDS Control Program
NNRTI	Non-Nucleoside Reverse Transcriptase Inhibitors

NRTI	Nucleoside Reverse Transcriptase Inhibitors
PI	Protease Inhibitors
PLHIV	People Living with HIV
TDF	Tenofovir
THIS	Tanzania HIV Impact Survey
UNAIDS	United Nations Program on HIV/AIDS
VL	Viral load
VLS	Viral Load Suppression
WHO	World Health Organization

DEFINITIONS OF KEY TERMS

Viral load:	Viral load is the quantification of HIV in blood[1]
.	
Viral Load Suppression:	When antiretroviral therapy reduces a person's viral load to an undetectable level[2].
Virological failure:	Plasma viral load above 1000 copies/ ml based on two consecutive viral load measurements after 3 months, with adherence support[3].
Antiretroviral:	A drug used to prevent retrovirus such as HIV to replicate[4].
Protease Inhibitors:	Antiretroviral HIV drug class that blocks protease HIV enzyme leading to failure of the virus to multiply and infect new CD4 cells[5].
Combination Antiretroviral Treatment:	Treatment that uses a combination of three or more drugs to treat HIV infection[6].

CHAPTER ONE

1.0 INTRODUCTION

1.1Background

A household survey carried out in 2016-17 showed Tanzania viral load suppression to be at 51.9%, which is far from 95% as per the target**.** The same study showed that there is an increase in HIV infection rate from 4% to 7.2% with viral suppression of 49.6%[7]. The increase in infection rate can be associated with low viral suppression in Mwanza. In order to attain epidemic control, we have to attain viral suppression of above 95%. A study in San Francisco showed that decrease in community viral load was associated with decrease in new HIV infections[8].

VL testing is an important tool in monitoring VL among HIV clients on ART. There are a number of platforms that are recommended by the WHO to be used for measuring HIV Viral load including COBAS Taq Man and Abbott Real Time m2000rt systems[9]. The systems can use Dried Blood Spot and Plasma samples for measuring viral load[10]. The two molecular systems are widely used in Tanzania.

UNAIDS set a global 95-95-95 goal to end HIV epidemic by 2030, that is 95% of people living with HIV are diagnosed, 95% are on treatment and 95% are virally suppressed[11]. According to UNAIDS 2018 world AIDS day report, 81% of HIV positive people on ART are virally suppressed, while only 47% of suppression is observed in all people living with HIV globally[12]. Suppression observed from the UNAIDS data in the Sub-Saharan African countries was 29%[13]. By 2017 Suppression observed for East and Southern Africa was 79%[14]. Data published by CDC in December 2016 showed Tanzania to have the least percentage of ART clients with one or more viral load tests in two consecutive years i.e. 5% and 9% in 2015 and 2016 respectively among 7 surveyed countries[15]. In both years Tanzania did not attain 90% suppression, where by suppression dropped from 88% in 2015 to 72% in 2016 respectively[15]. UNAIDS 2018 Data under treatment cascade shows that Tanzania achieved 73% of suppression[14].

Factors like pill burden, age and sex of the clients, CD4 levels, regimen used and the duration/length of time the client has been on medication, and adherence to medication contributes to patients viremia levels[16–18].

There is no study carried out that assessed the factors that can hinder clients attending ART clinics to achieve viral suppression in Mwanza. This study was aimed at determining the current proportion of viral load suppression among clients attending ART clinics and identify factors associated with viral suppression in Mwanza region, North West Tanzania.

1.2 Problem statement

To end HIV epidemic by 2030, WHO came up with the 95-95-95 goal UNAIDS 2018 report showed that 81% of HIV positive people on ART are virally suppressed while in the Sub-Saharan African countries it was 29%. The report also showed that Tanzania achieved 73% of suppression which is lower than other countries in Sub Saharan Africa like South Africa[15]. In addition, Mwanza was found to have high HIV burden, with viral load suppression at 49.6%.

Different studies have mentioned factors like pills burden, age, sex of the client, CD4 levels, regimen used and time client has been on medication, adherence to medication to be associated with viral load suppression[16–18].

Despite the development of different interventions and programs to improve viral load testing and suppression, we still have low levels in Tanzania. There is a need to identify factors that are associated with VL suppression in Mwanza so that they can be addressed to increase the chances of viral load suppression.

1.3 Conceptual framework

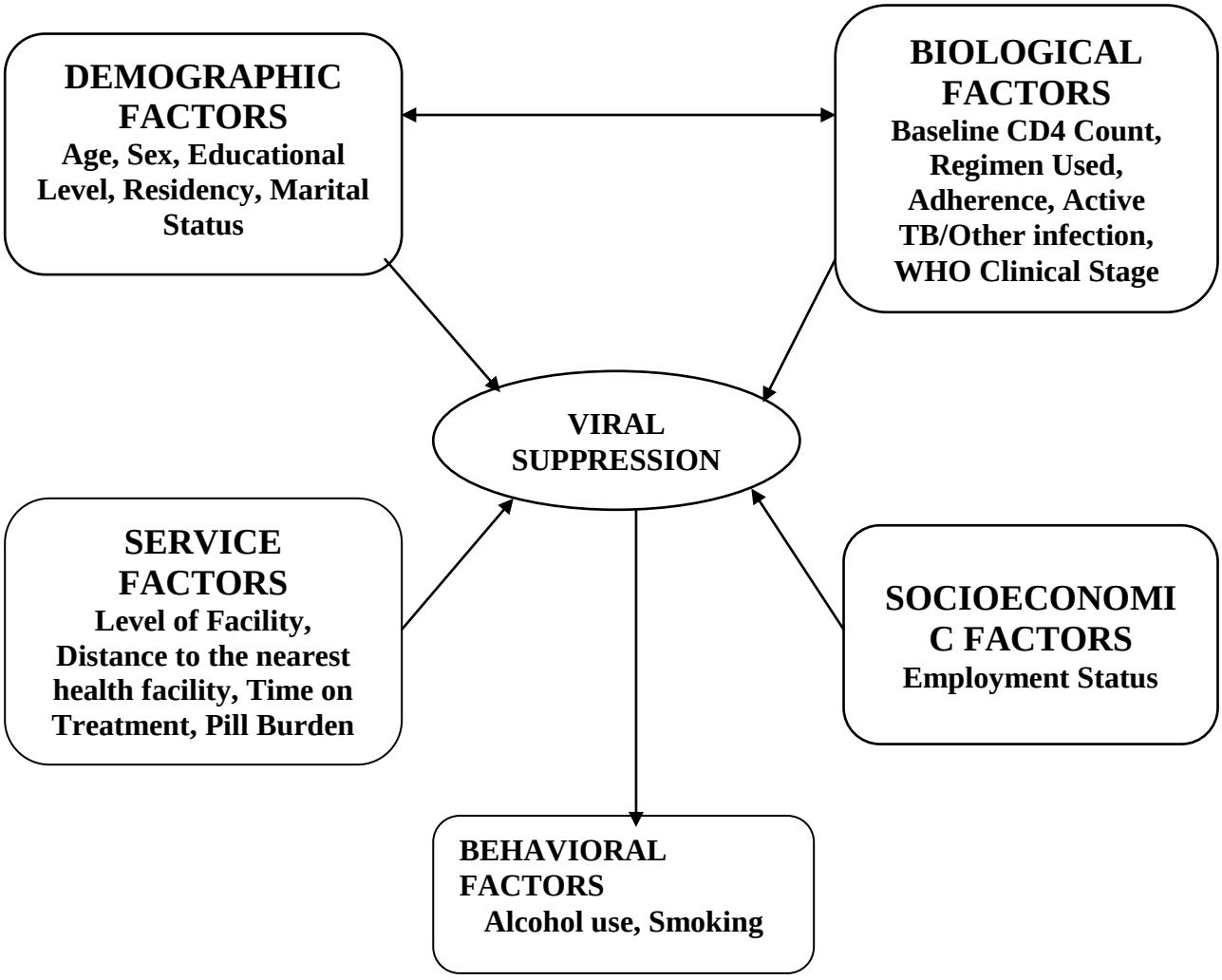


Figure 1: Factors associated with Viral Suppression

Description of the conceptual framework

The study comprises of four groups of factors i.e. demographic factors, biological factors, socioeconomic factors and service factors. Viral suppression which is our dependent variable can result from all four factors which are independent variables as per the conceptual framework. The biological factor that contribute most to viral suppression has been shown to be adherence. Behavioral factor like alcohol use can directly affect adherence to medication. Most of Service related factors mentioned in the framework can also lead to poor adherence to medication. These factors include facility level, distance to the facility that clients attend ART clinics. A statistical analysis of data collected will help

in showing relationship between these factors and how they contribute to viral suppression. We also have demographic factors including age, sex, educational level, residency and marital status. The study will look at how residents in the rural areas access VL service compared to residents in the urban areas.

1.4 Rationale

Poor viral load suppression has been associated with poor quality of life and increased chances of acquiring fatal opportunistic diseases such as cancer, resulting from HIV positive infection development to AIDS. Mwanza is one of the cities with a high number of HIV infections in Tanzania. Therefore, this study was carried out to provide general information on the current status of viral load suppression among clients attending ART clinics in Mwanza and the factors associated with it in Mwanza region. Information obtained from this study will also help in understanding VL services coverage in Mwanza Region, whereby we can understand how residency, facility level and distance among others affects test access to PLHIV. This information will provide an insight as to how service providers can attend their clients considering education and adherence among other factors; and also policy makers in order to improve services provided to PLHIV in care for them to attain suppression, eventually leading to improved quality of life.

1.5 Research Questions

1. What is the proportion of individual who have been tested for viral load among PLHIV in care in Mwanza, Tanzania?
2. What are the trends and number of episodes of viral testing among PLHIV in care in Mwanza, Tanzania?
3. What is the proportion of clients with viral load suppression among PLHIV in care in Mwanza, Tanzania?
4. What are the factors associated with viral load suppression among PLHIV in care in Mwanza, Tanzania?

1.6 Research Objectives

1.6.1Broad Objective

To determine the prevalence and factors associated with viral suppression among HIV patients in Mwanza, Lake Zone / Northern West Tanzania for year 2016-2018.

1.6.2 Specific objectives

1. To estimate the percentage of PLHIV with a viral load test in Mwanza, Tanzania.
2. To determine the frequency of viral load testing among PLHIV in Mwanza, Tanzania
3. To determine the prevalence of viral load suppression among PLHIV on ART in Mwanza, Tanzania.
4. To determine factors associated with viral suppression among PLHIV on ART in Mwanza, Tanzania

CHAPTER TWO

2.0 LITERATURE REVIEW

2.1 Overview of HIV infections and viral load

In the year 2016, it was estimated that 36.7 million people were living with HIV-AIDS globally, with 1.8 million new infections which is a 16% decline from the 2010 infections[12]. In the same year 1 million people died of HIV-AIDS, which was 48% less deaths compared to those that occurred in 2005. The decline in new HIV infections is slow as it was expected that there would be 500,000 new infections annually by 2016[19].

In 2016 there were 27% less AIDS related deaths among females than of males. More than 70% of the global burden of infections is accounted in Sub Saharan Africa while we have 19.1 Million people living with HIV/AIDS in Eastern and Southern Africa[20,21]. HIV/AIDS related deaths have been reduced by 51% from a peak of 1.9 million deaths in 2004, to 940,000 deaths reported in 2017[12].

A study done on the use of Non-nucleoside Reverse Transcriptase Inhibitor (NNRTIs) based HAART regimens resulted in suppression of viral load although this was highly influenced by adherence to medication[22]. Apart from adherence; age, sex, drug abuse, alcohol use, regimen, time on medication also have been shown to contribute to viral suppression[23,24]. Effective use of HAART has been proven to improve quality of life of clients on medication and also prevent clients to develop life threatening AIDS related diseases example cancer[25,26].

2.2 Proportion and episodes (frequency) of viral load testing among people living with HIV

According to Tanzania Care and Treatment guideline, HIV Viral load testing eligibility criteria include; 6 months after initiation of ART, 3 months after Enhanced Adherence Counselling (EAC) for patient with clinical or suspected with immunological failure and annual testing for suppressed clients[27]. The 2016 data review showed that among the 7 reviewed countries, Tanzania had 9% of eligible clients on ART with one or more viral

load results, while suppression was 72%[15]. These figures are much lower and far from achieving the 2020 UNAIDS goal of 90-90-90[28,15].

During a randomized study on HIV RNA measurement comparing effects of frequency of HIV-1 RNA at the 10th month follow up, the frequent group had an increase of 123 cells/cubic mm, whereas the infrequent group had an increase of only 73 cells/cubic mm[30].

A study by Romih *et al* showed that there was no significant different in the frequency of VL test for clients with CD4 count of <200 cells/cubic mm and those with ≥200 cells/cubic mm[31]. The earlier group had a 2.5 tests frequency per year where by the later had a 2.4 frequency per year of VL tests. The study also showed that there was no significant difference on rate of testing for HIV Viral load based on regimen used[31].

Clients using NNRT-based and PI-based regimens were observed to be tested for VL 2.5 and 2.4 respectively in a year. There was no data for NNRT plus PI and Nucleoside Reverse Transcriptase (NRT) only based regimens. A study in high income countries showed variation in testing characteristics with testing rate ranging from 3.9 to 5 from regimens based on NNRTI, Boosted PI, Single PI and Other cART[32].

2.3 Prevalence of viral load test among people living with HIV

Review of HVL in Kenya showed that among the population accessing viral load test services 30.5% were males and 65.9% were females[33]. The 2017 Tanzania Fact Sheet showed that there are more women that are living with HIV and on ART than men[34], which can result to having more women that can be accessing HVL testing services than men.

Due to accessibility and availability of services, clients living in rural areas may be limited to access some services due to infrastructures and availability of trained personnel. A study on access of CD4 test in Zimbabwe proved that clients in rural region were at the disadvantage when it comes to accessing the test[35]. In an effort to improve coverage in CD4 testing in Haiti, samples from peripheral sites which serves a substantial number of

clients had to be transported to testing hubs where by in 6 months there was a 76% increase in total number of clients tested for CD4 counts[36].

A study in Cameroon showed that time on ART can affect viral load testing uptake, there was a 65.67% rate in HVL testing uptake among clients with more than 24 months on ART compared to those with less time on ART, 25.87% (13-24 months) and 6.97% (7-12 months)[37]. The same study showed that there was no significant difference in HVL testing uptake among clients with pre-CD4 of greater or less than 500cells/cubic mm with the rate being at 24.27% and 24.18% respectively[37].

HVL testing rates among all clients on ART differ according to age. A review study in Kenya showed that only 11.8% of clients aged 20-<30 years were tested, while 61.9% of those aged 30 - <60 were tested[33].

A study in South Africa also showed that as distance to health facilities increased, the utilization of ART clinics decreased, and this will most likely result in low viral load test coverage to clients in care[13].

2.4 Factors associated with viral suppression among people living with HIV

Sex has been shown not to affect viral suppression. A study done in Swaziland by Jobanputra et al[23] showed that male and female had suppression rate of 82% and 85% respectively (not significantly different), which is more similar with a another study done in Kenya which showed the suppression rates to be 82.2% and 84.2% for male and female respectively. Among people on ART in Tanzania, overall viral suppression is 87.7%; with suppression among men at 84% and that among females at 89.2%[38]. Viral load suppression in HIV positive adults (15-64 years) in Tanzania is 52% where by 57.5% is in females and 41.2% is in males[38].

Naman et al study in Tanzania showed that good virological suppression is attained after 4yrs of ART initiation especially in rural Tanzania[39]. Education level has been proven to contribute to adherence to medication which has direct influence on viral load for clients in care. A study in Brazil showed that 67.8% of clients on HIV treatment with more or equal to 8 years of education had better adherence to their medication compared to 47.9% adherence among clients with 0-4 years of education[40]. Another study in Uganda also showed similar results to the one in Brazil[16].A study in Kenya showed that suppression was higher in Nairobi which is a city compared to other zones of the country and these were related to physical barriers which affects accessing of care among residents[33].

In Li et al[41] study done in France it was observed that gradual decrease of HVL concentration from month 1 to 12 to less than 200copies/mL led to steady increase in CD4 cells count[31]. Another study done in Swaziland by Jobanputra and colleagues showed that clients with CD4 Count of <350 cells/µl had a suppression rate of 79% and those with CD4 count of 350+ cells/µl had a suppression rate of 87% at the end of follow up[23]. A study in Ethiopia showed that there was higher rate of treatment failure (viral un-suppression) among clients aged <35 years, with low CD4 count, poor adherence to treatment, and longer exposure to ART[42].

A retrospective study in Kenya showed how time on ART affected suppression but the difference was not statistically significant. Clients on ART for 6 months to 10+yrs had suppression(<1000Copies/mL) ranging from 83% to 88%[33]. The first systematic review on 12 months viral suppression after initiation of ART showed that 84% suppression (300–500 copies/mL) was attained in low and middle income countries, which was not different from the developed countries[43].

Bansi et al[44] study showed that there was change in viral load pre and post HAART medication in 2-8 weeks of medication, but association was not found between use of nucleoside based regimens - ABC vs TDF and the change in viral load. A systematic review in high income countries showed that after 12 months of NNRTI-based ART regimens a 58–73% viral suppression was observed with threshold set at 400-500copies/ml of viral load[43]. A randomized trial with suppression threshold at 400copies/mL after 48wks medication with 2 NRTI & 1 PI, 2 NRTI& 1 NNRTI and 3 NRTI regimens resulted in suppression of 53%, 57% and 54% respectively[45].

The different studies presented here have shown that factors associated with VL suppression are not uniform in all areas. There was therefore a need to identify factors associated with VL suppression in Mwanza, an area with high HIV burden, so that they can be addressed by health care providers in order to increase suppression rate among clients on care. This will help to improve the quality of life of clients on ART, and reduce HIV transmission.

CHAPTER THREE

3.0 METHODOLOGY

3.1 Study design

This was an Epidemiological (Secondary Data Analysis and quantitative cross sectional) study, which data was generated from the national routine care and treatment clinic (CTC) database and interview from some participants.

3.2 Study area

This study was conducted in Mwanza Region which is located at North West Tanzania. According to the 2012 census, the population in Mwanza was estimated to be 2,772,509in 8 districts. The current HIV prevalence of Mwanza was7.2%. Out of the whole population with HIV infection 73,428 are registered in the CTC database in Mwanza (CTC2 electronic database installed in all CTC sites) as of the last quarter of 2018. Currently there are 322 centres that provides ART services with viral load testing, Ukerewe DC with 18 CTCs and Mwanza CC with 21 CTCs. By the end of 2018, there were about 5,362 new active PLHIV registered for ART services.

Health facilities were used to enrol the study participants. The health facilities were purposive selected from Mwanza City Council and Ukerewe District Council. Currently, Mwanza CC has 21,429 HIV clients and 4,139 clients in Ukerewe DC. All the facilities do provide CTC services and HVL testing as per the Tanzania care and treatment guideline. Clients recruited were proportionally distributed between the two districts. Twodistrict hospitals were used, while two health centres and one dispensary were randomly selected from each district. Clients distribution depended on proportion of each facility to the total number of adult clients in CTC.

3.3 Study population

All registered patients on CTC database. These databases capture information on almost every HIV positive patient as part of their routine ART clinics. A sub-sample of the participant recorded in the database were enrolled to participate in the study.

3.4 Inclusion and Exclusion criteria's

3.4.1 Inclusion Criteria

- They should have been enrolled in CTC database for six months and above.
- Clients should be from Mwanza CC and Ukerewe DC

3.4.2 Exclusion Criteria

- Individuals aged below 18 years (Justification; Viral Suppression Epidemiology for adults and children differs, including all age groups will make the relationship we want to determine confounded by age)

3.5 Sample size and sampling

3.5.1 Sample size estimation

For objective 1 and 2 all individuals registered in the database from January 2016 to December 2018 were included in the study.

For objective 3 and 4, a sub sample of the above study population with a valid viral load test results were enrolled in a cross sectional survey. The proportion of viral load suppression in Mwanza was estimated to be 46.9% and with significance level of 5% (Z=1.96) and precision of 5% we estimated a sample size of 383was enough to have a power of 80% to estimate the current status and generalizability of the results in hospital based setting.

A formula from Kish Leslie was used to obtain the estimated sample size above

$$n = \frac{z^2 p(1-p)}{d^2} : \frac{1.96^2 0.469(1-0.469)}{0.05^2}$$

n=383

Plus 10% for non-response = 383+38=421

Total sample was421

3.5.2 Sampling methods

This was a hospital based cross sectional study, where all participants attending CTC/ART clinics and eligible for and with viral load test within the time frame mentioned were eligible to participate.

The study was carried out in Mwanza CC and Ukerewe DC. The district hospital, 2 health centres and 1 dispensary were selected from each district. Systematic random sampling was used to recruit our study participants. In each hospital/health facility a list of eligible participants was generated and after the first recruitment the interval of 3 people attending the specific day was used to recruit the next one until the number intended was attained.

3.6 Data collection methods and tools

3.6.1 Data collection methods

- Questionnaire (Adopted from MEASURE Evaluation to monitor HIV and AIDS) was used to collect information on socio-demographic, economic, health and behavioral characteristics of the study participants.
- Data extraction was done directly from the CTC2 database through export of raw data.

3.6.2 Data collection tools

- Structured questions

3.7 Study variables

3.7.1 Dependent variable

- Viral load suppression & Viral load testing- data for calculating suppression and testing **was** extracted and computed from CTC2 data base. Following National Care and Treatment guideline we will get the set suppression criteria.

3.7.2 Independent variables

- Factors like age, sex, residency, marital status, baseline CD4 count, regimen used, adherence, active TB/Other infections, time on treatment and pill burden will be extracted from CTC2 database.
- Employments Status will be obtained using questionnaire informing on if the client is working and type of work or income activity they are involved in. Alcohol use will be assessed by the tool on frequency of drinking if client drinks, Smoking will be assessed by the type of smoke used by client if they have ever smoked. Distance

to the nearest facility will be assessed by the time clients use to reach the facilities they attend.

Demographic	**Socio-Economic**	**Behavioral**	**Service**	**Biological**
Age	Employment Status	Alcohol Use	Level of Facility	Baseline CD4 Count
Sex		Smoking	Distance to the Nearest health facility	Regimen Used
Educational Level			Time on Treatment	Adherence
Residency			Pill Burden	Active TB/Other infection
Marital Status				WHO Clinical Stage

3.8 Data management and analysis plan

Data were transferred from ACCESS database to STATA Version 14.0 (StataCorp LP, Texas, and USA) for analysis. Data was cleaned and processed before analysis. Descriptive analysis of the sample including demographic, socio-economic and biological characteristics was performed; t-tests was used to compare means for count variables and chi-square tests to determine the association between categorical variables.

Bivariate logistic regression was used to determine the unadjusted estimates between each independent variables and viral load suppression. Multivariate logistic regression models were fitted to assess adjusted associations between viral load suppression and all other independent variables that had a significant result in bivariate analysis and potential confounders. Significance was set at $P < 0.05$. Goodness of fit of the fitted models were assessed using Hosmer and Lemashow goodness of fit test using ROC curves. Tables and charts were used to present the results.

3.9 Ethical consideration

Ethical clearance was sought from MUHAS Institutional Review Board. Permission to use the CTC database was sought from the Ministry of Health through Regional Administrative Secretary via Regional Medical Officer. Informed consent were sought from clients for participation in the survey, and confidentiality was maintained through the use of identification numbers. To avoid stigmatization of study participants, recruitment was done at the CTC clinic

CHAPTER FOUR

4.0 RESULTS

4.1 Demographic characteristics of study participants

A total of 6206 clients eligible for HIV VL testing between 2016 and 2018 were extracted from the CTC2 databases of the 8 selected facilities from Ukerewe DC and Mwanza CC. The majority, 71% were females, 60% of the tested were from hospitals and 59% were from urban district. 82% of clients tested for HVL were ≥30yrs and above. Table 1 below shows the demographic characteristics of clients extracted from the CTC2 database.

Table1: Demographic characteristics of study participants (From CTC2 database) N=6206

Variable	N	%
Age group		
19-29	1125	18
30-39	2175	35
40-49	1727	28
50+	1179	19
Sex		
Male	1804	29
Female	4402	71
Health facility level		
Hospital	3561	60
Health Centre	1973	34
Dispensary	376	6
Residence/District		
Mwanza CC	3653	59
Ukerewe	2553	41

A total of 415 clients were involved in the quantitative cross sectional study to assess the prevalence of VL testing, VL suppression and associated factors. The characteristics of the study clients are given in the table 2 below. The dominant age group (35%) of participants were of 40-49 years of age followed by (30%) of 30-39 years of age. 65% of all participants were females. About half (53%) of all participants were Married/Cohabiting, while the others were never married (14%), widowed (18%) and separated/divorced (15%). Most 76% of participants completed primary and 16% completed secondary education or higher. Most of the study participants were attending hospitals and health centers (51% and 44% respectively), while only 5% were from dispensaries. Slightly over half (55%) of participants resided in urban areas.

Table 2: Demographic characteristics of study participants from the quantitative survey (N=415)

Variable	n	%
Age group		
19-29	52	13
30-39	124	30
40-49	147	35
50+	92	22
Sex		
Male	146	35
Female	269	65
Marital Status		
Never married	56	14
Married/Cohabiting	221	53
Widowed	76	18
Separated/Divorced	62	15
Education level		
None/Incomplete primary	33	8
Complete primary	317	76
Secondary and Above	65	16
Health facility level		
Hospital	211	51
Health Centre	183	44
Dispensary	21	5
Residence		
Rural (Remote)	88	21
Sub-urban	98	24
Urban	229	55

4.2 Proportion of viral load testing among PLHIV

Out of 6206 clients extracted from the CTC2 databases, 4140 were tested for HVL, giving an overall viral-load testing rate of 67% as shown in Table 3 below. 3500 of the tested clients were aged 30yrs and above. In 2016,82% of eligible clients were not tested, while 14% of HVL eligible clients were not tested in 2018. There was a statistically significant difference in in testing rate as years progressed ($p<0.001$). Statistical significance ($p<0.001$) was also observed in HVL testing by age groups. The majority (71%) of clients tested for HVL were females, and the difference in testing rate by sex was statistically significant ($p=0.019$). Statistical significance ($p=0.001$) was also observed when testing rate was compared by level of facilities, with testing rates of 75%in dispensaries, 66% in Hospitals and 64% in health centers. Seventy-three percent of eligible clients in rural areas were tested compared to 62% of clients from the urban areas.

Table 3: Testing rates among clients extracted from the CTC2 database.

Variable	**N**	Tested	Not tested	Chi-Square (P-value)
Overall	6206	4140 (67%)	2066 (33%)	
Age group				<0.001
19-29	1125	640 (57%)	485 (43%)	
30-39	2175	1407 (65%)	768 (35%)	
40-49	1727	1214 (70%)	513 (30%)	
50+	1179	879 (75%)	300 (25%)	
Sex				0.019
Male	1804	1164 (65%)	640 (35%)	
Female	4402	2976 (68%)	1426 (32%)	
Health facility level				0.001
Hospital	3561	2334 (66%)	1227 (34%)	
Health Centre	1973	1271(64%)	702 (36%)	
Dispensary	376	281(75%)	95 (25%)	
Missing =296				
Residence				<0.001
Rural	2553	1869 (73%)	684 (27%)	
Urban	3653	2271(62%)	1382 (38%)	
Testing year				<0.001
2016	1487	261(18%)	1226 (82%)	
2017	1950	1485 (76%)	465 (24%)	
2018	2769	2394 (86%)	375 (14%)	

4.3 Episodes (frequency) of viral load testing among PLHIV

A total number of 5060 Viral load tests were performed in the period 2016 to 2018, 3321 with (80.2%) of clients having been tested only once, 725 (17.5%) tested twice while 94 (2.3%) clients were tested more than 2 times. During those years, the testing frequency was high for females, having been tested up to 5 times, whereas males have been tested up to three times only. Figure 2 and 3 below show the trend of testing by sex and year.

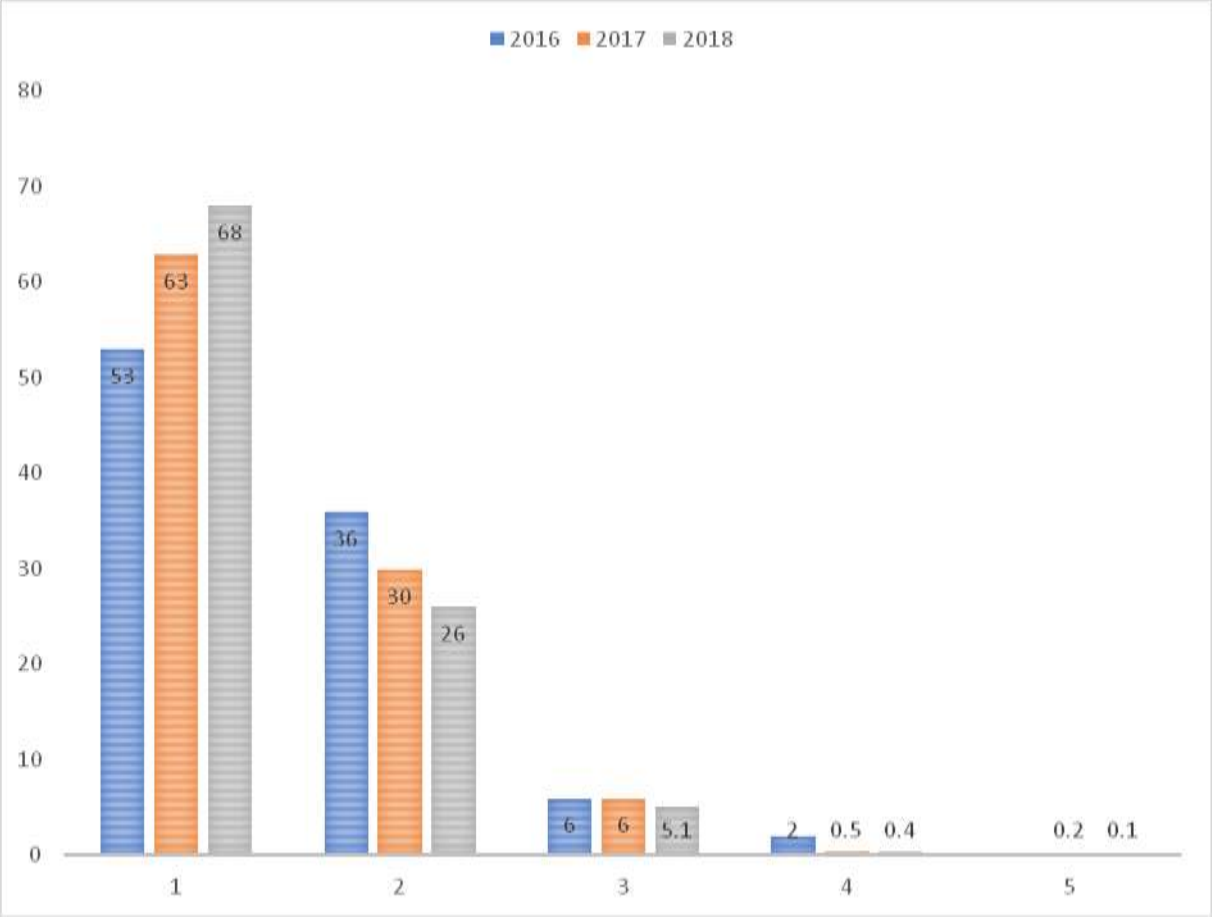


Figure 2: Proportion of viral load tests among Females living with HIV aids by year tested (n=3657)

Note: Key

1=Tested One Time, 2=Tested Two Times, 3=Tested Three Times, 4=Tested Four Times, 5=Tested Five Times

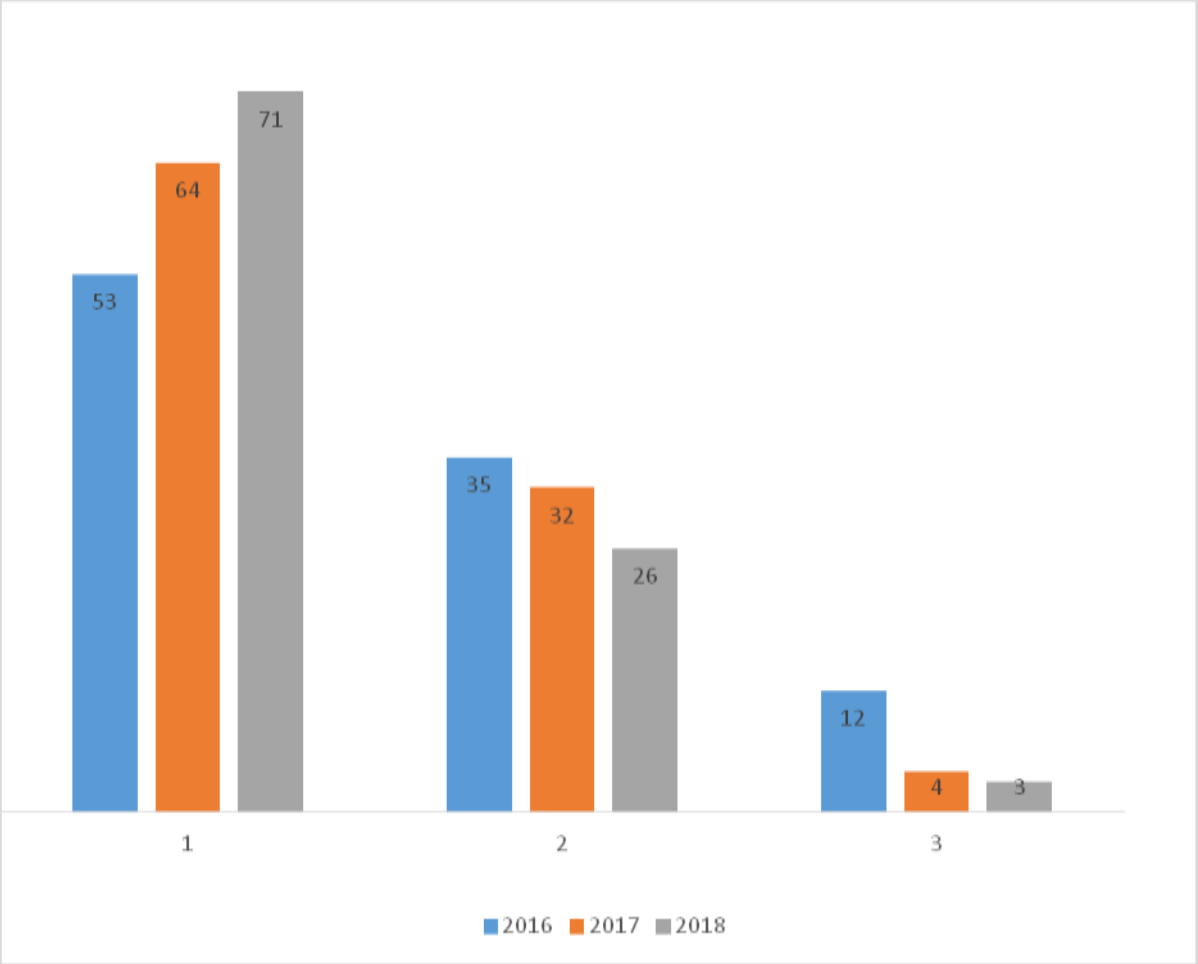


Figure 3: Proportion of viral load tests among Males living with HIV aids by year tested (N=1403)

Note: Key

1=Tested One Time, 2=Tested Two Times, 3=Tested Three Times

4.4 Prevalence of viral load test among PLHIV

A total of 415 people were included in the cross-sectional study. Overall, 88% were tested for HVL. Testing rate was 90% in the age group of 30 years and above. Testing rates by sex were almost equal, at 88 and 90% among male and female respectively. Testing rate by marital status was high in the widowed group 91% and least in the never married group 84%. Those with none or incomplete primary education were highly tested at, 91%; compared to 82% in the secondary and above group. However, the differences in testing rates by socio-demographic characteristics were not significant as shown in table 4 below.

Table 4: Testing rates among clients for cross-sectional study by socio demographic characteristics (n=415)

Variable	Number	Viral Load Testing n (%)		Chi-Square (P-value)
		Yes	No	
All study participants	415	367 (88)	48 (12)	
Age groups				0.051
18-29	52	40 (77)	12 (23)	
30-39	124	111 (90)	13 (10)	
40-49	147	133 (90)	14 (10)	
50+	92	83 (90)	9 (10)	
Sex				0.544
Male	146	131 (90)	15 (10.)	
Females	269	236 (88)	33 (12)	
Marital Status				0.673
Never married	56	47 (84)	9 (16)	
Married/Cohabiting	221	196 (89)	25 (11)	
Widowed	76	69 (91)	7 (9)	
Separated/Divorced	62	55 (89)	7 (11)	
Education level				0.163
None/ Incomplete primary	33	30 (91)	3 (9)	
Complete Primary	317	284 (90)	33 (10)	
Secondary and Above	65	53 (82)	12 (18)	
Residence				0.134
Rural-remote	88	75 (85)	13 (15)	
Sub-urban	98	83 (85)	15 (15)	
Urban	229	209 (91)	20 (9)	
Employment				0.766
Working	374	332 (89)	42 (11)	
Do not work	39	34 (87)	5 (13)	

4.5 Characteristics of individuals tested for VL

We analyzed 367 (88%) participants who were tested for viral load. Among the participants, 172(47%) and 177(48%) received their services from Health Centers and hospitals respectively, while 18(5%) received services from dispensaries. Most of the participants, 81% didn't drink alcohol, and91% were non-smokers. According to the WHO classification, 58% of clients were in WHO Stage 1 and 2, and 66% of the participants had baseline CD4 of less than 350copies/ml. The majority (96%) of participants were in the first line regimen, 55% participants have bee non medication for less than 5 years. Also the majority (94%) of participants had good adherence, and 88% participants' medication contained only one pill. Only 6(2%) had active TB/other infections. The table 5 below provides summary statistics of the participants' behavioral and biological measured characteristics.

Table 5: Characteristics of enrolled individuals tested for VL (n=367)

Variable	n (%)
Type of HF receiving care	
Dispensary	18 (5)
Health Centre	172 (47)
Hospital	177 (48)
Time to the nearest Health facility (Hours)	
Less than 1 hour	224 (61)
Greater than 1 hour	143 (39)
Alcohol drinking	
Do not drink	297 (81)
Current drinkers	70 (19)
Smoking	
Do not smoke	332 (91)
Current smokers	35 (9)
WHO clinical stage	
Stage 1	116 (32)
Stage 2	93 (26)
Stage 3	131 (36)
Stage 4	23 (6)
Missing=4	
Baseline CD4 level	
Greater or equal to 350	113 (34)
Less than 350	217 (66)
Missing=37	
Regimen	
First line	350 (96)
Second line	14 (4)
Missing=3	
Time on treatment (Years)	
Less than 5 years	201 (55)
5-9 Years	132 (36)
Greater or equal to 10 years	34 (9)
Reported Adherence level	
Good	345 (94)
Poor	22 (6)
Pill Burden	
One	323 (88)
Two or more	43(12)
Missing=1	
Active TB/Other infection	
Yes	6(2)
No	355 (98)
Missing=6	

4.6 Prevalence of viral load suppression

The overall viral load suppression was 94%. In the group of those aged30-39years, female participants had higher suppression; while in the 40-49years' group male participants had higher suppression (Figure 4). However, the difference in VL suppression rates was not statistically significant by sex and by age (p-value>0.05).

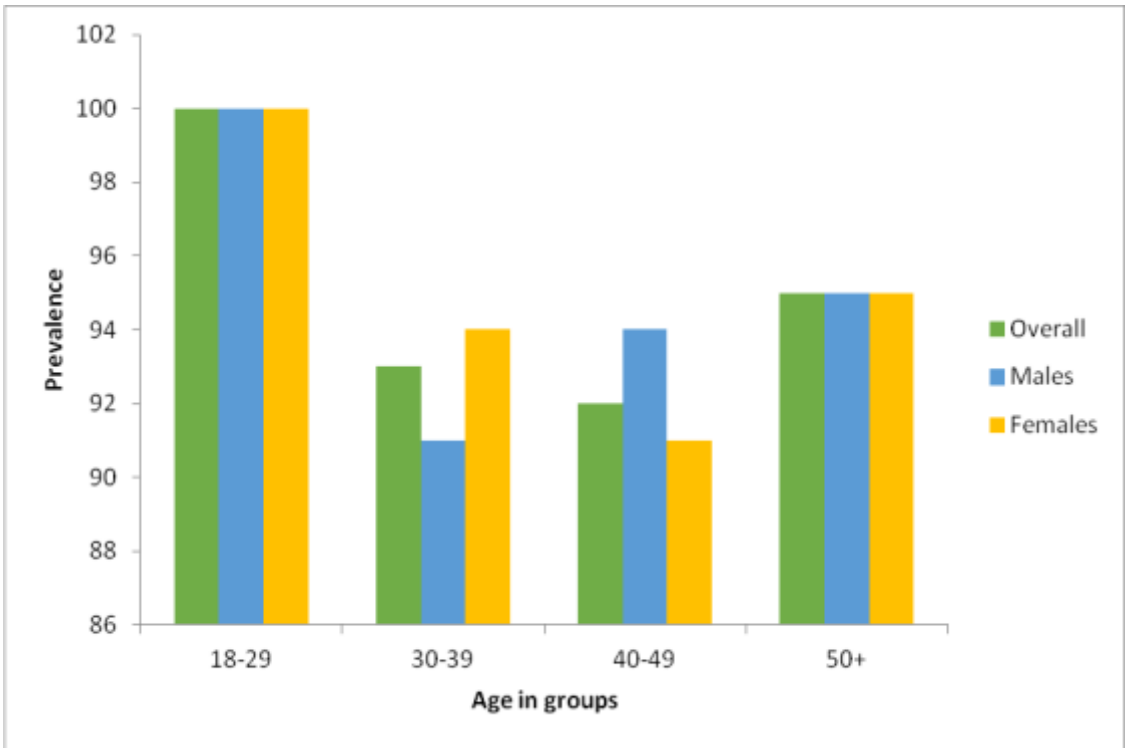


Figure 4: Prevalence of viral load suppression by age and sex

4.7 Viral load suppression by characteristics of study participants

Table 6 displays the viral load suppression status according to participant's characteristics. For most variables, including sex, age groups, time to nearest health clinic, alcohol drinking, smoking, baseline CD4 level, time on treatment and the marital status, suppression rate was >90%.There was significant difference observed on viral suppression by the following variables: education level (p=0.02), regimen used (p<0.001), adherence level reported (p<0.001), pills burden (p<0.001) and active TB infection/other infection (p<0.001).

Table 6: Bivariate analysis to determine factors associates with viral load suppression (n=379)

Variable	N?	Viral load suppression n (%)		Chi-square (P-value)
		Suppressed	Un-Suppressed	
Sex				0.946
Male		123 (94)	8 (6)	
Females		222 (94)	14 (6)	
Age in groups				0.231
18-29		40 (100)	0 (0)	
30-39		103 (93)	8 (7)	
>=40		202 (94)	14(6)	
Marital Status				0.301
Never married		46(98)	1 (2)	
Married/Cohabiting		185(94)	11 (6)	
Widowed		65(94)	4 (6)	
Separated/Divorced		49(89)	6 (11)	
Education level				
None/ Incomplete primary		24 (80)	6 (20)	0.002
Complete Primary		269 (95)	15(5)	
Secondary and Above		52 (98)	1 (2)	
Residence				0.140
Rural-remote		67 (89)	8 (11)	
Sub-urban		80 (96)	3 (4)	
Urban		198 (95)	11 (5)	
Employment				0.138
Working		314 (95)	18 (5)	
Do not work		30 (88)	4 (12)	
Type of HF receiving care				0.146
Dispensary		15 (83)	3 (17)	
Health Centre		163 (95)	9 (5)	
Hospital		167 (94)	10 (6)	
Time to the nearest Health facility (Hours)				0.847
Less than 1 hour		211 (94)	13 (6)	
Greater than 1 hour		134 (94)	9 (6)	
Alcohol drinking				0.313
Do not drink		281 (95)	16 (5)	
Current drinkers		64 (91)	6 (9)	
Smoking				0.429
Do not smoke		311 (94)	1 (3)	
Current smokers		33 (97)	21 (6)	
WHO clinical stage				0.069
Stage 1		114 (98)	2 (2)	
Stage 2		87 (94)	6 (6)	
Stage 3		120 (92)	11 (8)	

Stage 4	20 (87)	3 (13)	
Baseline CD4 level			0.680
Greater or equal to 350	107(95)	6 (5)	
Less than 350	203 (94)	14 (6)	
Regimen			<0.001
First line	333 (95)	5 (5)	
Second line	9 (64)	5 (36)	
Time on treatment (Years)			0.537
Less than 5 years	190 (95)	11 (5)	
5-9 Years	122 (92)	10 (8)	
Greater or equal to 10 years	33 (97)	1 (3)	
Reported Adherence level			<0.001
Good	338 (98)	7 (2)	
Poor	7 (32)	15 (68)	
Pill Burden			<0.001
One	310 (96)	13 (4)	
Two or more than 2	34 (79)	9 (21)	
Active TB/Other infection			<0.001
Yes	3 (50)	3 (50)	
No	19(5)	336 (95)	

4.8 Univariate analysis to determine factors associated with viral suppression

We fitted a model on the variables that showed a significant chi square test on the difference in proportion of viral suppression. A number of variable were associated with viral load suppression. Being educated increased the odds of having viral load suppression by more than 4, with those having completed primary school having higher odds of suppression compared to those had no education or incomplete education. The odds of being suppressed decreases as the reported baseline WHO clinical stage increases, with participants with WHO Stage 3 and 4 having more than 80% less odds of being suppressed compared to those with Stage 1. Having poor adherence and being on regimens with two or more pills also decreased the chances of being suppressed. Participants with no active TB/other infections were less likely to be virally un-suppressed. The odd of VL suppression associated with the different variables are presented in table 7 below.

Table 7: Univariate logistic regression analysis to determine factors associated with viral load suppression.

Variable	Un-Adjusted OR (95% CI)	P-Value
Education level		
None/ Incomplete primary	1	
Complete Primary	4.483 (1.593, 12.64)	0.005
Secondary and Above	13 (1.482, 114.445)	0.021
Type of HF receiving care		
Dispensary	1	
Health Centre	3.62 (0.885, 14.831)	0.074
Hospital	3.340 (0.828,13.466)	0.090
WHO clinical stage		
Stage 1	1	
Stage 2	0.254 (0.050, 1.291)	0.099
Stage 3	0.191 (0.042, 0.882)	0.034
Stage 4	0.117 (0.018, 0.745)	0.023
Regimen		
First line	1	
Second line	0.092 (0.0278, 0.304)	<0.001
Reported Adherence level		
Good	1	
Poor	0.009 (0.003, 0.031)	<0.001
Pill Burden		
One	1	
Two or more than 2	0.158 (0.063, 0.398)	<0.001
Active TB/Other infection		
Yes	1	
No	17.68 (3.34, 93.54)	0.001

4.9 Multivariate analysis to determine factors associated with viral suppression

The multiple logistic regression was performed to assess the strength of association between a number of factors and viral load suppression. Only variables that were statistically significant in the univariate analysis P<0.05 were included in the analysis. Sex was included in all models as a priori confounder. In multivariate analysis (using forward selection technique) after adjusting for all significant variables in bivariate analyses and potential confounder(sex) we found only drug line 0.0106 95% CI 0.012, 0.955, reported adherence level 0.006 95% CI 0.0011, 0.310, pill burden 0.119 95% CI 0.021, 0.669 and active TB/Other infection 42.44 95% CI 3.24, 555.91) to be associated with viral load suppression(p<0.05). Clients with no TB infections or other infections had 42 times odds of having viral load suppression compared to clients with active TB infection/other infections 42.44 (3.24, 555.91)**,** although the confidence intervals were wide, which is due to the small number of people in that particular category.

Table 8: Multivariate logistic regression analysis to determine factors associated with viral load suppression.

Variable	**Adjusted OR (95% CI)**	**P-Value**
Regimen		
First line	1	
Second line	0.0106 (0.012, 0.955)	0.045
Reported Adherence level		
Good	1	
Poor	0.006 (0.0011, 0.310)	<0.001
Pill Burden		
One	1	0.016
Two or more than 2	0.119 (0.021, 0.669)	
Active TB/Other infection		
Yes	1	0.004
No	42.44 (3.24, 555.91)	

CHAPTER FIVE

5.0 DISCUSSION

5.1 Discussion

The objective of this study were to determine the VL suppression and associated factors among people living with HIV in Mwanza, Tanzania. In the study we also reviewed the proportion of clients tested for VL and factors that may contribute to affect VL testing. Results show that the testing rate has increased over the years, from 18% in 2016 to 86% in 2018. Among clients involved in the cross sectional study, the overall testing rate was 88%.

The findings of the reviewed data show that in three years, there has been a tremendous increase in HVL testing in Mwanza, as there has been an increase in the proportion of clients tested for HVL from 18% in 2016 to 76% in 2017, thereafter to 86% in 2018. Lecher et al[15] review of Tanzania data showed that there was only 9% of clients with at least 1 or more HVL result by 2016 where by the review of data sets obtained showed that 86% of eligible clients were tested for HVL by 2018 which was nowhere close to the target of testing all eligible clients.

The study also showed that as years go by the chances of being tested increased significantly from 18% in 2016 to 86% in 2018. A number of interventions were implemented with the intention to improve HVL services provision including increasing number of platforms for testing, trainings to health care providers, decentralization of HVL services, increasing of awareness to clients[46,47]. Tanzania developed training programs for health care workers, development and adoption of HVL test in the care and treatment, as well development of sample referral system that is focused in HVL samples. Awareness on the testing has also increased for both service providers and CTC clients, there is an increase in the number of testing platforms in Tanzania, and also new and advanced platforms are now available in Tanzania as in other countries that adopted the WHO guidelines[27,28,48–50]. By 2018 Tanzania had a total of 15 Testing labs for HVL all over the country, from the 6 that existed before the scaling up of HVL testing. One of the laboratories is in Mwanza, at Bugando Medical Centre. Massive campaigns on VL testing

were carried out in 2018 to make sure all clients are reached. The use of colour code stickers to identify all eligible clients was done for visual identification of clients during clinics. Awareness campaigns were done to clients attending CTC for them to enquire for the test during the morning education session for clients[51].

The study shows there was a statistically significance difference in testing rate by sex in the reviewed data bases, with more women being tested than males. This can be due to the tendency of women seeking care more than their partners. Also the fact that HIV counseling and testing services available to pregnant women gives the chance to women to be reached by the services earlier than men who are more likely to be reached when they are sick[52]. This observation that many females are tested than women is similar to the observation made in Kenya on review of HVL from national database[33].

Data review showed that women were tested 1 to 5 times, and the proportions were increasing as years went by. However, men were tested from 1-3 times with their proportions also increasing as time went by. The difference in number of testing observed can be attributed to the fact that women tend to seek for medical care more than men, but also contribution of women attending PMTCT clinics who have higher testing rates as per the HVL testing algorithm for pregnant and lactating women[27,52]. The Tanzania HVL testing algorithm requires the first test to be done after 6 months on ART, followed by a second test 6 months later, then annual testing[27], 42% of all clients tested should be having 3 tests and above by end of 2018, but we only have 2.3% of clients with 3 tests and above.

The current quantitative study showed that the HVL testing rate among male participants was slightly higher (90%) compared to female (88%) participants, although the differences were not statistically significant, implying that sex was not a factor in testing for VL. Massive campaigns carried out in 2018 and 2019 for HVL testing and awareness of the test may have led to an increase in the participation of male clients in testing. The campaign included following of clients to their residents using HBCs and calling them in for testing.

As age increased, there was an increase in the proportion of clients in respective age groups that were tested for viral load across the years. A similar observation was made on the relationship between age and testing rate in the cross sectional study, although the findings were not statistically different. This observation is similar to the one from *Mwau et al* review in Kenya which showed that more than 62% of the HVL tested clients were 30 years and above[33].

The review of data showed that clients from the rural facilities were more likely to be tested than clients from the urban facilities, also clients from the dispensaries were more likely to be tested. One of the reasons could be due to workload these types of facilities have every day, with facilities in the urban areas serving a bigger volume of clients per day compared to those in rural areas. This applies to dispensaries; they can be reached by their eligible clients easily as they serve a small number of clients compared to hospitals. The findings on dispensaries can also be due to pull effect as they serve a small number of clients compared to health centres and hospitals.

Overall, viral suppression was observed to be high, at 94%. Findings also showed that participants in the 18-29 years' group were virally suppressed by 100%, compared to other age groups. This was different from what was observed in a study by Mwau *et. al.*, which found that viral suppression was attained as age groups increased[35]. However, the number of participants in this age group in our study was small compared to other groups, which may have resulted to biased findings due to pull effect.

Although viral suppression was higher in urban areas than to rural areas, the difference was not statistically significant. A study previous study also in Tanzania showed that viral suppression can also be attained in rural areas, but attrition must be looked upon for clients in care[53].Time on medication showed no significant effect on viral suppression in our study participants. Studies done in West Africa and Canada have shown that some clients on treatment for HIV can develop resistance after using medications for a while. In West Africa resistance developed after an average of 37 months in medication while in Canada it took an average of 30 months in medication[54,55].

The study found that there is a strong association between viral suppression and adherence to medication, with clients with poor adherence observed to be least likely to be suppressed. Most (98%) of participants with good adherence were virally suppressed compared to 32% among participants with poor adherence. Proper use of medication is key for any client on ART to attain suppression. Viral load testing is also used as a key indicator of adherence to medication. Findings by *Arnsten et al* also support the findings that adherence to medication affects viral load[56].

Number of pills a client on ART use on a daily basis has also been associated with suppression. The study found out there is an association between using two or more pills a day and being virally un-suppressed. Findings from *Uzochukwu etal* and *Nachega et al* showed that pill burden can directly affect adherence of clients to their medication, which eventually leads to affect their viral suppression[57,58]. A study in the US proved that single pill use is highly associated with viral suppression as clients adhere more to their medication[59].

The study found out that clients on treatment with no TB/other opportunistic infection were more likely to be virally suppressed compared to clients who had other infections. These findings can be corroborated by the study done by *Ekwaru et al* on relationship between opportunistic infections, CD4 and viral suppression[60]. Opportunistic infections are mostly a result of the body not being able to protect itself due to decreased CD4 cells that protects the body, as a result the virus replicates more in the body of the client attacking more CD4 cells.

Study participants in second line treatment regimen were less likely to attain suppression compared to those in the first line. Tanzania use drugs from NRTIs and PIs as second line combination drugs of choice[27]. Study done on NRTIs showed that there is a broad growth of resistance towards NRTIs and proper sequencing is needed before medication, for clients on ART to be properly medicated[61]. A study done in South Africa showed that it takes longer and with proper adherence follow up time to attain viral suppression, some taking up to 41 months[62]. Also mutation of viral RNA leads to resistance to medication among clients in second line leading to un-suppression of viral load[63].

5.2 Limitations

Use of secondary data was affected by the quality of data stored in the database, as we found duplicates of tests and missing information for some variables. The duplicates were removed during data cleaning.

Findings from this study may not be representative of HIV infected persons with less frequent hospital visits, such as patients that are considered stable and are put on the Multi Month Scripting scheme as they attend clinics to see the clinicians once in six months, and they get their prescription drugs in 3 months' refills. This may lead to incorrect estimation of the percentage of PLHIV with VL suppression.

CHAPTER SIX

6.0. CONCLUSSION AND RECOMMENDATIONS

6.1 Conclusion

Viral load test is key in monitoring clients' treatment for clients on ART. Test coverage has increased significantly from the national coverage of 7.3% reported in 2016 to 88% as per the cross section study done. Viral suppression was also found to be very high, at 94%; and as per these findings, we are close to attaining the third 95 of the UNAIDS 2030 goals.

The study found that non-adherence to medication contributes to clients not attaining viral suppression. Clients with TB/other infections are also faced with the challenge of attaining suppression, as are clients on the second line regimens and clients using two or more pills a day.

Although the prevalence of VL testing has improved significantly, the frequency of testing is still low. As years have passed by we expected to have more clients from 2016 to have more than three VL tests as per our national HVL testing algorithm.

6.2 Recommendations

- Counselling on adherence to medication should continue to be provided to clients on ART in order to improve their response to medication and hence VL suppression.

- More efforts should be put to make sure all eligible clients are tested for viral load 6 months after they start their medication or annually as per guideline.

- Initiation of special clinics for clients with high viral load so that they can be attended to the highest attention they need.

- Although not significantly different, testing rate among males was lower than that of females. Special program should be designed to encourage men to attend clinics more and for them to be tested more for HVL.

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APPENDICES

Appendix 1: Questionnaire (English Version)

Title: Prevalence and factors associated with viral load suppression among HIV patients in Mwanza Tanzania.

Main questionnaire

CTC2 link number

ID NO: .....

	Sex (circle one)	Male 1 Female2	
	Qn.1 Date of birth (write 99 if day or month not known, 9999 if year not known)	⌊_⌋⌊_⌋ ⌊_⌋⌊_⌋ ⌊_⌋⌊_⌋⌊_⌋⌊_⌋ dd mm yyyy	
	Qn.2 Age or approximate age (refer to calendar of events if needed)	⌊_⌋⌊_⌋ years	

Education & literacy

	Qn.3 How many years of education did you have?	
	Primary	
	Secondary (including A level)	
	College/Vocational training	
	University	
	Other (specify below)	
		……

Residence and mobility

	Qn.4 Which district of this region do you currently live in? (use code sheet or drop down menu to select district number within region)	

	Qn.5 What type of place is it?	Circle only one response
	Rural – remote	1
	Rural – on main road	2
	Urban	3

Economic activity

	Qn.6 Do you perform any work that helps you or your household earn money?	Circle only one response
	Yes	If answer is not Yes → Qn.9
	No, I am still a student	1
	No, I just look after the house	2
	No, I am too ill to work	3
	No, I am too old to work	4
	No, other reason (specify below)	5
		6
		……
	Qn.8 What are the different ways you earn money? *Do not read out the list below, but after each response ask if there are other ways*	Write 01 for the way mentioned first, 02 for the second, etc. When respondent runs out of answers write 00 in all unused lines
	Farming / Tending livestock	⌊_⌋⌊_⌋
	Business	⌊_⌋⌊_⌋
	Professional	⌊_⌋⌊_⌋
	Driver	⌊_⌋⌊_⌋
	Skilled manual worker	⌊_⌋⌊_⌋
	Unskilled labourer	⌊_⌋⌊_⌋
	Fishing	⌊_⌋⌊_⌋
	Bar Work	⌊_⌋⌊_⌋
	Other (specify below)	⌊_⌋⌊_⌋
		……

Current marriage or cohabitation: men and women

	Qn.9 What is your current marital status?	Circle only one response
	Never married or been in cohabiting union	1
		2
	Monogamously married or cohabiting	3
	Polygamous married or cohabiting	4
	Widowed	5
	Separated or divorced	

Drinking alcohol

	Qn.10During the last year, how frequently have you had at least one alcoholic drink?	Circle only 1 response never less than once a month 1-3 days per month 1-4 days per week 5-6 days per week every day don't know	 0→ Qn.15 1 2 3 4 5 9
	Qn.11During the last month, on how many days did you have at least one alcoholic drink?	number (99 = don't know)	⌊_⌊_⌋
	Qn.12During the last month, when you drank alcohol, on average, how many drinks did you have on those days?	number (99 = don't know)	⌊_⌊_⌋
	Qn.13During the last month, when you drank alcohol, what was the largest number of drinks that you had on any one day?	number (99 = don't know)	⌊_⌊_⌋
	Qn.14During the last month, how many times did you have more than 5 drinks in a day (men)? or more than 4 drinks in a day (women)?	number (99 = don't know)	⌊_⌊_⌋

Smoking

	Qn.15Have you ever smoked any kind of tobacco (like cigarettes or pipes)?	Yes 1 No 2	no → Qn.23
	Qn.16Do you currently smoke tobacco?	Yes 1 No 2	no → Qn.23
	Qn.17Do you smoke tobacco every day?	Yes 1 No 2	no → Qn.23
	Qn.18 How old were you when you first started to smoke daily?	(99 = don't know)	⌊_⌋⌊_⌋ years
	Qn.19 How many years ago did you first start smoking daily?	(99 = don't know)	⌊_⌋⌊_⌋ years
	Qn.20 How many manufactured cigarettes do you smoke every day?		⌊_⌋⌊_⌋ number
	Qn.21 How many hand-rolled cigarettes do you smoke every day?		⌊_⌋⌊_⌋ number
	Qn.22 How many pipes do you smoke every day?		⌊_⌋⌊_⌋ number

Health facility information

	Qn.23 What is the distance to the nearest health facility	⌊_⌋⌊_⌋	km
	Qn.24 How much time do you use to get to the nearest health facility	⌊_⌋⌊_⌋	minutes
		⌊_⌋⌊_⌋	hours
	Qn. 24 What type is the facility level	Dispensary 1	1
		Health Centre	2
		Hospital	3

Clinical information – This information will be obtained from the CTC2 Database.

	WHO clinical staging	
	Baseline CD4 count	
	Current CD4 count (within 6months)	
	Treatment regimen (within 6months/ the longest)	
	Time on treatment	
	Reported adherence level(Good/Poor)	
	Number of pills per dose	
	Current viral load test results	Copies/ml
	HIV medical care in past year	Yes 1 No 2
	Current cART use	Yes 1 No 2
	Undetectable VL	Yes 1 No 2
	Laboratory-confirmed VL <50 copies/mL	Yes 1 No 2
	Active TB or other infections	Yes 1 No 2

AT END OF INTERVIEW THANK PARTICIPANT FOR THEIR TIME AND PATIENCE

Notes:

.....

.....

Appendix 2: Questionnaire (Swahili Version)

Jina la Utafiti: Kutambua visababishi vinavyochangia wingi wa virusi kati ya watu waishio na virusi vya UKIMWI jiji Mwanza.

Dodoso Kuu

Namba ya kuunganishwaCTC2

Namba ya Utambulisho: .....

	Sw.1 Jinsia (Zungushia moja)	Me 1 Ke2	
	Sw.2 Tarehe ya Kuzaliwa (andika 99 kama siku au mwezi haujulikani, 9999 kama mwaka haujulikani)	⌊_⌋⌊_⌋ ⌊_⌋⌊_⌋ ⌊_⌋⌊_⌋⌊_⌋⌊_⌋ siku mwezi mwaka	
	Sw.3 Umri/Kadiria umri (rejea kalenda ikibidi)	⌊_⌋⌊_⌋ miaka	

Elimu & Kusoma na Kuandika

	Sw.4 Kiwango cha elimu?	
	Msingi	
	Sekondari (Kidato cha 5 na 6 pia)	
	Chuo/Mafunzo ya Ufundi	
	Chuo Kikuu	
	Nyingine (elezea kwenye nafasi chini)	
		……

Makazi

	Sw.5 Kwa sasa unaishi wilaya gani katika mkoa huu.	

	Sw.6 Makazi Unayoishi	Zungushia jibu moja tu
	Kijijini	1
	Kijijini pembezoni mwa barabara kubwa	2
	Mjini	3

Shughuli za kiuchumi

	Sw.7Unafanya kazi yoyote ya kukuingizia kipato?	Zungushia jibu moja tu	
	Ndio		Kama jibu ni hapana→ Sw.9
	Hapana, ni mwanafunzi	1	
	Hapana, ni muangalizi wa nyumbani	2	
	Hapana, ni mgonjwa nisiyeweza kufanya kazi	3	
	Hapana, ni mzee nisiyeweza kufanya kazi	4	
		5	
		.....	
	Sw.8Njia gani zinayokuingizia kipato? *Usisome kazi tajwa ila baada ya kupata jibu ulizia kama kuna njia ingine*	Andika 01 kwa njia tajwa ya kwanza, 02 kwa njia ya pili,na kadhalika.Mteja akimaliza majibu andika 00 kwa njia zilizobakia	
	Kilimo / Ufugaji	⌊_⌊_⌋	
	Biashara	⌊_⌊_⌋	
	Muajiriwa kazi maalum	⌊_⌊_⌋	
	Dereva	⌊_⌊_⌋	

	Kibarua mwenye ujuzi maalum	⌊⌋⌊⌋
	Kibarua asiye na ujuzi	⌊⌋⌊⌋
	Uvuvi	⌊⌋⌊⌋
	Muhudumu hoteli/baa	⌊⌋⌊⌋
	Nyingine (elezea chini)	⌊⌋⌊⌋
		……

Taarifa za ndoa na mahusiano

	Sw.9Hali yako ya ndoa kwa sasa?	Zungushia jibu moja tu
	Sijawahi Kuolewa/kuoa	1 **Error! eference source not found.**
	Ndoa/Mahusiano ya mke mmoja	2
	Ndoa/Mahusiano zaidi ya mke mmoja	3
	Mjane	4
	Tumetengana/Talikiana	5

Matumizi ya vilevi

	Sw.10Katika kipindi cha mwaka uliopita umetumia kilevi walau kimoja mara ngapi?	Zungushia jibu moja tu Sijatumi Chini ya mara moja kwa mwezi Siku 1-3 kwa mwezi Siku 1-4 kwa mwezi Siku 5-6 kwa mwezi Kila siku Sikumbuki	 0→ Sw.15 1 2 3 4 5 9
	Sw.11 Katika mwezi ulioisha umetumia kilevi siku ngapi za mwezi?	Namba (99 = Sijui)	⌊_⌊_⌋
	Sw.12 Kwa wastani umetumia vilevi vingapi katika kipindi cha mwezi uliopita?	Namba (99 = Sijui)	⌊_⌊_⌋
	Sw.13Katika mwezi uliopita ukitumia kilevi ni,siku uliyotumia kilevi cha juu kabisa ni kiasi gani?	Namba (99 = Sijui)	⌊_⌊_⌋
	Sw.14 Katika mwezi uliopita ni mara ngapi umekunywa Zaidi ya vinywaji vitano (mwanaume) au vine (mwanamke) kwa siku?	Namba (99 = Sijui)	⌊_⌊_⌋

Matumizi ya Tumbaku

	Sw.15 Umeshawahi kutumia aina yoyote ya tumbaku (sigara au kiko)?	Ndio 1 Hapana 2	Hapana → Sw.23
	Sw.16 Unatumia tumbaku kwa sasa?	Ndio 1 Hapana 2	Hapana → Sw.23
	Sw.17 Unatumia tumbaku kila siku?	Ndio 1 Hapana 2	Hapana → Sw.23
	Sw.18 Ulikuwa na umri gani ulipoanza matumizi ya tumbaku kila siku?	Namba (99 = Sijui)	⌊_⌊_⌋ miaka
	Sw.19 Ulianza uvutaji tumbaku miaka mingapi iliyopita?	Namba (99 = Sijui)	⌊_⌊_⌋ miaka
	Sw.20 Unavuta sigara ngapi zilizotengenezwa kiwandani kwa siku?		⌊_⌊_⌋
	Sw.21 Unavuta sigara ngapi ulizotengeneza mwenyewe kila siku?		⌊_⌊_⌋
	Sw.22 Unavuta kiko mara ngapi kwa siku?		⌊_⌊_⌋

Taarifa za kituo unachopatia huduma za afya

	Sw.23 Umbali unapoishi mpaka kituo unachopatia huduma	⌊_⌊_⌋	km
	Sw.24 Muda unaotumia kufika kituo cha afya	⌊_⌊_⌋	dakika
		⌊_⌊_⌋	masaa
	Sw.25 Aina ya kituo unachopatia huduma za afya	Zahanati	1
		Kituo cha afya	2
		Hospitali	3

Taarifa za Kitabibu – Taarifa zitatolewa kwenye mfumo wa CTC2.

	Hatua ya maambukizi ya WHO	
	Matokeo ya awali ya CD4	
	CD4 ndani ya miezi sita	
	Aina ya dawa anazotumia ndani ya miazi sita au zaidi	
	Muda ulioko kwenye matibabu	
	Ufuasi wa matumizi ya dawa(Nzuri/Mbaya)	
	Idadi ya vidonge kwa dozi	
	Majibu ya karibuni ya wingi wa virusi	Copies/ml
	Anapata huduma ndani ya mwaka uliopita	Yes 1 No 2
	Anatumia cART sasa	Yes 1 No 2
	Undetectable VL	Yes 1 No 2
	Wingi wa virusi vya UKIMWI <50 copies/mL	Yes 1 No 2
	Anaugua Kifua kikuu au magonjwa nyemelezi	Yes 1 No 2

Mwishoni mwa mahojiano mshukuru mshiriki na mpe pole kwa kusubiri

Kumbuka:

.....

.....

Appendix 3: Consent Form (English Version)

Study ID No _____

Study title: Prevalence and factors associated with viral load suppression among HIV patients in Mwanza, Tanzania.

I, Deogratius Joseph, am going to carry out this research study as a partial fulfilment of Master of Public Health Course of MUHAS. The purpose of this study is to determine Prevalence and Factors associated with viral load suppression among HIV Patients in Mwanza, Tanzania. Findings from this study will help to provide an insight and may be used to improve services provided to HIV positive clients in care for them to attain suppression resulting to improved quality of life. You are invited to participate in a research study. We ask that you read this form and ask any questions you may have before agreeing to participate in this study.

Study Procedures: For all participants fulfilling the criteria, a structured questionnaire will be administered to obtain demographic information and social economic factors, while biological factors will be obtained from CTC 2 data base.

Benefits of Participation in the Study: There will be no direct benefits to you from this study. However, the information obtained from this study may be used to advance services provided to you and other HIV positive clients in care for them to attain suppression resulting to improved quality of life.

Risk of Participation in the Study: There is no risk to you other than spending extra time in the health facility while waiting to be interviewed.

Confidentiality: All information from this study will be kept private. Any presentations or publication will not include any information that will identify you as a subject.

Right to Withdrawal: Participation in this study is voluntary. You have the right to withdrawal from the study at any time if you decide to do so and you do not have to give reason. Your decision will not affect your relationship with the research team, or diagnosis or treatment you will receive.

Contacts and Questions: This study is supervised by Deogratius Joseph (Study investigator). You may ask any question now. If you will have questions later you are welcome to contact him at: +255 759 010399. Also you may contact the Office of Director of Research and Publications, MUHAS, through +255-022-2152489

Statement of Consent: I have read the above information. I have asked questions and have received answers. I consent to participate in this study.

Participant: NAME……

Witness: NAME…… Signature…… Date……...

Study Investigator: NAME…… Signature……. Date……

Appendix 4: Consent Form (Swahili Version)

Fomu ya idhini ya mshiriki

Nambari ya utafiti _____

Jina la utafiti: Kutambua visababishi vinavyochangia wingi wa virusi kati ya watu waishio na virusi vya UKIMWI jiji Mwanza.

Mimi, Deogratius Joseph, nitafanya utafiti huu ikiwa ni moja ya mahitaji katika kukamilisha shahada ya Afya ya Jamii Chuo Kikuu ca Afya na Sayansi Shirikishi. Nia ya utafiti huu ni kutambua visababishi vinavyochangia wingi wa virusi kati ya watu waishio na virusi vya ukimwi jijini Mwanza. Majibu ya utafiti huu yanaweza kusaidia kuongeza ufahamu na kuboresha utoaji wa huduma kwa watu waishio na virusi vya ukimwi ili kuweza kuboresha Maisha yao. Tunaomba usome fomu hii na uulize maswali uliyonayo kwa uelewa zaidi kabla ya kukubali kushiriki kwenye utafiti huu.

Taratibu za utafiti;
Washiriki wote wataokidhi vigezo watashawishiwa kushiriki, kila mshiriki atahitajika kujaza dodoso ambalo litauliza taarifa za mshiriki kama taarifa za awali kama umri, jinsia, na hali ya kiuchumi na kijamii zitajazwa, wakati mfumo wa kielektroniki wa utunzaji taarifa za watu waishio na virusi vya UKIMWI utatumika kupata taarifa za kibiologia.

Faida za kushiriki katika utafiti;
Hakutakuwa na faida za moja kwa moja kwako kutokana na utafiti huu, bali taarifa zitakazopatikana kutoka kwenye utafiti huu zinaweza kusaidia kujua ukubwa wa tatizo na kusaidia kuboresha huduma zitozelewazo kwako na kwa watu wengine waishio na virusi vya UKIMWI ili kuboresha hali ya maisha yao na huduma zitolewazo.

Hasara za kushiriki katika utafiti; Hakuna hasara yoyote utakayopata Zaidi ya kutumia muda mrefu zaidi kituoni tofauti na mahudhurio mengine ili kuweza kuongea na mtafiti.

Usiri: Katika utafiti huu, taarifa zote zitatunzwa kwa siri. Katika machapisho au maonyesho yoyote hatutaweka taarifa ambazo zitawezesha kukutambua.

Haki ya kujitoa: Kushiriki katika utafiti huu ni hiari. Una haki ya kujitoa kwenye utafiti huu wakati wowote kama utaamua kufanya hivyo na hautotakiwa kutoa sababu. Uamuzi wako wa kushiriki au kutoshiriki katika utafiti huu hakutoathiri mahusiano yako na watafiti. Kama utaamua kushiriki, uko huru kujitoa wakati wowote bila kuathiri mahusiano hayo, au utambuzi wa ugonjwa wako au tiba utakayopata.

Mawasiliano na Maswali; Utafiti huu unaongozwa na Deogratius Joseph. Unaweza kuuliza swali lolote ulilonalo sasa. Kama utakuwa na maswali baadae katika utafiti tunakuhimiza kuwasiliana nae kupitia: Namba ya simu ya mkono +255 759 010399. Pia unaweza kuwasiliana na ofisi ya Mkurugenzi wa Utafiti na Machapisho, MUHAS, kwa simu namba +255-022-2152489

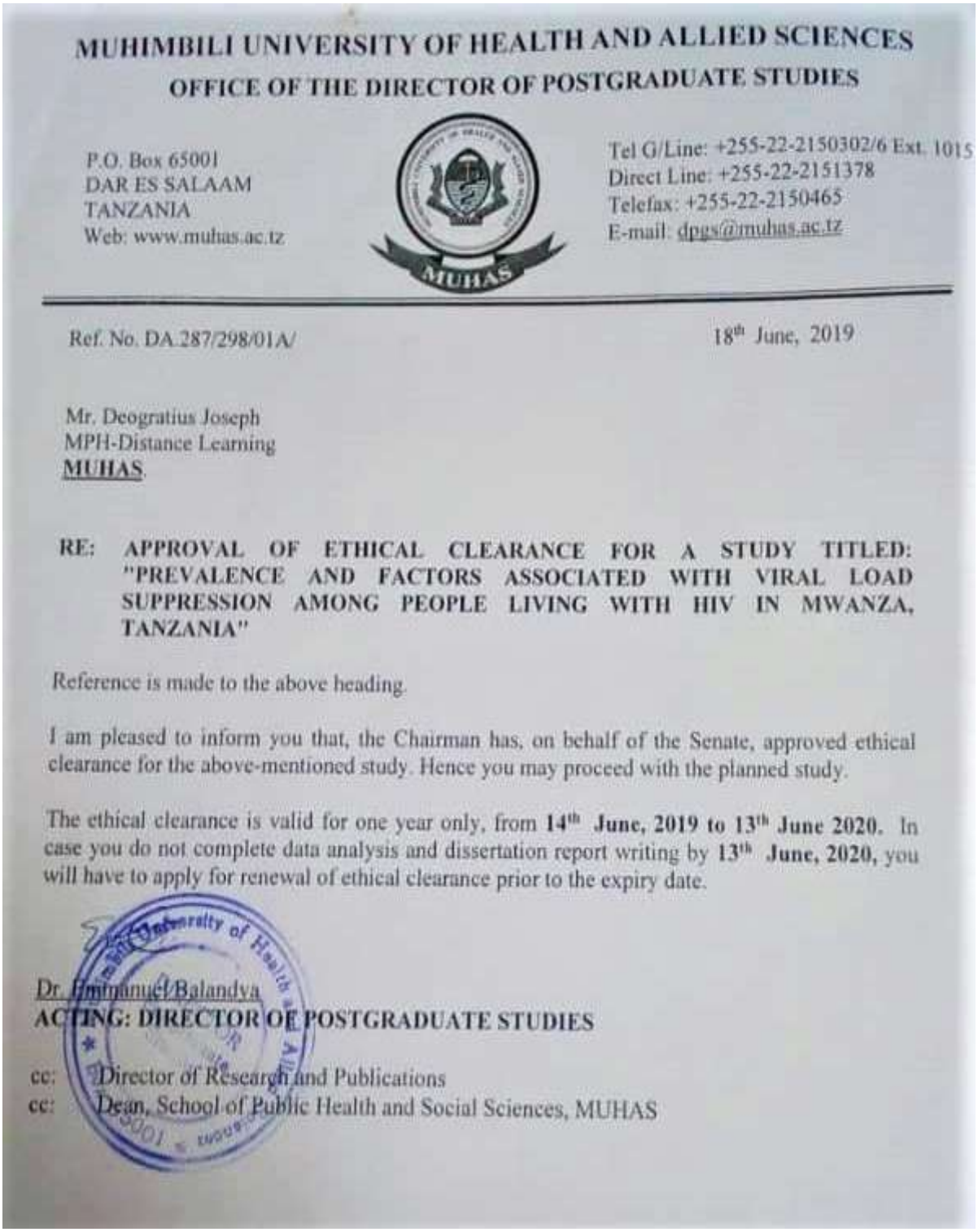
Tamko la Ridhaa; Nimesoma maelezo hayo hapo juu. Nimeuliza maswali na nimepewa majibu. Ninaridhia kushiriki katika utafiti huu.

Mshiriki; JINA …….

Shuhuda; JINA …… Saini…… Tarehe……

Mtafiti; JINA ……... Saini …… Tarehe……

Appendix 5: Ethical Clearance



MUHIMBILI UNIVERSITY OF HEALTH AND ALLIED SCIENCES
OFFICE OF THE DIRECTOR OF POSTGRADUATE STUDIES

P.O. Box 65001
DAR ES SALAAM
TANZANIA
Web: www.muhas.ac.tz

Tel G/Line: +255-22-2150302/6 Ext. 1015
Direct Line: +255-22-2151378
Telefax: +255-22-2150465
E-mail: dpgs@muhas.ac.tz

Ref. No. DA.287/298/01A/

18th June, 2019

Mr. Deogratius Joseph
MPH-Distance Learning
MUHAS.

RE: APPROVAL OF ETHICAL CLEARANCE FOR A STUDY TITLED: "PREVALENCE AND FACTORS ASSOCIATED WITH VIRAL LOAD SUPPRESSION AMONG PEOPLE LIVING WITH HIV IN MWANZA, TANZANIA"

Reference is made to the above heading.

I am pleased to inform you that, the Chairman has, on behalf of the Senate, approved ethical clearance for the above-mentioned study. Hence you may proceed with the planned study.

The ethical clearance is valid for one year only, from **14th June, 2019 to 13th June 2020.** In case you do not complete data analysis and dissertation report writing by **13th June, 2020,** you will have to apply for renewal of ethical clearance prior to the expiry date.

Dr. Emmanuel Balandya
ACTING: DIRECTOR OF POSTGRADUATE STUDIES

cc: Director of Research and Publications
cc: Dean, School of Public Health and Social Sciences, MUHAS

Appendix 6: Introduction Letter

MUHIMBILI UNIVERSITY OF HEALTH AND ALLIED SCIENCES
OFFICE OF THE DIRECTOR OF POSTGRADUATE STUDIES

P.O. Box 65001
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TANZANIA
Web: www.muhas.ac.tz

Tel G/Line: +255-22-2150302/6 Ext. 1015
Direct Line: +255-22-2151378
Telefax: +255-22-2150465
E-mail: dpgs@muhas.ac.tz

Ref. No. HD/MUH/T.342/2016 18th June, 2019

Regional Medical Officer
Mwanza Region
P.O. Box 132
MWANZA.

Re: INTRODUCTION LETTER

The bearer of this letter Mr. Deogratius Joseph is a student at Muhimbili University of Health and Allied Sciences (MUHAS) pursuing MPH-Distance Learning.

As part of his studies he intends to do a study titled: ***"Prevalence and factors associated with viral load suppression among people living with HIV in Mwanza, Tanzania".***

The research has been approved by the Chairman of University Senate.

Kindly provide him the necessary assistance to facilitate the conduct of him research.

We thank you for your cooperation.

Ms. Shoffa Kamby
For: DIRECTOR, POSTGRADUATE STUDIES

cc: Dean, School of Public Health and Social Sciences, MUHAS

Appendix 7: RAS Mwanza Permission

THE UNITED REPUBLIC OF TANZANIA
PRESIDENT'S OFFICE
REGIONAL ADIMINSTRATIVE AND LOCAL GOVERNMENT

MWANZA REGION
Tel Address: "REGCOM"
Tel: 028-2500690 -2500686
Fax: 028-2501057/2541242
E-mail: ras.mwanza@tamisemi.go.tz
Please quote:

Regional Commissioner Office,
P. O. Box. 119,
MWANZA.

Ref. No.FA.137/264/01/

18th July, 2019

City Director
P. O. Box 1333
MWANZA

Municipal Director
ILEMELA

District Executive Directors
Misungwi, Ukerewe, Sengerema, Buchosa,
Kwimba and Magu
MWANZA REGION

RE: INTRODUCTION OF MR. DEOGRATIAS JOSEPH

Mr. Deogratias Joseph is a student at Muhimbili University of Health and Allied Sciences (MUHAS), pursuing a Master of Public Health- Distance Learning.

One of the requirements of his studies is to undertake a research. The student has been granted clearance to conduct a research titled **"Prevalence and factors associated with Viral Load suppression among people living with HIV in Mwanza, Tanzania".**

The ethical clearance is valid for one year from 14th June, 2019 to 13th June 2020.

Since the research will be conducted in Mwanza region, kindly provide him necessary support.

Dr. Thomas Rutachunzibwa
For: REGIONAL ADMINISTRATIVE SECRETARY
MWANZA

CC: Mr. Deogratias Joseph,
MUHAS

P.O.Box 65001

DAR ES SALAAM