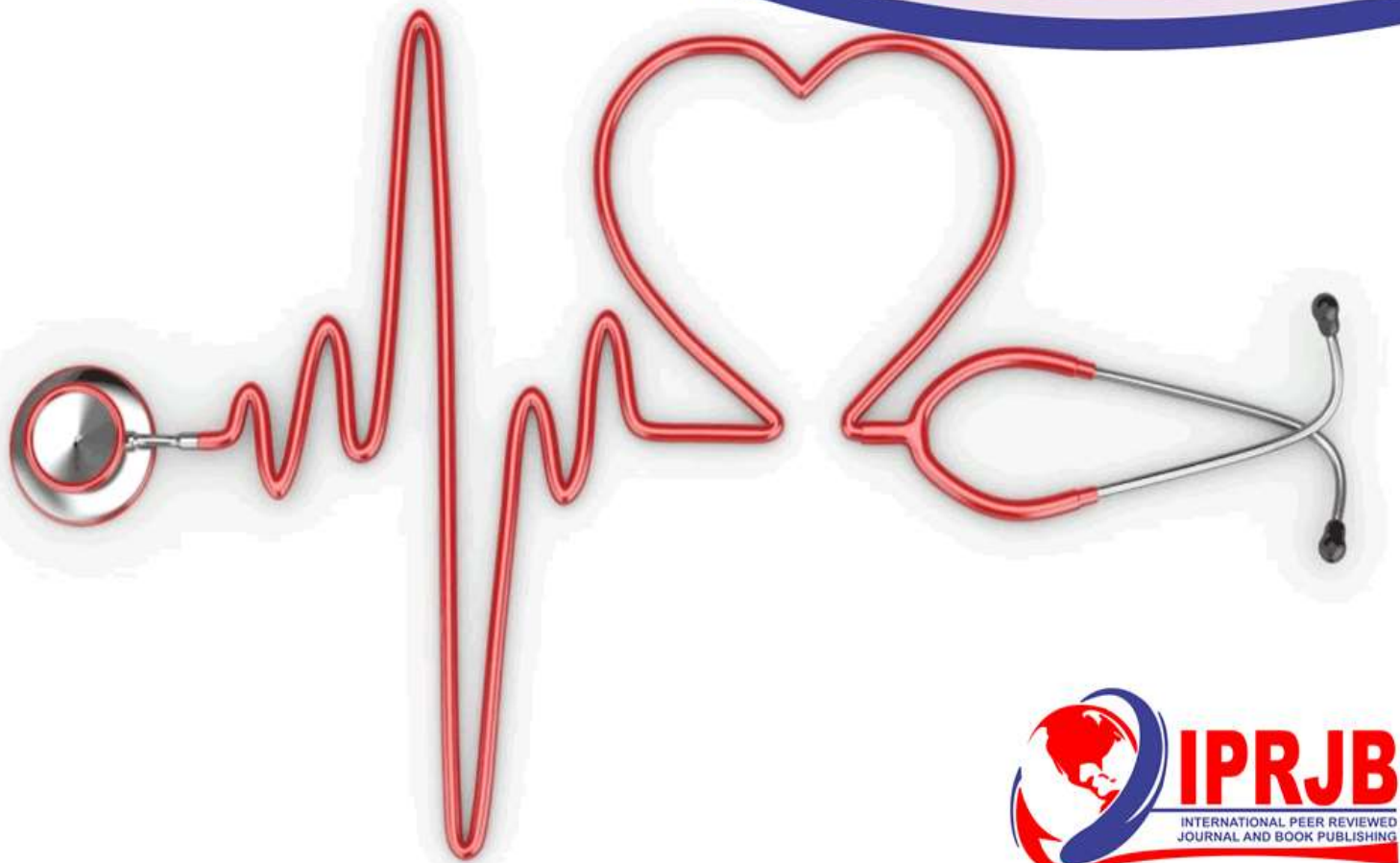


# Journal of Health, Medicine and Nursing (JHMN)

**Viral Suppression among Men Who Have Sex with Men Living With HIV on Risk  
Reduction Interventions in Mvita Sub-County, Mombasa County, Kenya**

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### Viral Suppression among Men Who Have Sex with Men Living With HIV on Risk Reduction Interventions in Mvita Sub-County, Mombasa County, Kenya

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#### Article History

Received 17<sup>th</sup> August 2024Received in Revised Form 21<sup>st</sup> September 2024Accepted 22<sup>nd</sup> October 2024

How to cite in APA format:

Karanja, J., Ngure, K., & Adem, A. (2024). Viral Suppression among Men Who Have Sex with Men Living With HIV on Risk Reduction Interventions in Mvita Sub-County, Mombasa County, Kenya. *Journal of Health, Medicine and Nursing*, 10(5), 1–29. <https://doi.org/10.47604/jhmn.3022>

#### Abstract

**Purpose:** The aim of this study was to compare viral load suppression levels among men who have sex with men (MSM) living with HIV who were put on risk reduction interventions versus a control group in Mvita sub-county, Mombasa County, Kenya between December 2020 and June 2021.

**Methodology:** A quasi-experimental study design using quantitative methods was conducted among MSM living with HIV from December 2020 to June 2021. The study involved a questionnaire and various laboratory investigations. The respondent-driven sampling (RDS) was used to obtain the sample of respondents. A total of 114 HIV positive MSM completed the study and were all subjected to a battery of tests. Blood was drawn for alcohol, syphilis, hepatitis B, and viral load tests, while urine was used to screen for drugs and gonorrhoea. Half (57) of the HIV positive MSM were actively followed and risk reduction interventions such as adherence to ARVs, general counselling, and HIV prevention measures such as prompt treatment of STI/OI and condom use were offered after every 2 months. The control group (57) received no risk reduction interventions. Thereafter, both groups were asked to respond to a questionnaire. Since the study was carried out during COVID-19, the risk reduction interventions were conducted over the phone to minimize transmission. Log-binomial univariate and the multivariate regression analysis model was used to identify the variables which were associated with undetectable viral load. Undetectable viral load was defined as having an HIV viral load of less than 50 copies/ml. Data generated from the questionnaires were collected, cleaned, coded and analysed using STATA software, Version 17. Level of significance was fixed at 5% (95% confidence interval).

**Findings:** Majority of MSM living with HIV were between 19-20 years and 49% were actively followed by the researcher and received risk reduction interventions while 54% were in the control group. However, the baseline demographic characteristics were not significantly different (all  $p > 0.05$ ). MSM in the control group who were neither Christian nor Muslim (11%) and had a lower income (35%), were likely to have detectable viral load. However, MSM who had a higher income in both groups (1.8%), were likely to have undetectable viral load. MSM in the control group, who reported ever use of PEP/PrEP (44%), were likely to have detectable viral load while MSM who received interventions, who reported condom break more than once during anal sex (61%), who had more than one regular anal sex partner (61% both groups), and those who drank more than 2 bottles of beer (33% both groups) were likely to have undetectable viral load. However, MSM who received interventions but used non-prescribed injectables drugs 1 to 2 times in a week (15%), were likely to have detectable viral load. MSM in the control group who reported being always high on alcohol during anal sex (19%), were likely to have detectable viral load but those chewing *muguka* (type of khat) (79%) were likely to have undetectable viral load. MSM who received interventions who reported feeling uneasy while seeking health services (75%), had detectable viral load while those in the control group who attended private clinics (42%), had undetectable viral load. Overall, after six months, the proportion of MSM achieving viral load suppression was significantly higher in the intervention group as compared to control group by 60% (95% CI 49–70),  $p$ -value  $< 0.001$ .

**Unique Contribution to Theory, Practice and Policy:** The study found out that majority of HIV positive MSM who received risk reduction intervention, had undetectable viral load as compared to those in the control group. HIV viral suppression is the desirable outcome for MSM on ART, since once achieved, MSM cannot transmit the virus to their sex partners. The Government/NGO should encourage peer-led HIV services to run the HIV programmes involving MSM with other stakeholders. Thus, many MSM will be able to access the HIV services where their needs will be addressed and supported in a non-judgemental environment.

**Keywords:** HIV Positive MSM, Risk Reduction Intervention, Viral Suppression, Mombasa, Kenya

**JEL Codes of Classification:** I15, O15, I18

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## INTRODUCTION

In 2022, approximately, 39 million people in the world were living with HIV, nearly 85% of people knew their HIV status, 88% were on antiretroviral therapy while 92% had attained viral suppression (UNAIDS, 2023). However, about 650,000 people died of HIV related infection (UNAIDS, 2023). Many countries in the world were committed towards attaining the global targets of achieving '95-95-95' treatment goals by 2025 and ending HIV by 2030 (UNAIDS, 2022). However, lack of political good will, emergence of COVID-19, punitive laws instituted against same sex relationships, insecurity, dwindling resources from the donor countries among other factors, might reverse the progress gained and hence the targets might be unattainable (UNAIDS, 2022).

Globally, 71 countries have criminalized same sex relationship and 32 of these countries are in Africa. Punitive laws have been passed, including death penalty in countries like, Iran, Saudi Arabia, Nigeria, Mauritania, Sudan and Somalia (ILGA, 2020). Consequently, HIV prevalence was higher in the countries where criminalization of same relationships existed, as compared to the countries which did not criminalize same sex relationship (Lyons *et al.*, 2023). The risk of contracting HIV among men who have sex with men (MSM) was 28 times greater than in the general population (UNAIDS, 2023). The HIV infection and transmission could be prevented and viral suppression achieved, if many HIV positive MSM were promptly linked to care (Jeffries *et al.*, 2020). However, treatment outcome could be hindered if there was limited access to healthcare, homelessness, and poverty (Jeffries *et al.*, 2020). Majority of MSM were unable to seek HIV services either because of fear of negative reaction from health care workers or breach of confidentiality, hence increasing the risk of HIV (Lyons, 2020). MSM also engaged in high-risk behaviours such as having condomless anal sex, multiple sex partners, indulgence in alcohol, and drugs including injectable drugs thus, increasing the risk of HIV (Kumar, *et al.*, 2020). Moreover, MSM who were older, who had other underlying diseases, who were HIV positive and not on treatment could be very sick once they contract COVID 19 (UNAIDS, 2022). A study by Stannah *et al.* (2022) on MSM in Africa, indicated that viral suppression was at 62% which was lower than the UNAID set targets which required at least 90% of all MSM who test HIV positive and on ART, 86% should be virally suppressed.

In another study conducted in Johannesburg, South Africa by Fearon *et al.* (2020), HIV prevalence was estimated to be very high among MSM/TG but only half of those who were HIV positive had undetectable viral load. Approximately, 1.4 million Kenyans were living with HIV in 2023 and mode of transmission was mainly heterosexual (UNAIDS, 2023). About 94% of all people living with HIV knew their status, 98% were on ART, and 95% had achieved viral suppression (UNAIDS, 2023). HIV prevalence among MSM was high (18.9%) as compared to that of general male population (15-49 years) which was 3.1 (NASCOP, 2020). In Kenya MSM population was approximately 32,600 with ART coverage of about 38.8% (UNAIDS (2022), however, data was seldom available (Musyoki *et al.*, 2021).

HIV prevalence among MSM in Nairobi was 25% (Smith *et al.*, 2021), however, in the country, MSM accounted for 15.2% of all new HIV infection (NASCOP, 2020). A study conducted in Nairobi, Kenya among men and transgender persons who had sex with men, 76% knew their HIV status, 65.3% were on antiretroviral therapy (ART), and 47.4% had achieved viral suppression (<50 copies/mL) (Smith *et al.*, 2021). However, younger participants 18-22 years, were unlikely to be aware of their HIV status, unlikely to be on ART or have suppressed viral load. The participants were likely to have bacterial sexually transmitted infection both in the rectal and urethral sites (Smith *et al.*, 2021). A study conducted in Coastal town of Mtwapa,

Kenya among gay, bisexual, and other men who have sex with men (GBMSM) living with HIV where interventions such as counseling and adherence to ART were offered to one group while the other group received only standard care. The intervention group had a higher viral suppression than the standard group after six months of follow up (Graham *et al.*, 2020). Similar results were found in the study where, risk reduction interventions such as adherence to ARV, general counselling, and HIV prevention were offered to one group. After six months of follow up, viral suppression was significant in intervention group as compared to the control group. In another study conducted by Nyongesa, *et al.* (2022) on viral suppression study among young people living with HIV (YLWH) in Mombasa and Kilifi, indicated high levels of unsuppressed viral load which was attributed to non-adherence to ART, lack of support among others. Thus, emphasizing the need to address the challenges affecting the YLWH to avert HIV drug resistance. In Kenya, the former Coast Province had the second highest (1686) estimated number of MSM in the country and Mvita Sub-County in Mombasa County was chosen because it had the highest (341) estimated number of MSM (NASCOP/MOH, 2013).

### **Problem Statement**

In Kenya, HIV prevalence among MSM was approximately 6 times that of general male population (15-49 years) (NASCOP, 2020). Same sex relationship in Kenya is illegal, and punitive laws have been passed (Kenya constitution, 2010), making the group to go underground. Ratified and perceived sexual stigma among MSM (Korhonen *et al.*, 2022) has deterred the MSM from accessing HIV services and some also maintained heterosexual relationships to conceal their identity (Veronese *et al.*, 2019). Stigma among MSM deterred majority from accessing HIV service, either due lack of information, fear of being discriminated, fear of positive results or lack of trained professionals (Lewis *et al.*, 2023). In Kenya, antiretroviral therapy coverage among MSM living with HIV was still low (38.8%). This notwithstanding, the donor countries have reduced funding and the country has to increase domestic funding to fight HIV (UNAIDS, 2023). Insufficient fundings may reverse the gains made and resurgence in HIV McDade *et al.* (2021) may be experienced with fewer MSM attaining viral suppression (Garnett, 2021). More than half of MSM using drugs and alcohol, were likely to have multiple sex partners, engage in condomless anal sex (Wang *et al.*, 2022). Highly risky behaviours were associated with lower viral load suppression (Sheehan *et al.*, 2020). In the study, MSM who received risk reduction intervention such as adherence to ART, HIV prevention and counselling, majority achieved viral load suppression. Viral load suppression was a desirable outcome for people living with HIV since they cannot effectively transmit the virus to their partners (Quinn *et al.*, 2020). The study aims to determine viral suppression between the HIV positive MSM who received risk reduction intervention and the control group.

### **Specific Objectives**

The aim of this study was to compare viral load suppression levels among men who have sex with men living with HIV who were on risk reduction interventions and control group in Mvita sub-county, Mombasa County, Kenya between December 2020 and June 2021. The specific objectives included:

### **Research Question**

- i. What is the effect of interventions on viral load suppression on the knowledge of HIV among men who have sex with men living with HIV in Mvita Sub-County, Mombasa County?

- ii. What is the effect of interventions on viral load suppression on the individual behaviours among men who have sex with men living with HIV in Mvita Sub-County, Mombasa County?
- iii. What is the effect of interventions on viral load suppression on the health systems among men who have sex with men living with HIV in Mvita Sub-County, Mombasa County?
- iv. What is the effect of interventions on viral load suppression on the HIV treatment outcome among men who have sex with men living with HIV in Mvita Sub-County, Mombasa County?

### **Hypothesis**

The null hypothesis in this study was that there is no significant difference on viral load suppression between men who have sex with men living with HIV who received risk reduction interventions such as adherence to ARVs, general counselling and HIV prevention measures and the control group.

### **Conceptual Framework**

Conceptual framework (figure 1) was based on the literature review and the objectives of the study, indicated the relationship between the independent variables and dependent variable of the study.

### **Independent variables were;**

- Knowledge of HIV included, importance of screening of STI, sex preference, use of lubricants, and use of PReP/PEP.
- Behaviours of MSM included, unprotected sex, multiple sex partners, alcohol and drug use and presence of STI.
- Health systems included confidentiality, competency, friendly workers, stigma and discrimination.
- HIV treatment outcome included, linkage to HIV care, adherence to ARVs, and treatment of STI/OI.

**Dependent variable** was viral load suppression after 6 months of the study.

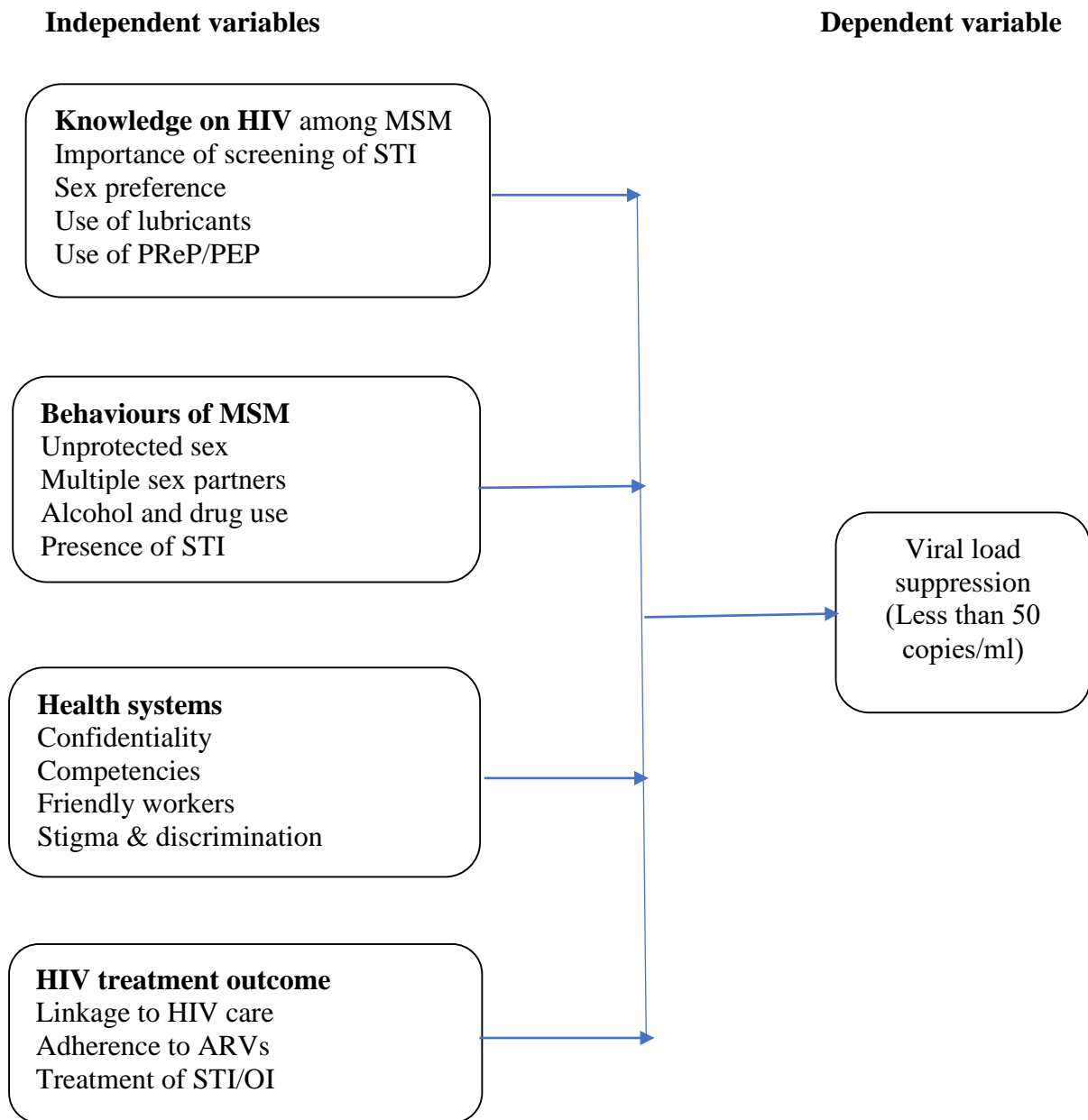


Figure 1: Conceptual Framework

Source: Researcher (2023)

## LITERATURE REVIEW

Men who have sex with men (MSM) are more vulnerable to HIV as compared to men in the general population (UNAIDS, 2023). Globally, about 85% of people living with HIV knew their HIV status, 88% were on antiretroviral therapy while 92% had attained viral suppression (UNAIDS, 2023). In Africa, despite increase in HIV testing and ART use, decrease in HIV incidences has not been observed and 1 in 3 HIV positive MSM have not achieved undetectable viral load (Stannah *et al.*, 2022). In Kenya, HIV prevalence among MSM was 18.9% while that of male in general population (15-49 years) was 3.1% (NASCO, 2020). About 94% of all people living with HIV in Kenya, knew their status, 98% were on ART, and 95% had achieved viral suppression. However, ART use among MSM was only 38.8% (UNAIDS, 2023).

A study on HIV/AIDS knowledge among MSM conducted by Lai *et al.* (2020) in China, indicated that, fewer MSM (42.9%) could completely and correctly answer questions about HIV/AIDS as compared to those who were not MSM (69.6%). However, MSM as compared to those who were not MSM, were able to recognize risky behaviours such as inconsistent condom use, alcohol and drugs abuse and smoking. According to study conducted on MSM by Qin *et al.* (2023) in China, receptive and versatile anal sex carried a higher risk of contracting HIV as compared to the insertive anal sex. MSM who were insertive (top) were considered more masculine than the receptive and decided whether to use condom or not during anal sex leaving receptive MSM (bottom) with no say (Nakiganda *et al.*, 2021).

Major barriers to HIV reduction among MSM were lack of knowledge, information and easy access to HIV services (Nakiganda *et al.*, 2021). For instance, some MSM did not know where they could get condoms and some reported not knowing how to use condoms, while some MSM were aware of PrEP but could not easily access it because of the adverse side effects and fear of being labelled as HIV positive (Nakiganda *et al.*, 2021). Approximately 70% of new HIV infection globally, occurred among the key population (UNAIDS, 2022), however, about one third of MSM and TGW were unaware if they were HIV positive, and fewer had taken the HIV test in the past 12 months (UNAIDS, 2020). MSM shunned taking HIV test because they feared being discriminated and stigmatized regardless of the outcome of the test (Thapa *et al.*, 2024).

Globally approximately 34 million people were living with HIV and 68% were in sub-Saharan Africa (UNAIDS, 2020). Unfortunately, the sub-Saharan Africa had also the highest prevalence of unhealthy alcohol use in the world (Duko *et al.*, 2019) which was associated with increased sexual risky behaviours, non-adherence to ART and detectable viral load (Puryear *et al.*, 2020) hence transmission of HIV. According to the study conducted in Tanzania, by Mbita *et al.* (2022), alcohol consumption led to reduced inhibition and hence increased exposure to risky sexual behaviour, such as condomless sex, violence and transactional sex. Similarly, the study by Kumar *et al.* (2020), conducted in India indicated, MSM were likely to indulge in alcohol and drugs, thus more likely to contract HIV while MSM who used injectable drugs were at higher risk of getting HIV because of shared needles and syringes.

In Miami-Dade County in USA, Sheehan *et al.* (2020) found that alcohol or drug use among MSM was associated with lower viral load suppression. Alcohol use has been theorized as coping mechanism for stigma and discrimination which MSM and Transgender women (TGW) living with HIV experienced (Turner *et al.*, 2020). According to a study in China by Wang *et al.* (2022), more than half of MSM were found to use drugs than alcohol and both groups were likely to have multiple sexual partners, engage in condomless anal sex while sexual drug users were likely to be HIV positive. Armstrong *et al.* (2021) found that Bisexual and other men who have sex with men (GBM) in Vancouver, Canada, who reported transactional sex were likely to be lonely and anxious, were likely to engage in high sexual risky behaviours such as non-condom use with partners of unknown HIV status, have multiple sex partners, abuse drugs such as injectables and crystal methamphetamine.

In Kenya and Uganda, Puryear *et al.* (2023) reported that alcohol use among MSM resulted in no significant difference in viral suppression between MSM who received counselling on alcohol and those who did not. However, MSM who received counselling on alcohol reduced alcohol intake and their health generally improved. In a study conducted in rural Uganda by Nakiganda *et al.* (2021), on MSM, showed that condomless anal sex was preferred because it was more erotic and easier to maintain an erection. According to a Brazilian study by Hentges

*et al.* (2023), over 50% of MSM inconsistently used condoms for anal sex with the casual partners. In another study Mitchell *et al.* (2021), on effects of COVID -19 on HIV among MSM, there was increased use of condomless sex, reduced HIV testing, reduced undetectable viral load, PrEP initiation and adherence, and initiation of ART which led to increased new cases of HIV.

The study by Nakiganda *et al.* (2021) also showed, MSM avoided seeking HIV services including sexual health issues, for fear of being stigmatized and discriminated and disclosure of their sexual preference especially in areas where same sex was criminalized. In Canada, a study conducted by Moore *et al.* (2021), three largest cities, among Gay, Bisexual, and other men who have sex with men (GBMSM) indicated, that GBMSM who were HIV and had a primary care giver were likely to have suppressed viral load while those who participated in the emotional wellbeing, had reduction in anxiety, depressive symptoms and viral load (Barrington *et al.*, 2023), hence the importance of holistically handling all issues affecting the MSM.

According to the study conducted in Mexico by Jiménez-Rivagorza *et al.* (2024) indicated, GBMSM who experienced stigma while accessing HIV care were likely to be non-adherent to ART; MSM also felt the HIV services were tailored to meet the needs of the heterosexual who may not present STI infection in the anal region. Thus, the MSM could not disclose their issues to the healthcare providers for fear of breach of confidentiality and being stigmatized (Balogun *et al.*, 2020). Some of the healthcare providers were not competent to deal with the MSM issues hence preferred to refer them to NGO for assistance (Matlapeng *et al.*, 2022). The public facilities which offered HIV services were shunned by MSM since they were overcrowded and MSM feared being seen by their acquaintances and friends.

Some of the MSM reported being mistreated by the healthcare providers and some reported lengthy waiting times (Matlapeng *et al.*, 2023). However, the private facilities and NGO were preferred sites by the MSM because their service was perceived to be private and confidential and they were friendly but at a cost (Moyo *et al.*, 2021). MSM also reported that the healthcare providers discussed and disclosed private matters of MSM including HIV information to their family members (Matlapeng *et al.*, 2022), hence MSM withheld important information to the healthcare providers that could assist in their treatment (Gumindega & Maharaj, 2022). MSM who were more optimistic about ART were likely to be adherent to treatment and hence likely to be virally suppressed (Armstrong *et al.*, 2022), however, younger MSM who were on stimulants such as ecstasy and crystal methamphetamine were unlikely to be virally suppressed (Armstrong, *et al.*, 2021).

A study on MSM and transgender women who were living with HIV showed only 60% had achieved undetectable viral load which was below UNAIDS targets, indicating suboptimal access to HIV care such as linkage to care, retention and adherence ART (Twahirwa *et al.*, 2020). Consequently, MSM who had poor uptake of HIV services, were likely to have poor treatment out comes as compared to other adults in sub-Saharan African (Twahirwa *et al.*, 2020). A study on the trends in HIV testing among MSM in Africa conducted by Stannah *et al.* (2022), indicated despite improvement on HIV testing, and linkage to HIV care, viral load suppression was still low at 69% which was below the UNAIDS set target of 95%. Thus, in order for majority of MSM to access and remain in care, HIV services have to be diversified. Services such as HIV self-testing and virtual services among others, would improve knowledge on HIV and increase the number of MSM who will be linked into care in Africa (WHO, 2023).



## Summary

In order to achieve UNAIDS target, and to contain the HIV epidemic, it is imperative that these vulnerable populations have to be reached to access HIV testing and treatment (Rocha *et al.*, 2023). According to Cota *et al.* (2021), barriers to HIV testing among MSM were low perception risk of HIV, fear of seroconverting, fear of stigma and discrimination and acceptance of their sexuality. Despite MSM engaging in high-risk behaviours such as having condomless anal sex, multiple sex partners, alcohol, and drugs use, majority did not seek HIV services, for fear of their sexual orientation being revealed or because of hostile healthcare workers. Criminalization of same sex relationship has also made the group to go underground, however, accurate data was seldomly available. In order to achieve the global targets of 95-95-95, by 2025 and ending AIDS epidemic in 2030, MSM and other key population must be kept in check.

## Research gap

Despite MSM being more vulnerable to HIV than men in the general population, they are less likely to access HIV services and data is seldomly available. Some of the gaps identified include; scanty information on sex education, new trends that lure men to risky sexual behaviours, the role of healthcare workers in reducing HIV among MSM and MSM utilization of available HIV services.

## METHODOLOGY

### Study Design

A quasi-experimental study design using quantitative methods was conducted among MSM living with HIV from December 2020 to June 2021.

### Study Population

The study was conducted in Mvita Sub-County in Mombasa County, Kenya. The target population was MSM living with HIV residing in the five (5) wards of Mvita sub-county. A total of 114 HIV positive MSM who participated in the study were divided into two groups. Half of the participants (57) were actively followed up and risk reduction interventions were done after every two months for a period of 6 months while the other 57 participants (control group) interacted with the researcher only at the beginning and at the end of the study and no risk reduction interventions was offered. Men who identified themselves as male at birth, were 18 years and above, had an identification card, had a comprehensive care clinic card (CCC), had a phone, had had anal sex with a man in the last 3 months, was a Mvita resident, and willing to give a written consent were recruited to participate in the study. The respondent driven sampling (RDS) was used to collect the sample in the absence of a sampling frame. Convenient sampling was used to select the 5 'seeds' from the 5 administrative wards in Mvita Sub-County. Each 'seed' was given 3 coupons to recruit 3 participants randomly from the social networks which ensured sampling continued even if some 'seeds' did not recruit. Oversampling of the recruits with similar characteristics was limited by issuing 3 coupon per 'seed', thus reducing recruitment bias. The 'seeds' recruits formed the 0<sup>th</sup> wave while the recruits of the 'seeds' were also given 3 coupon each and formed the 1<sup>st</sup> wave. A desired sample of 114 was reached after several recruitments and wave formations.

## **Data Collection Process**

Semi-structured, self-developed questionnaires both in English and Kiswahili were used to collect the quantitative data. The participants took about 45 minutes to answer the questionnaires, which were pretested prior to the study at HIV & AIDS People Alliance of Kenya (HAPA-Kenya), in Kisauni, since the residents did not participate in the study. The study was used to review the tools and also ensure the validity and reliability of the data. All the participants who were HIV positive, were subjected to a battery of tests which included drug test done using cypress diagnostics drug screen card which was a urine dip-and-read test strip. Drugs such as amphetamine, tetrahydrocannabinol, morphine, methadone, phencyclidine, benzodiazepines, 6-mam heroin (metabolite) and cocaine were tested. Other tests included, gonorrhoea, syphilis, hepatitis B, alcohol and viral load tests. These tests were done at the beginning and at the end of the study in June 2021. Half of the MSM were actively followed by the researcher. Risk reduction interventions such adherence to ARVs, general counselling and HIV prevention measures such as prompt treatment of STI/OI, condom usage were done after every two months to the group that was followed up by the researcher while the other half (control group) interacted with the researcher only at the beginning of the study and at the end of the study and no interventions were offered. Thereafter both groups were asked to respond to the questions in the questionnaire. To minimize COVID-19 transmission (the risk reduction interventions) data was done by phone.

## **Data Analysis**

All data errors detected in the statistical software were flagged and corrected by replacing with correct values in respondents' records. Data were assumed not to be missing at random, an extra category 'missing' was added to each variable with missing values to ensure all participants were included in the regression models. Univariate log-binomial regression analysis was first conducted, with the intervention status as the only independent variable. To perform multivariate regression analysis, all the independent variables were included as indicated in the succeeding tables. Statistical analysis was conducted using STATA software Version 17 with level of significance fixed at 5% significance level.

## **Ethical Considerations**

The ethical review committee (ERC) of Pwani University and national commission for science, technology & innovation (NACOSTI) gave approval to conduct the research. The participants willingly offered consent in writing before participating in research and they were allowed voluntarily to exit the study at any stage. The unique identification numbers and passwords were used to protect electronic data and also to maintain confidentiality and privacy.

## **RESULTS**

### **Baseline Characteristics of the Participants Who Completed Six Months of Follow-Up**

A total of 114 HIV positive MSM completed the study. Out of these, 57 participants were on active follow up and risk reduction interventions were offered every two months for six months. The other half (control group) interacted with the researcher only at the beginning of the study in December 2020 and at the end of the study in June 2021 with no interventions offered. However, their baseline demographics characteristics were not significantly different (all  $p$ -values  $>0.05$ ) as given by Table 1.

**Table 1: Baseline Characteristics of the Participants Who Completed Six Months of Follow-Up**

Variables	Control (N=57)	Interventions (N=57)	Chi-square value	P-value
<b>Age in years</b>				
<18	4 (7.0)	3 (5.3)		0.49*
19 to 29	31 (54)	28 (49)		
30 to 40	16 (28)	23 (40)		
≥41	6 (11)	3 (5.3)		
<b>Relationship status</b>				
Single	44 (77)	40 (70)		0.42*
Married	12 (21)	13 (23)		
Cohabiting/casual	1 (1.8)	4 (7.0)		
<b>Religion</b>				
Christian	35 (61)	33 (58)		0.63*
Muslim	16 (28)	20 (35)		
Others	6 (11)	4 (7.0)		
<b>Level of education</b>				
No education/Primary	30 (53)	30 (53)	0.33	0.85
Secondary	19 (33)	17 (30)		
Middle level college/university	8 (14)	10 (18)		
<b>Occupation</b>				
Student	8 (14)	7 (12)	1.11	0.58
Working	36 (63)	32 (56)		
Not working	13 (23)	18 (32)		
<b>Ever married to a female</b>				
No	35 (61)	36 (63)	0.04	0.85
Yes	22 (39)	21 (37)		
<b>Income per month (KSh)</b>				
<5000	33 (58)	37 (65)		0.85*
5000 to 10000	20 (35)	17 (30)		
10000 to 20000	3 (5.3)	2 (3.5)		
20000 to 30000	1 (1.8)	1 (1.8)		
<b>In past 6 months, no enough money for:</b>				
Rent	5 (8.8)	7 (12)	0.37	0.54
Food	25 (44)	30 (53)	0.88	0.35
Others	1 (1.8)	2 (3.5)		0.50*

\*P-values from fisher's exact test, all other P-values are from Chi-square test of association

### The Effect of Interventions on Viral Load Suppression after Six Months Adjusted for Baseline Demographics

The results are as shown in Table 2. The intervention was associated with 76% higher chance of having undetectable viral load (crude risk ratio = 1.76, 95%CI=1.26–2.45, p=0.001). After controlling for demographics characteristics, intervention was associated with adjusted risk ratio of 2.21 (95%CI=1.42–3.44) of undetectable viral road after six months as shown by Table 2. Having an income between 20,000 to 30,000 (aRR=1.58, 95% CI=1.04–2.39) was positively associated with undetectable viral load, while not being a Christian or Muslim (aRR= 0.51, 95%CI= 0.35-0.75) and having an income between 5,000 to 10,000 per month (aRR= 0.80, 95% CI =0.66–0.97) was negatively associated with undetectable viral load after six months of follow-up. No other demographic features were significantly associated with undetectable viral road.

**Table 2: Effect of Interventions on Viral Load Suppression after Six Months Adjusted For Baseline Demographics**

Variables	Control (N=57)	Interventions (N=57)	Adjusted Risk ratios (95% CI)	P-value
<b>Age in years</b>				
<18	4 (7.0)	3 (5.3)	Reference	
19 to 29	31 (54)	28 (49)	0.83 (0.66-1.04)	0.10
30 to 40	16 (28)	23 (40)	0.82 (0.64-1.04)	0.10
≥41	6 (11)	3 (5.3)	0.97 (0.68-1.40)	0.88
<b>Relationship status</b>				
Single	44 (77)	40 (70)	Reference	
Married	12 (21)	13 (23)	1.18 (0.86-1.62)	0.31
Cohabiting/casual	1 (1.8)	4 (7.0)	0.56 (0.20-1.55)	0.26
<b>Religion</b>				
Christian	35 (61)	33 (58)	Reference	
Muslim	16 (28)	20 (35)	0.92 (0.69-1.23)	0.59
Others	6 (11)	4 (7.0)	0.51 (0.35-0.75)	0.001
<b>Level of education</b>				
No education/Primary	30 (53)	30 (53)	Reference	
Secondary	19 (33)	17 (30)	1.04 (0.87-1.25)	0.67
Middle level college/university	8 (14)	10 (18)	0.99 (0.80-1.24)	0.99
<b>Occupation</b>				
Student	8 (14)	7 (12)	Reference	
Working	36 (63)	32 (56)	0.76 (0.55-1.04)	0.09
Not working	13 (23)	18 (32)	0.77 (0.47-1.27)	0.30
<b>Ever married to a female</b>				
No	35 (61)	36 (63)	Reference	
Yes	22 (39)	21 (37)	0.90 (0.67-1.22)	0.51
<b>Income per month (KSh)</b>				
<5000	33 (58)	37 (65)	Reference	
5000 to 10000	20 (35)	17 (30)	0.80 (0.66-0.97)	0.03
10000 to 20000	3 (5.3)	2 (3.5)	0.89 (0.73-1.09)	0.26
20000 to 30000	1 (1.8)	1 (1.8)	1.58 (1.04-2.39)	0.03
<b>In past 6 months, no enough money for:</b>				
<b>Rent</b>				
No	52 (91)	50 (88)	Reference	
Yes	5 (8.8)	7 (12)	0.54 (0.22-1.35)	0.19
<b>Food</b>				
No	32 (56)	27 (47)	Reference	
Yes	25 (44)	30 (53)	1.11 (0.93-1.31)	0.24
<b>Others</b>				
No	56 (98)	55 (96)	Reference	
Yes	1 (1.8)	2 (3.5)	1.54 (0.69-3.44)	0.29

Adjusted risk ratio (95% confidence intervals) are from multivariable log-binomial regression mode

### The Effect of Interventions on Viral Load Suppression after Six Months Adjusted for Knowledge of HIV/AIDS

After controlling for knowledge on HIV/AIDS prevention services among MSM, intervention was associated with adjusted risk ratios of 2.34 (95%CI =1.27–4.34, p=0.007) as shown in Table 3. Only “not knowing if being faithful to uninfected partner” can reduce risk of HIV (aRR=0.55, 95%CI= 0.40–0.75) and use of PEP/PrEP for HIV prevention (aRR= 0.76, 95%CI

=0.64–0.91) were negatively associated with risk of undetectable viral load after six months of follow-up as shown in Table 3.

**Table 3: The Effect of Interventions on Viral Load Suppression after Six Months Adjusted for Knowledge of HIV/AIDS**

Variables	Control (N=57)	Interventions (N=57)	Adjusted Risk ratios (95% CI)	P-value
<b>Motivation to take HIV test<sup>s</sup></b>				
Know HIV status	42 (74)	44 (77)	0.79 (0.44-1.42)	0.43
Poor health	25 (44)	20 (35)	0.75 (0.50-1.14)	0.18
Had unprotected sex	19 (33)	23 (40)	0.87 (0.59-1.28)	0.47
Coerced by Health workers	5 (8.8)	3 (5.3)	0.69 (0.34-1.40)	0.30
<b>Ever declined to take HIV test<sup>s</sup></b>				
HIV has no cure				
No	34 (60)	35 (61)	Reference	
Yes	23 (40)	22 (39)	1.25 (0.88-1.78)	0.21
<b>Fear of positive results</b>				
No	21 (37)	29 (51)	Reference	
Yes	36 (63)	28 (49)	1.07 (0.91-1.24)	0.41
<b>Stigma attached to HIV</b>				
No	16 (28)	18 (32)	Reference	
Yes	41 (72)	39 (68)	0.98 (0.77-1.28)	0.93
<b>Frequency of HIV screening in last year</b>				
Once	16 (28)	6 (11)	Reference	
More than once	6 (11)	3 (5.3)	1.21 (0.83-1.78)	0.32
Never	10 (18)	9 (16)	0.98 (0.83-1.15)	0.79
No response	25 (44)	39 (68)	0.98 (0.56-1.73)	0.96
<b>Frequency of STI screening in last year</b>				
Once	25 (44)	27 (47)	Reference	
More than once	17 (30)	17 (30)	0.76 (0.56-1.05)	0.10
Never	15 (26)	13 (23)	0.75 (0.54-1.04)	0.08
<b>HIV services are free</b>				
Yes	39 (68)	45 (79)	0.70 (0.45-1.09)	0.12
No	5 (8.8)	2 (3.5)	Reference	
Don't know	13 (23)	10 (18)	0.51 (0.22-1.16)	0.11
<b>HIV transmitted</b>				
Unprotected sex				
No	4 (7.0)	3 (5.3)	Reference	
Yes	53 (93)	54 (95)	1.18 (0.76-1.83)	0.47
<b>Sharing utensils</b>				
No	45 (79)	47 (82)	Reference	
Yes	12 (21)	10 (18)	0.89 (0.51-1.57)	0.70
<b>Insect bites</b>				
No	46 (81)	50 (88)	Reference	
Yes	11 (19)	7 (12)	0.77 (0.46-1.28)	0.31
<b>Sharing of needles and syringes</b>				
No	24 (42)	20 (35)	Reference	
Yes	33 (58)	37 (65)	1.12 (0.89-1.41)	0.34
<b>Sex preference</b>				
Insertive	12 (21)	14 (25)	Reference	
Receptive	14 (25)	12 (21)	1.24 (0.80-1.92)	0.33
Both	31 (54)	31 (54)	1.14 (0.81-1.59)	0.45
<b>MSM likely to contact HIV</b>				
Insertive	9 (16)	6 (11)	Reference	
Receptive	23 (40)	20 (35)	1.40 (0.64-3.08)	0.40
Both	25 (44)	31 (54)	1.52 (0.60-3.81)	0.38
<b>Faithfulness to uninfected partner reduces the risk of HIV</b>				
Yes	39 (68)	45 (79)	0.89 (0.58-1.39)	0.61
No	7 (12)	4 (7.0)	Reference	
Don't know	11 (19)	8 (14)	0.55 (0.40-0.75)	<0.001
<b>A healthy-looking person could be HIV positive</b>				
Yes	35 (61)	40 (70)	1.15 (0.77-1.73)	0.49
No	7 (12)	10 (18)	Reference	
Don't know	15 (26)	7 (12)	1.09 (0.88-1.34)	0.43

Condom use reduces transmission of HIV				
Yes	43 (75)	55 (96)	0.48 (0.09-2.48)	0.38
No	2 (3.5)	0	Reference	
Don't know	12 (21)	2 (3.5)	0.64 (0.19-2.10)	0.46
Use lubricant during anal sex				
Yes	54 (95)	55 (96)	2.53 (0.64-10.1)	0.19
No	3 (5.3)	2 (3.5)	Reference	
Ever accessed PEP/PrEP				
Yes	42 (74)	43 (75)	0.94 (0.55-1.61)	0.81
No	14 (25)	13 (23)	Reference	
Ever used PEP/PrEP for HIV prevention				
Yes	25 (44)	18 (32)	0.76 (0.64-0.91)	0.003
No	32 (56)	38 (67)	Reference	
Circumcision reduces HIV				
Yes	32 (56)	37 (65)	1.03 (0.57-1.87)	0.91
No	10 (18)	8 (14)	Reference	
Don't know	15 (26)	12 (21)	1.27 (0.75-2.12)	0.37
ARVs boost immunity				
Yes	52 (91)	50 (88)	1.50 (0.70-3.21)	0.30
No	0	2 (3.5)	Reference	
Don't know	5 (8.8)	5 (8.8)	1.56 (0.51-4.81)	0.44
Sharing sex toys increases risk of HIV				
Yes	32 (56)	28 (49)	1.08 (0.71-1.64)	0.74
No	13 (23)	14 (25)	Reference	
Don't know	12 (21)	15 (26)	1.06 (0.75-1.49)	0.75
Attended training on HIV/AIDs prevention among MSM				
Yes	36 (63)	37 (65)	0.94 (0.71-1.24)	0.65
No	19 (33)	16 (28)	Reference	
Cannot remember	2 (3.5)	4 (7.0)	1.24 (0.65-2.37)	0.51

Adjusted risk ratio (95% confidence intervals) are from multivariable log-binomial regression model, -no enough data to be included in the multivariable regression model

### The Effect of Interventions on Viral Load Suppression after Six Months Adjusted for Individual Behaviours of MSM

After controlling for individual behaviour of MSM, intervention was associated with adjusted risk ratios of 2.42 (95%CI=1.57–3.71,  $p<0.0010$ ) as given by Table 4. Thus, MSM on active follow-up were twice (2.4 times) more likely to have undetectable viral load after six months compared to those in the control group.

In the multivariate model, undetectable viral load after six months of follow-up was positively associated with declining to answer if one had anal sex after being drugged/alcohol (aRR=1.51,95%CI=1.12–2.03); having anal sex with more than one regular partner (aRR=1.22, 95%CI=1.01–1.48), having no regular anal sex partner (aRR 2.20 (95%CI 1.33–3.64)), condom break more than once during anal sex (aRR =1.17, 95%CI =1.08–1.26); drinking more than 2 bottles of alcohol daily (aRR= 3.37, 95%CI= 1.14–9.98), started abusing drugs after being influenced by adults (aRR =1.51,95%CI =1.16–1.97); and use of *muguka* (type of khat) (aRR=3.07, 95%CI =1.85–5.10). Being raped (aRR=0.48, 95%CI = 0.23–0.97), always having anal sex while high on alcohol (aRR = 0.58, 95%CI= 0.38–0.88), injecting with non-prescribed drugs 1 to 2 times in a week (aRR =0.40, 95%CI =0.32–0.51), and declining to answer if injectable drugs have been used (aRR =0.46, 95%CI =0.25–0.85) were negatively associated with undetectable viral load after six months of follow-up (Table 4).

**Table 4: The Effect of Interventions on Viral Load Suppression after Six Months Adjusted for Individual Behaviours of MSM**

Variables	Control (N=57)	Interventions (N=57)	Adjusted Risk ratios (95% CI)	P-value
Viral road after six months				
Detectable	28 (49)	6 (11)	Reference	
Not detectable	29 (51)	51 (89)	2.42 (1.57-3.71)	<0.001
Anal sex debut				
< 18 years	35 (61)	30 (53)	Reference	
19 to 29 years	21 (37)	24 (42)	0.92 (0.73-1.16)	0.49
30 to 40 years	1 (1.8)	3 (5.3)	1.01 (0.52-1.96)	0.98
Engaged in anal sex due to <sup>3</sup>			No reference	
Peer pressure				
No	29 (51)	26 (46)	Reference	
Yes	28 (49)	31 (54)	0.87 (0.75-1.01)	0.07
Money				
No	15 (26)	28 (49)	Reference	
Yes	42 (74)	29 (51)	1.10 (0.78-1.56)	0.58
Curiosity				
No	40 (70)	38 (67)	Reference	
Yes	17 (30)	19 (33)	0.93 (0.72-1.20)	0.57
Rape				
No	55 (96)	53 (93)	Reference	
Yes	2 (3.5)	4 (7.0)	0.48 (0.23-0.97)	0.04
Gifts given in exchange of sex <sup>5</sup>			No reference	
Money				
No	5 (8.8)	9 (16)	Reference	
Yes	52 (91)	48 (84)	0.87 (0.53-1.42)	0.57
Drugs				
No	39 (68)	44 (77)	Reference	
Yes	18 (32)	13 (23)	0.67 (0.40-1.11)	0.12
Food				
No	35 (61)	39 (68)	Reference	
Yes	22 (39)	18 (32)	0.87 (0.68-1.11)	0.26
Accommodation				
No	43 (75)	41 (72)	Reference	
Yes	14 (25)	16 (28)	0.84 (0.69-1.02)	0.08
Paid a man to have anal sex				
No	24 (43)	21 (37)	Reference	
Yes	32 (57)	36 (63)	0.99 (0.77-1.26)	0.91
Had anal sex after being drugged/alcohol				
No	23 (40)	23 (40)	Reference	
Yes	34 (60)	31 (54)	0.93 (0.72-1.21)	0.61
Declined to answer	0	3 (5.3)	1.51 (1.12-2.03)	0.006
Anal sex with regular male partner				
One partner	20 (35)	22 (39)	Reference	
More than one partner	35 (61)	35 (61)	1.22 (1.01-1.48)	0.04
No regular partner	2 (3.5)	0	2.20 (1.33-3.64)	0.002
Anal sex with casual male partner				
One partner	22 (39)	19 (33)	Reference	
More than one partner	33 (58)	35 (61)	0.75 (0.52-1.07)	0.11
No casual partner	2 (3.5)	3 (5.3)	0.97 (0.59-1.59)	0.91
Group sex with male sex partners				
1 to 2 partners	18 (32)	24 (42)	Reference	
More than 2 partners	19 (33)	18 (32)	1.20 (0.88-1.62)	0.25
Never	20 (35)	15 (26)	1.23 (0.97-1.56)	0.09
Condomless insertive sex with a regular male partner				
Sometimes	16 (28)	15 (26)	Reference	
Always	22 (39)	26 (46)	1.00 (0.82-1.23)	0.96
Never	19 (33)	16 (28)	1.10 (0.87-1.39)	0.44
Condomless receptive sex with a regular male partner				
Sometimes	19 (33)	22 (39)	Reference	
Always	24 (42)	18 (32)	1.00 (0.82-1.23)	0.96
Never	14 (25)	17 (30)	1.09 (0.87-1.39)	0.44
Condomless insertive sex with a casual male partner				
Sometimes	30 (53)	26 (46)	1.00 (0.71-1.40)	0.99
Always	4 (7.0)	7 (12)	Reference	
Never	23 (40)	24 (42)	0.99 (0.64-1.56)	0.98
Condomless receptive sex with a casual male partner				
Sometimes	29 (51)	26 (46)	0.92 (0.68-1.23)	0.57
Always	3 (5.3)	7 (12)	Reference	
Never	25 (44)	24 (42)	1.02 (0.69-1.53)	0.91

<b>Condomless virginal sex</b>				
Sometimes	27 (47)	16 (28)	0.75 (0.51-1.11)	0.15
Always	11 (19)	12 (21)	Reference	
Never	19 (33)	29 (51)	0.66 (0.42-1.02)	0.06
<b>Condom break</b>				
Once	24 (42)	16 (28)	Reference	
More than once	27 (47)	35 (61)	1.17 (1.08-1.26)	<0.001
Never	6 (11)	6 (11)	1.12 (0.69-1.83)	0.64
<b>Experience after anal sex<sup>5</sup></b>			No reference	
<b>Anal bleeding</b>				
No	30 (53)	31 (54)	Reference	
Yes	27 (47)	26 (46)	1.07 (0.62-1.86)	0.80
<b>Sore penis/anus</b>				
No	13 (23)	15 (26)	Reference	
Yes	44 (77)	42 (74)	0.99 (0.50-1.99)	0.99
<b>Anal warts</b>				
No	53 (93)	47 (82)	Reference	
Yes	4 (7.0)	10 (18)	1.05 (0.49-2.28)	0.89
<b>Urethral discharge</b>				
No	45 (79)	44 (77)	Reference	
Yes	12 (21)	13 (23)	0.81 (0.40-1.64)	0.56
<b>Alcohol debut</b>				
< 18 years	15 (26)	18 (32)	Reference	
19 to 29 years	27 (47)	22 (39)	0.81 (0.54-1.23)	0.33
30 to 50 years	4 (7.0)	3 (5.3)	0.90 (0.40-2.03)	0.81
Never	11 (19)	14 (25)	2.76 (0.83-9.19)	0.09
<b>Reasons for drinking alcohol<sup>5</sup></b>			No reference	
<b>Peer pressure</b>				
No	28 (49)	33 (58)	Reference	
Yes	29 (51)	24 (42)	0.91 (0.62-1.33)	0.62
<b>Influenced by adults</b>				
No	39 (68)	37 (65)	Reference	
Yes	18 (32)	20 (35)	0.98 (0.76-1.25)	0.86
<b>Curiosity</b>				
No	43 (75)	50 (88)	Reference	
Yes	14 (25)	7 (12)	0.81 (0.50-1.32)	0.39
<b>Never</b>				
No	46 (81)	41 (72)	Reference	
Yes	11 (19)	16 (28)	0.38 (0.06-2.33)	0.29
<b>Had anal sex while high on alcohol</b>				
Once	11 (19)	9 (16)	Reference	
More than once	23 (40)	24 (42)	1.03 (0.58-1.82)	0.93
Always	11 (19)	7 (12)	0.58 (0.38-0.88)	0.01
Never	12 (21)	17 (30)	0.75 (0.38-1.47)	0.40
<b>Drunk alcohol to enhance sex performance</b>				
Once	5 (8.8)	13 (23)	Reference	
Sometimes	22 (39)	15 (26)	0.82 (0.27-2.47)	0.72
Always	16 (28)	10 (18)	0.72 (0.24-2.17)	0.56
Never	14 (25)	19 (33)	0.64 (0.20-2.03)	0.45
<b>Alcohol intake</b>				
1 to 2 bottles daily	13 (23)	15 (26)	Reference	
More than 2 bottles	19 (33)	19 (33)	3.37 (1.14-9.98)	0.03
Occasionally	13 (23)	10 (18)	2.82 (0.84-9.45)	0.09
Never	12 (21)	13 (23)	2.22 (0.81-6.07)	0.12
<b>Drug use before anal sex</b>				
Once	10 (18)	8 (14)	Reference	
Sometimes	18 (32)	17 (30)	1.05 (0.45-2.44)	0.91
Always	19 (33)	19 (33)	0.97 (0.34-2.82)	0.96
Never	10 (18)	13 (23)	1.13 (0.46-2.77)	0.79
<b>Reason for abusing drugs<sup>5</sup></b>			No reference	
<b>Peer pressure</b>				
No	25 (44)	30 (53)	Reference	
Yes	32 (56)	27 (47)	0.78 (0.57-1.07)	0.12
<b>Influenced by adults</b>				
No	49 (86)	48 (84)	Reference	
Yes	8 (14)	9 (16)	1.51 (1.16-1.97)	0.002
<b>Curiosity</b>				
No	45 (79)	44 (77)	Reference	
Yes	12 (21)	13 (23)	1.42 (0.92-2.21)	0.12
<b>Never</b>				
No	46 (81)	42 (74)	Reference	
Yes	11 (19)	15 (26)	1.36 (0.53-3.46)	0.53
<b>Drugs used in the last 6 months<sup>5</sup></b>			No reference	
<b>Marijuana</b>				
No	32 (56)	23 (40)	Reference	
Yes	25 (44)	34 (60)	0.93 (0.81-1.06)	0.28



Cocaine				
No	44 (77)	49 (86)	Reference	
Yes	13 (23)	8 (14)	0.65 (0.32-1.31)	0.22
Club drugs				
No	45 (79)	49 (86)	Reference	
Yes	12 (21)	8 (14)	0.59 (0.24-1.45)	0.25
Viagra				
No	54 (95)	53 (93)	Reference	
Yes	3 (5.3)	4 (7.0)	1.04 (0.51-2.13)	0.91
Prescription drugs				
No	55 (96)	54 (95)	Reference	
Yes	2 (3.5)	3 (5.3)	1.18 (0.63-2.19)	0.60
Methamphetamine				
No	56 (98)	55 (96)	Reference	
Yes	1 (1.8)	2 (3.5)	1.11 (0.31-3.92)	0.87
Muguka				
No	12 (21)	14 (25)	Reference	
Yes	45 (79)	43 (75)	3.07 (1.85-5.10)	<0.001
Miraa				
No	20 (35)	23 (40)	Reference	
Yes	37 (65)	34 (60)	1.15 (0.78-1.68)	0.48
Never				
No	48 (84)	44 (77)	Reference	
Yes	9 (16)	13 (23)	2.84 (0.85-9.53)	0.09
Use of non-prescribed Injectable drugs				
Daily	7 (12)	5 (8.8)	Reference	
1 to 2 times in a week	5 (8.8)	9 (15)	0.40 (0.32-0.51)	<0.001
Decline to answer	26 (46)	21 (37)	0.46 (0.25-0.85)	0.01
Never	19 (33)	22 (39)	1.03 (0.85-1.24)	0.78
Drug use to enhance sex performance				
Once	5 (8.8)	6 (11)	Reference	
Sometimes	21 (37)	15 (26)	0.68 (0.23-2.02)	0.49
Always	21 (37)	20 (35)	0.98 (0.46-2.08)	0.95
Never	10 (18)	16 (28)	0.89 (0.41-1.89)	0.75
Have you disclosed your HIV status?				
No	30 (53)	40 (70)	Reference	
Yes	25 (44)	17 (30)	1.29 (0.68-2.46)	0.43
Decline to answer	2 (3.5)	0	1.25 (0.14-11.2)	0.84
Disclosure of sex preference				
No	37 (65)	47 (82)	Reference	
Yes	19 (33)	10 (18)	0.73 (0.33-1.60)	0.43
Decline to answer	1 (1.8)	0	0.86 (0.09-8.41)	0.89
Ever been assaulted?			No reference	
Verbally				
No	10 (18)	6 (11)	Reference	
Yes	47 (82)	51 (89)	0.98 (0.42-2.32)	0.97
Physically				
No	32 (56)	27 (47)	Reference	
Yes	25 (44)	30 (53)	1.12 (0.61-2.03)	0.72
Sexually				
No	39 (68)	38 (67)	Reference	
Yes	18 (32)	19 (33)	1.00 (0.56-1.78)	0.98
Experienced rejection by			No reference	
Family				
No	36 (63)	28 (49)	Reference	
Yes	21 (37)	29 (51)	0.87 (0.51-1.50)	0.62
Friends				
No	32 (56)	33 (58)	Reference	
Yes	25 (44)	24 (42)	0.85 (0.50-1.45)	0.56
Society				
No	25 (44)	20 (35)	Reference	
Yes	32 (56)	37 (65)	1.04 (0.58-1.85)	0.89
Colleagues				
No	49 (86)	48 (84)	Reference	
Yes	8 (14)	9 (16)	1.04 (0.49-2.21)	0.91
Denied opportunity for business, education or employment				
No	30 (53)	30 (53)	Reference	
Yes	25 (44)	25 (44)	0.90 (0.51-1.57)	0.70
Decline to answer	2 (3.5)	2 (3.5)	1.16 (0.35-3.79)	0.81
Participation in religious activities				
No	18 (32)	9 (16)	Reference	
Yes	35 (61)	44 (77)	0.86 (0.45-1.66)	0.66
Decline to answer	4 (7.0)	4 (7.0)	1.07 (0.35-3.31)	0.90

### Effect of Interventions on the Tests Subjected to MSM after Six Months

At baseline, the proportion with undetectable viral load was significantly higher among those on active follow-up (39% versus 14% in the control group,  $p=0.003$ ). However, all other tests were not significantly different at baseline. After six months follow-up, the proportion with undetectable viral load was significantly higher among those on active follow-up (89% versus 51% in the control group,  $p<0.001$ ). The proportion of participants with Hepatitis B, VDRL and urine positive results were not significantly different after six months of follow-up between the two methods of follow-up. However, the proportion of abnormal alcohol range was significantly higher ( $p=0.005$ ) in the control group ( $n=21$  or 37%) compared to those actively followed up ( $n=8$ , or 14%). MOP (morphine) and THC-tetrahydrocannabinol (*marijuana*) were the most common individual drugs which tested positive. Slightly more than half of all the participants were negative for all the drugs tested (Table 5). The distribution of individual drugs between the two methods of follow-up were not different save for THC and MOP after six months of follow-up (Table 5). The proportion on THC ( $p=0.03$ ) and MOP ( $p=0.001$ ) were higher among patients in the control group.

**Table 5: Effect of Interventions on the Tests Subjected to MSM after Six Months**

Variables	Baseline				After six months			
	Intervention (N=57)	Control (N=57)	Chi-square value	P-value	Interventions (N=57)	Control (N=57)	Chi-square value	P-value
Viral load								
Undetectable	22 (39)	8 (14)	8.9	0.003	51 (89)	29 (51)	20.3	<0.001
Detectable	35 (61)	49 (86)			6 (11)	28 (49)		
Hepatitis B								
Negative	49 (86)	51 (89)	0.33	0.57	49 (86)	52 (91)	0.78	0.38
Positive	8 (14)	6 (11)			8 (14)	5 (8.8)		
VDRL#								
Negative	51 (89)	49 (86)	0.33	0.57	56 (98)	57 (100)	1.01	0.32
Positive	6 (11)	8 (14)			1 (1.8)	0		
Alcohol								
Normal range (5-40U/L)	43 (75)	36 (63)	2.02	0.16	49 (86)	36 (63)	7.8	0.005
Abnormal range	14 (25)	21 (37)			8 (14)	21 (37)		
Urine test								
Negative	53 (93)	50 (96)	0.53	0.47	55 (96)	56 (98)	1.33	0.51
GC positive	4 (7.0)	2 (3.9)			2 (3.5)	1 (1.8)		
Individual Drugs*								
AMP	22 (39)	21 (37)	0.04	0.85	22 (39)	21 (37)	0.04	0.85
COC	1 (1.8)	5 (8.8)	2.81	0.09	1 (1.8)	5 (8.8)	2.81	0.09
THC	18 (32)	21 (37)	0.35	0.55	10 (18)	20 (35)	4.52	0.03
MTD	0	1 (1.8)	1.01	0.32	0	1 (1.8)	1.01	0.32
PCP	0	1 (1.8)	0.32	0.32	0	1 (1.8)	1.01	0.32
BZO	2 (3.5)	5 (8.8)	1.37	0.24	2 (3.5)	5 (8.8)	1.37	0.24
MOP	6 (11)	6 (11)	0.08	0.91	1 (1.8)	6 (11)	8.43	0.001
MAM	2 (3.5)	3 (5.3)	0.21	0.65	2 (3.5)	3 (5.3)	0.21	0.65
Number of drugs								
Negative for all drugs	31 (54)	29 (51)	3.53	0.62	32 (56)	29 (51)	8.20	0.15
One drug	8 (14)	8 (14)			17 (30)	9 (16)		
Two drugs	12 (21)	8 (14)			4 (7.0)	7 (12)		
Three drugs	5 (8.8)	10 (15)			3 (5.3)	10 (18)		
Four drugs	1 (1.8)	1 (1.8)			1 (1.8)	1 (1.8)		
Five drugs	0	1 (1.8)			0	1 (1.8)		

All the results are frequencies (percentages); all the p-values are from chi-square test of association

### The Effects of Interventions on Participants Viral Load Suppression after Six Months Adjusted for Health System

After controlling for health system features, active follow-up was associated with adjusted risk ratios of 2.55 (95%CI =2.02–3.21).

In the multivariate model, undetectable viral load after six months of follow-up was also positively associated with baseline viral load (aRR =2.41, 95%CI= 1.98–2.93). Attending check-ups in private clinic (aRR= 1.32, 95%CI =1.04–1.66), given information on how to disclose HIV status by healthcare workers (aRR =1.81, 95%CI =1.07–3.06) and being sent away due to lack of ARVs (aRR 1.27 (95%CI 1.01–1.60)) were positively associated with undetectable viral load while feeling uneasy while seeking health services (aRR =0.70, 95%CI =0.55–0.90), not knowing whether to feel uneasy while seeking health services, (aRR =0.66, 95%CI =0.52–0.83), not knowing if the healthcare workers were friendly to MSM (aRR= 0.76, 95%CI =0.60–0.96), were negatively associated with undetectable viral road after six months of follow-up (Table 6).

**Table 6: Effect of Interventions on Participants Viral Suppression after Six Months Adjusted for Health System Features**

Variables	Control (N=57)	Interventions (N=57)	Adjusted Risk ratios (95% CI)	P-value
<b>Viral road after six months</b>				
Detectable	28 (49)	6 (11)	Reference	
Not detectable	29 (51)	51 (89)	2.55 (2.02-3.21)	<0.001
<b>Preferred hospital for MSM</b>				
Public hospital	33 (58)	36 (63)	Reference	
Private hospital/clinics	24 (42)	21 (37)	1.32 (1.04-1.66)	0.02
<b>Facility that offers better care</b>				
Public hospital	25 (44)	35 (61)	Reference	
Private hospital/clinics	32 (56)	22 (39)	0.94 (0.84-1.05)	0.29
<b>Feel uneasy seeking health services</b>				
No	16 (28)	10 (18)	Reference	
Yes	35 (61)	43 (75)	0.70 (0.55-0.90)	0.004
Don't know	6 (11)	4 (7.0)	0.66 (0.52-0.83)	0.001
<b>Healthcare workers are competent to handle MSM issues</b>				
No	16 (28)	9 (16)	Reference	
Yes	34 (60)	42 (74)	0.85 (0.69-1.05)	0.13
Don't know	7 (12)	6 (11)	1.05 (0.61-1.82)	0.86
<b>Friendly healthcare workers</b>				
No	15 (26)	15 (26)	Reference	
Yes	32 (56)	37 (65)	0.99 (0.66-1.48)	0.96
Don't know	10 (16)	5 (8.8)	0.76 (0.60-0.96)	0.02
<b>Time taken to reach healthcare facility</b>				
Minutes	16 (28)	19 (33)	Reference	
Hours	41 (72)	38 (67)	1.25 (0.94-1.67)	0.12
<b>Flexible operating clinic hours</b>				
No	15 (27)	11 (19)	Reference	
Yes	25 (45)	33 (58)	0.94 (0.72-1.22)	0.63
Don't know	16 (29)	13 (23)	0.99 (0.48-2.05)	0.98
<b>Have been denied HIV services</b>				
No	34 (60)	39 (68)	Reference	
Yes	21 (37)	16 (28)	0.99 (0.78-1.26)	0.94
Don't know	2 (3.5)	2 (3.5)	0.81 (0.44-1.48)	0.49
<b>Pre- and Post-HIV counselling done</b>				
No	5 (8.8)	2 (3.5)	Reference	
Yes	48 (84)	55 (96)	1.52 (0.87-2.67)	0.14
Declined to answer	4 (7.0)	0	1.38 (0.87-2.19)	0.17
<b>Given information on how to disclose HIV status</b>				
No	17 (30)	12 (21)	Reference	
Yes	35 (61)	38 (67)	1.31 (0.83-2.07)	0.25
Declined to answer	5 (8.8)	7 (12)	1.81 (1.07-3.06)	0.03
<b>Given information on ARVs/PEP/PrEP</b>				
No	1 (1.8)	2 (3.5)	Reference	
Yes	54 (95)	55 (96)	0.87 (0.60-1.26)	0.46
Declined to answer	2 (3.5)	0	1.31 (0.33-5.24)	0.70
<b>Maintenance of confidentiality</b>				
No	14 (25)	14 (25)	Reference	
Yes	31 (54)	34 (60)	1.05 (0.85-1.30)	0.64
Don't know	12 (21)	9 (16)	0.81 (0.61-1.06)	0.12
<b>MSM right for quality healthcare</b>				
No	6 (11)	10 (18)	Reference	
Yes	51 (89)	47 (82)	0.89 (0.68-1.17)	0.40
<b>Received assistance from government/NGO</b>				
No	24 (42)	32 (56)	Reference	
Yes	31 (54)	24 (42)	0.97 (0.85-1.11)	0.66
Declined to answer	2 (3.5)	1 (1.8)	1.62 (0.95-2.77)	0.08
<b>Lack of HIV commodities<sup>5</sup></b>				
<b>HIV testing kits</b>				
No	48 (84)	54 (95)	Reference	
Yes	9 (16)	3 (5.3)	0.88 (0.52-1.47)	0.62
<b>ARVs</b>				
No	41 (72)	40 (70)	Reference	
Yes	16 (28)	17 (30)	1.27 (1.01-1.60)	0.04

Adjusted risk ratio (95% confidence intervals) are from multivariable log-binomial regression model, -no enough data to be included in the multivariable regression model.

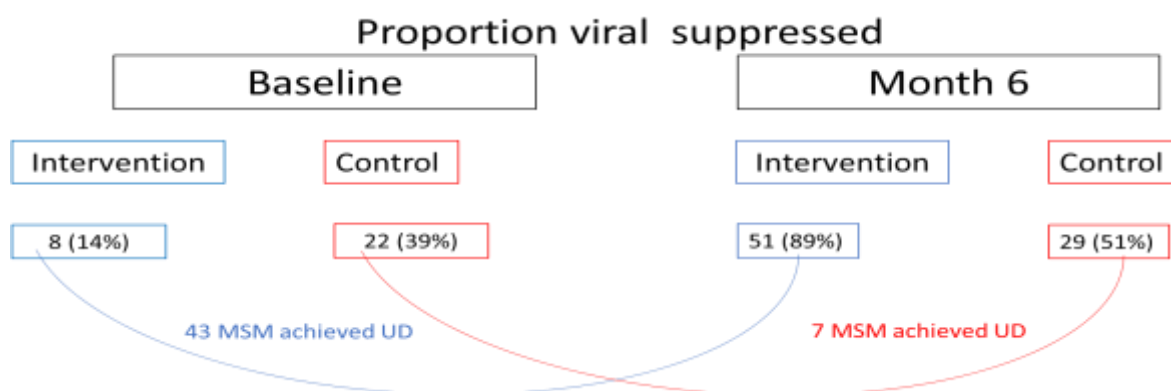
## HIV Treatment Outcomes: Changes in Undetectable Viral Load from Baseline to Month Six

Among the intervention groups, 51/57 (89%, 95%CI= 82–97) MSM achieved viral suppression at month 6 from 8/57 (14%, 95%CI =5.0–23), a proportion difference of 75% (95%CI =63–87). While among the controls, the proportion with viral suppression increased from 39% (95%CI= 26–51) at baseline to 51% (95%CI= 38–64) at month 6, a proportion difference of 12% (95%CI= 5.8–30). Overall, after six months, the proportion of MSM achieving viral suppression was significantly higher in the intervention compared to control group by 60% (95%CI =49–70,  $p < 0.001$ ) (Table 7). In the intervention group 43/57 MSM achieved viral load suppression while in the control group only 7/57 MSM achieved viral load suppression from baseline to month 6 (Figure 2).

**Table 7: Changes in Undetectable Viral Load among Participants from Baseline to Month Six**

Arm	Baseline, % (95% CI)	Month 6, % (95% CI)	Proportion difference between Month 6 & baseline, % (95% CI)	Proportion difference between the intervention and control group, % (95% CI)	P-value#
Intervention	14 (5.0–23)	89 (82–97)	75 (63–87)	60 (49–70)	<0.001
Control	39 (26–51)	51 (38–64)	12 (5.8–30)		

#P-value from McNemar's test, McNemar's test chi-square value=50.0 and degree of freedom of 1.



*Figure 2: Proportion of Undetectable Viral Load Change from Baseline to Month Six Stratified by Intervention*

### Discussion

The study indicated that the young MSM were less likely to have undetectable viral load but this was not significant ( $p=0.10$ ). The MSM who had a higher income were more likely to have undetectable viral load while those who were neither Christian nor Muslim were less likely to have undetectable viral load. This result is consistent with a study conducted in central North Carolina by Yates *et al.* (2018), which indicated that religious institution affiliation did not significantly affect the viral suppression. In line with this study, is the study by Dean *et al.* (2020), conducted in United States which indicated that, MSM who were living with HIV, who were unemployed, and who did not have an insurance cover, were likely to experience financial difficulties and were also less likely to achieve viral load suppression. In line with the study, was also findings by Kim (2020) in Malaysia, which indicated that not having a full-time job

was associated with a high viral load. In the study, MSM who had higher income were more likely to have undetectable viral load because they were more likely to have better nutrition, accommodation, healthcare and prompt treatment of opportunistic infections.

The MSM in the control group, who reported to have ever used PEP/PrEP were unlikely to have undetectable viral load. In a similar study conducted in France by Gantner *et al.* (2020), MSM who were on either PrEP/PEP were likely to have condomless sex and hence unlikely to have undetectable viral load. According to a study by Pines *et al.* (2020), conducted in Mexico, MSM on PrEP/PEP should be encouraged also to use condoms correctly and consistently to protect them from contracting STIs. In line with the study, was a study conducted in Kenya by Wahome *et al.* (2020), which indicated 4 out of 5 participants who contracted HIV, had reported PrEP use, but did not take PrEP. MSM felt PrEP/PEP could prevent them from contracting HIV and forgot that these preventive measures could not stop them from contracting other STIs which made them more vulnerable to HIV.

MSM in both intervention and control group, who had anal sex with more than one regular partner and who drunk more than 2 bottles of alcohol daily were likely to have undetectable viral load. MSM who had condom break more than once during anal sex and who were on active follow up, were likely to have viral load suppression. This could have been because the MSM were adherent to ARVs and were faithful in their relationships. Consistent with the study, were findings by Yu *et al.* (2019) in Tianjin, China, which indicated that MSM living with HIV, who were commenced on ARVs were able to attain undetectable viral load after one year despite behaviour risk. In this study, MSM in the control group who reported being always high on alcohol while having anal sex were likely to have detectable viral load. Similar findings were in study conducted by Sheehan *et al.* (2020), which indicated MSM who were on alcohol or drugs were likely to have detectable viral load since they were likely to have inconsistent condom use while engaging in anal sex (Fu *et al.*, 2023). Similar findings were obtained in study by Turner, *et al.* (2020), which indicated that daily alcohol use was associated with missing of ARVs on that day, hence MSM were unlikely to achieve undetectable viral load.

In this study, MSM on active follow up, who used non-prescription injectable drugs, 1-2 times in a week were less likely to achieve undetectable viral load. In line with the study, were findings from a study conducted in Canada which indicated, that the use of drugs was associated with non-adherence to ARVs and detectable viral load (Armstrong *et al.*, 2022). However, MSM in this study, who were in the control group, who chewed *muguka*, whose leaves contained natural amphetamine (stimulant) were likely to achieve viral suppression. *Muguka* was chewed in *maskani* (dwelling place especially for men), hence members could offer support to one another and hence adherence to ARVs. Contrarily to the study, MSM who were on drugs/alcohol, were not only likely to have detectable viral load but were also likely to be homeless, and lacked transport during their appointments (Sheehan *et al.*, (2020). MSM who were on drugs were also likely to engage in high sexual behaviour, such as having long anal sex encounters, which could lead to genital and anal trauma, hence increased risk of HIV (Wang, *et al.*, 2022). In the study, the MSM in the control group, had abnormal alcohol level and majority were on marijuana (tetrahydrocannabinol) and morphine.

Majority of MSM in the control group who attended private clinics for checkup were likely to have undetectable viral load. This finding was consistent with the study by Mwaniki *et al.* (2022) conducted in Nairobi-Kenya which indicated that, private and MSM friendly facilities offered better care to MSM as compared to the public institutions. MSM who were on active follow up, who felt uneasy while seeking health services were likely to have detectable viral

load. MSM also reported being discriminated and stigmatized in public institutions and being kept in the queue longer than other patients (Matlapeng *et al.*, 2023). Similar findings were found in a study by Bourne *et al.* (2022), conducted in Nairobi-Kenya which indicated that some staff in the public institution lacked relevant skills in handling MSM issues and stigma and discrimination in the institutions, deterred the MSM from attending these institutions where they could benefit and sometimes withholding important information that would help in diagnosing their problems (Gumindega & Maharaj, 2022). MSM who were on active follow up, who reported lack of HIV commodities such as ARVs were likely to achieve viral suppression. This could be because the institutions could easily share the commodities with the institutions that lacked.

MSM who were on active follow up, who received risk reduction interventions, were able to achieve overall a significant higher viral suppression as compared to the control group. Similar findings were found in a study on uptake of ARVs and viral suppression conducted by Palumbo *et al.* (2021), in sub-Saharan Africa on MSM and transgender women who were followed for 12 months. Risk reduction intervention such as adherence to ARVs, HIV prevention was offered to the participants. Consequently, the number of participants on ARVs increased two folds while the number of those who achieved viral suppression increased almost three folds. Similar findings were found in a study on effectiveness of interventions aimed at reducing HIV acquisition and transmission among bisexual men who have sex with men (GBMSM) conducted by Sewell *et al.* (2022), which indicated, the participants who received interventions such as behaviour change were able to reduce the acquisition and transmission of HIV.

On limitation and strength of the study, MSM may not have fully disclosed some of the behaviours that make them not achieve viral suppression. Due to stigma and discrimination, the study may have inadvertently recruited the non-Mvita residents, since MSM preferred attending HIV providing centres that are far from where they reside. During screening, MSM who had recently taken a viral load test, were not re-tested. The study took place during COVID-19, due to lock down, there was restriction of movement and hence some of the MSM may not have been able to access HIV services. The study could not recruit MSM who were below 18 years for lack of proper identification and involvement of guardian who would provide an insight of homosexuality among the youth. This is the first study in Mvita sub-county and presents unique data which will enable the relevant bodies take action so that all MSM can access HIV testing, be commenced on ARVs promptly, and achieve viral suppression, hence may accelerate the achievement of set targets of 95:95:95 by 2025 and end HIV by 2030. Further research is recommended on the role of healthcare workers in reduction of HIV among MSM and following MSM living with HIV for a period longer than 6 months.

## **CONCLUSION AND RECOMMENDATIONS**

### **Conclusion**

The study found out that there were significant differences between MSM living with HIV who received risk reduction and control group. MSM who were in the control group and who ever reported use of PEP/PrEP had detectable viral load. However, MSM in both intervention and control group, who had anal sex with more than one regular partner and who drunk more than 2 bottles of alcohol daily had undetectable viral load. MSM who were on active follow up who had condom break more than once during anal sex had undetectable viral load while those who used non-prescribed injectables had detectable viral load. In the control group, MSM who chewed *muguka* had undetectable viral load while those who reported being high always on

alcohol during anal sex had detectable viral load. On the same breath, MSM in this group also had abnormal range of alcohol and majority were on THC (*Cannabis*) and morphine at the end of 6 months. MSM who reported feeling uneasy while seeking health services who were on active follow up, had detectable viral load while the MSM who attended private clinics and who were in control group had undetectable viral load. After 6 months of the study, MSM on risk reduction interventions had a higher viral load suppression than the control group.

### **Recommendations**

Based on the findings, the study recommends, supporting peer-led HIV prevention services such condom use and continuous sharing of HIV information. Incorporating peers in re-designing effective substance use intervention programs to rehabilitate the MSM on alcohol and drugs and re-deploying competent and friendly healthcare providers. Risk reduction interventions such as adherence to ARVs, general counselling and HIV prevention measures such as prompt treatment of STI/OI and condom use should be offered to all MSM living with HIV.



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