



# Determinants of Adherence Levels to Oral Pre-exposure Prophylaxis among Seronegative Partners in HIV Discordant Heterosexual Relationships

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**Abstract:** Adherence to pre-exposure prophylaxis (PrEP) medication is key for its efficacy in prevention of Human Immunodeficiency Virus (HIV) infection acquisition by uninfected partner in HIV discordant couples during high risk periods of HIV exposure. This study aimed at establishing determinants of adherence levels to oral PrEP drugs among seronegative partners in HIV discordant heterosexual relationships attending and registered at Mbagathi Hospital Comprehensive Care Center (CCC). The study adopted a cross-sectional design that applied two data collection methods: semi structured questionnaires guided interview and a checklist that assessed respondents' medical records. Both qualitative and quantitative data was collected. Convenience sampling method was used to get a sample size of 51 participants in serodiscordant heterosexual relationships taking oral PrEP. Data was analyzed using Statistical Package for the Social Sciences (SPSS) IBM statistics version 24 software. Both descriptive and inferential analysis were done. Level of significance was set at P value of  $\leq 0.05$ . A higher proportion of the respondents were females (52.9%) and male (47.1%). Most were self-employed (56.9%) with primary level of education (39.2%) and between 30-39 years age group (38%). Adherence levels assessed included; adherence to intake of oral PrEP pills (89.4%), adherence to time of taking PrEP (96%) and adherence to scheduled clinic appointments (80%). Male respondents were 1.01 times more likely to adhere to intake of PrEP pills than females. Determinants that positively influenced adherence to PrEP intake included: increase in age and higher education ( $p=0.01$ ); longer period of being in HIV discordant relationship ( $p=0.04$ ); use of condom after PrEP break ( $p=0.04$ ); partners' adherence support and having a plan of remembering to take PrEP e.g. an alarm ( $p=0.04$ ); and increase in frequency of doing a HIV test ( $p=0.04$ ). Determinants that negatively influenced adherence to PrEP intake included: presence of side effects ( $p=0.003$ ); engaging in extra marital sex ( $p=0.04$ ) and alcohol use ( $p=0.05$ ). The positive determinants of good adherence should be upheld and negative determinants should be addressed. In management of these clients there is need to look out for determinants that promote adherence that include maturity in age, level of education, length of being in discordant status and partners support. Programs should be initiated to create awareness on the effect of bad social habits like alcoholism and extra marital affairs. Laboratory services access should be strengthened in monitoring patients' adherence and side effects to treatment.

**Keywords:** Pre-exposure Prophylaxis, Adherence, Determinants, Serodiscordant, Heterosexual, Couples, HIV

## 1. Introduction

According to 2018 statistics released by UNAID data; indicated the total number of people living with HIV globally are about thirty seven million. The newly infected people

with HIV were estimated to be about 1.8 million people every year and 940,000 AIDS related deaths were recorded by year 2017. There are about 5000 new HIV infections a day by 2017 globally, about 66% are in sub-Saharan Africa. The number of people living with HIV in Kenya is estimated

to be about 1.5 million people. The total number of AIDS related deaths were 28,000 people and 53,000 people acquired new HIV infections by 2017 [1, 2].

In response to addressing the high incidences of new HIV infections reported globally; World Health Organization (WHO) in September 2015 released recommendations on use of oral pre-exposure prophylaxis (PrEP) drugs which aims at reducing the chances of HIV acquisition by the HIV negative individual when exposed to periods of high risk of HIV infection acquisition [3]. According to WHO, oral PrEP is defined as provision of antiretroviral (ARVs) to individuals who are not infected with HIV during periods they are exposed to high chances of acquiring HIV infection [4].

Tenofovir Disoproxil Fumarate (TDF) 300mg and Emtricitabine (FTC) 200mg formulated as fixed dose combination are the current global recommended oral PrEP regimen for use as recommended by Food and Drug Administration (FDA) in United States of America (USA) since July 2012 [5]. The current Kenya antiretroviral therapy (ART) guidelines released in 2018 endorsed the same combination recommended by FDA as the preferred regimen for oral PrEP in the country. The guidelines also recommend use of TDF alone or combination of the TDF and lamivudine (3TC) when the preferred regimen is not available. Thorough assessment of the client to include suitability and benefits of use, adherence readiness to both clinic appointments and drugs and lack of contraindications to any of the drugs should be performed before oral PrEP is commenced [2]. The use of oral PrEP is recommended in seronegative partner in HIV discordant relationship especially when the couple is not using condoms during sexual engagement like when they want to conceive or when the viral loads of the seropositive partner are still detectable due to poor adherence to ART, resistance to ART or at the initial period of Highly Active Antiretroviral Therapy (HAART) commencement before 6 months of treatment to achieve viral suppression [2].

About 50% of the HIV positive individuals in Southern and East Africa have been shown to be living in HIV serodiscordant relationship [6]. A study in Uganda showed that out of the married couples from the general population, about 5% to 7% were living in HIV discordant relationship [6]. Therefore if there is no intervention of HIV infection prevention among the HIV uninfected partners in serodiscordant heterosexual relationship, it will translate to high levels of HIV seroconversion which is estimated to be 3.7% to 19% annually [6].

The effectiveness of oral PrEP in clinical trial settings is directly associated with good adherence to oral PrEP by the clinical trial subjects [7]. WHO description of good adherence to oral PrEP is when the client commenced on oral PrEP is able to take about 4 to 7 doses on average per week which is adequate dose to protect them from acquiring HIV infection during the periods that they are highly exposed to HIV infection [4]. Adherence levels varies in different studies, and may be determined through self-reporting, pill count and blood drug concentrations. Adherence to PrEP can be categorized as high, moderate and low based on drug

concentration measured from different blood samples. When a client on oral PrEP is able to take one or two tablets of PrEP in 7 days it is enough to detect the drug in blood samples taken. Individuals with high drug adherence are classified as having more than 70% drug blood levels, moderate adherence as 41-70% and low adherence as 40% and below [7]. The efficacy rates of oral PrEP ranges between 0-75 percent and these discrepancies could be attributed to poor adherence of the PrEP drugs prescribed [12]. Several clinical trials in U.S. have demonstrated that the efficacy of oral PrEP is closely associated with adherence which determines HIV infection acquisition risk [5]. The Vaginal and Oral Interventions to Control the Epidemic (VOICE) and Preexposure Prophylaxis Trial for HIV Prevention among African Women (FEM-PrEP) which are the two major clinical trials ever conducted in Africa on PrEP efficacy in reducing HIV infection, showed no benefits of PrEP use, and lack of efficacy was attributed to poor adherence to PrEP with increased rates of side effects from PrEP drugs [8, 9]. Further studies are required to determine whether the lack of efficacy in the two clinical trials above were as a result of poor adherence or were associated with other factors like physiological, population culture and social behaviors [10, 11].

A study conducted in Kenya a site at Thika which analyzed 96 HIV uninfected individuals sexual behavior change and adherence to PrEP found no correlation of unprotected sex with PrEP use and participants who were engaging in sex regularly had high levels of PrEP adherence than those who had sexual abstinence [10]. Another study conducted in Kenya focusing on oral PrEP administration to homosexual men in Kilifi and Kangemi sites, concluded that lower adherence to PrEP was influenced by transactional sex, frequent travels and prolonged period of PrEP use. However participants who had good source of income had a higher adherence than the unemployed participants [13]. Personal factors infringing on clients' lifestyle like excess alcohol intake, injectable drug abuse, multiple sexual partners, engaging in transactional sex are all attributed with increased HIV infection since some may interfere with the intellect judgement when engaging in sex and also reduce adherence to PrEP drugs hence increasing risk of seroconversion of the seronegative partner in the serodiscordant heterosexual relationship. Other factors that may influence oral PrEP adherence are age of the couple, number of children and marital status [10]. Economic factors have also a role in adherence because it have been shown those clients who are employed have good adherence to oral PrEP than the unemployed ones [6]. Oral PrEP drug factors like side effects will deter good adherence, hence some clients may opt out completely from the oral PrEP program or reduce their adherence levels especially when the adverse effects are severe [4]. Oral pre-exposure prophylaxis use in Kenya is barely three years since implementation in 2016, therefore there is scarce information on adherence and determinants associated with oral PrEP use by the seronegative partners in HIV discordant heterosexual relationships.

This study therefore assessed three levels of adherence to oral PrEP on; adherence to PrEP drugs intake, adherence to time of taking treatment and adherence to scheduled clinic appointments. It also assessed the determinants of these adherence levels to oral PrEP among seronegative partners in HIV discordant heterosexual relationships attending Comprehensive Care Centre (CCC) at Mbagathi Hospital.

## 2. Methods and Materials

### 2.1. Study Design and Setting

A cross-sectional study carried out at Mbagathi Hospital, which is a Level 4 Hospital in Nairobi Kenya located at Kenyatta Golf Course, Mbagathi Way in Nairobi County, Lang'ata Sub-County with one of the largest catchment area of about one million people, mainly comprising of the urban poor. It is easily accessible and offers affordable healthcare services. It provides curative, preventive, promotive and rehabilitative healthcare services to all Kenyans. It offers both outpatient and inpatient services with a bed capacity of about 200 beds. Mbagathi Hospital Comprehensive Care Centre is a department of the hospital which gives comprehensive HIV care services with about 4,851 active registered clients and 4,828 clients on treatment. The clinic offers free services to all the clients. The CCC also serves the HIV discordant couples with about 200 active serodiscordant couples registered. It offers comprehensive counselling to discordant couples, highly active antiretroviral therapy (HAART) to seropositive partners, oral PrEP to seronegative partners and other HIV prevention methods like condom dispensation. About 60 clients who are seronegative partners in HIV discordant relationships are currently on oral PrEP.

### 2.2. Sampling Technique

Convenience sampling was used to enroll a study sample of 51 participants from the 60 HIV negative partners in serodiscordant heterosexual relationships above the age of 18 years registered at Mbagathi Hospital CCC and taking oral PrEP. Since not all the HIV negative partners in discordant relationships visiting the clinic were on oral PrEP, the investigator used convenience sampling by identification of the seronegative partners who were taking and enrolled in oral PrEP programme with the help of the clinic's staff. The sample size was calculated using the Fischer's formula [14].

### 2.3. Data Collection and Quality Control

The data collection tools used included a semi-structured questionnaire which was used to interview the participants and a checklist for extracting data from their clinic's medical records. Data was obtained from the sampled HIV negative partners in serodiscordant heterosexual relationship through interview process using a semi structured questionnaire which guided the interviewer on the flow and questions to ask. The interviewer used either English or Kiswahili language based on the study participant preference. The interviewer systematically interviewed the study participant

guided by the questions in the questionnaire and filled in all the responses given by the study participant in the questionnaire. A checklist was used to get the secondary data which was extracted from the study participants' clinic's medical records which was used to clarify and validate some information given inaccurately by the study participant. The interview process took about 15 to 20 minutes and on completion the investigator/interviewer appreciated the participant for willingly accepting to be interviewed and providing their information to be used in analyzing the study findings. The filled questionnaire and the checklist with the secondary medical data of the study participants were serialized to generate a unique code which was used for data analysis process.

Both qualitative and quantitative data was obtained from the study participants. Qualitative data collected included seronegative partner data in relation to oral PrEP attitudes towards acceptance of use, adherence to oral PrEP regimen, side effects experienced when taking oral PrEP drugs, social factors related with adherence and change in risky sexual behavior. Quantitative data collected included demographic data and status of clinical monitoring from the checklist. The data collected by the two tools was integrated to inform on determinants of adherence levels to oral PrEP of this special group.

A pretest study of 5 participants was conducted at Mbagathi Hospital CCC before commencement of the main study within a period of 2 days which determined the reliability and validity of the questionnaires in generating the data required to answer the research questions. Reliability test conducted was checking on the consistency of the data generated from the questionnaires when the two research assistants and the investigator interviewed the respondents. Validity test was conducted by comparison of self-report on PrEP adherence by the respondents with the documented self-assessment adherence already recorded in the respondents' clinic's medical records.

### 2.4. Data Analysis

With the assistance of a statistician the data collected was entered into Statistical Package for Social Sciences (SPSS) IBM statistics version 24 software and categorized into the following: demographic data, social and behavioral data, side effects of the drugs and clients attitudes. Data was analyzed using SPSS IBM statistics version 24 software.

Statistical tests of significance like binomial logistic regression and Chi square were used to test the influence of the following determinants on PrEP adherence levels; PrEP drugs side effects, respondents' demographics, respondents' knowledge and attitude towards PrEP and social lifestyle of the respondents. The significance level was set at a P value of  $\leq 0.05$ .

### 2.5. Ethical Consideration

Ethical approval to conduct the study was sought from Kenyatta National Hospital/University of Nairobi Ethics and Research Committee. Permission to access the study

population was sought from Mbagathi Hospital administration. Informed consent was signed by the 51 study respondents.

The right to privacy and confidentiality of the study participants was maintained at all the stages of the study. This was achieved by not using participants' names in the questionnaires instead serialization and generation of unique codes was used. The data was stored using unique identifiers for any future reference or requirement.

Any HIV uninfected participant in serodiscordant relationship was entitled to full HAART initiation in case of seroconversion in the course of the study.

### 3. Findings

#### 3.1. Demographic Characteristics

Most of the respondents were females represented by 52.9% (n=27) and males at 47.1% (n=24). A larger proportion of the respondents attained primary level of education (39.2%) (n=20), followed by those with secondary level of education (31.4%) (n=16), college (23.5%) (n=12) and few with University level of education (5.9%) (n=3). The study participants who were self-employed represented a bigger proportion (56.9%) (n=29), followed by the unemployed (23.5%) (n=12) and employed (19.6%) (n=10). Most of the respondents (38%) (n=19) of the respondents were within the age bracket of 30-39 years, followed by age bracket of 40-49 years (30%) (n=15), 20-29 years (24%) (n=12), 50-59 years (6%) (n=3) and over 60 years (2%) (n=1).

Table 1. Respondents' demographics.

Respondents Demographics		Frequency	Percentage
Gender	Male	24	47.1
	Female	27	52.9
	Total	51	100.0
Age	20-29	12	24.0
	30-39	19	38.0
	40-49	15	30.0
	50-59	3	6.0
	>60	1	2.0
	Total	50	100.0
Education level	Primary	20	39.2
	Secondary	16	31.4
	College	12	23.5
	University	3	5.9
	Total	51	100.0
Employment status	Employed	10	19.6
	Self employed	29	56.9
	Unemployed	12	23.5
	Total	51	100.0

Effect of demographic factors on adherence to PrEP pills intake;

A binary logistic regression was performed to ascertain the effects of age, gender, level of education and employment status on the likelihood that participants adhered to PrEP medication. The regression model was statistically significant,  $\chi^2(8) = 27.647$ ,  $p = 0.01$ . Males were 1.01 times more likely to adhere to intake of PrEP pills than females.

Increase in age and education level was associated with an increased likelihood of overall adherence to PrEP. Employment status did not significantly influence adherence.

#### 3.2. Adherence Levels to Oral PrEP

The adherence levels addressed in this study focused on three parameters which included; adherence to taking PrEP pills, adherence to time of taking PrEP pills and adherence of attending clinic appointments on scheduled dates.

##### 3.2.1. Adherence to Taking PrEP Pills

Majority of the respondents (89.4%) (n=42) reported that they were taking their pills of PrEP every day and had never missed a single dose while a small group of those who occasionally missed their PrEP pills was recorded (10.6%) (n=5). Checklist analysis on adherence assessment status from the respondents files revealed adherence assessment status was documented in majority of respondents' files at 89.6% (n=43) while 10.4% (n=5) were not evaluated.

Table 2. Respondents who were taking PrEP pill every day without fail.

Respondents taking PrEP pill every day without fail	Frequency	Percentage
Yes	42	89.4
No	5	10.6
Total	47	100.0

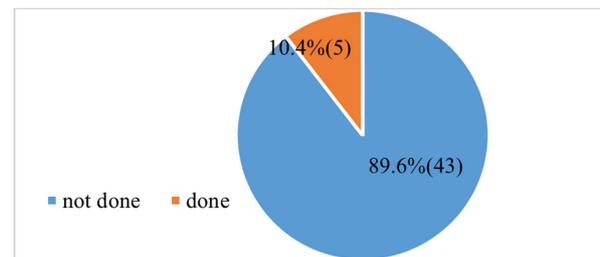


Figure 1. Respondents' medical files assessment on PrEP adherence status documentation.

##### 3.2.2. Determinants of Adherence to PrEP Intake

The determinants that were found to influence adherence to intake of PrEP pills were as described below.

i. Respondents' duration in years of being in HIV discordant relationship.

The mean length of time of being in a serodiscordant heterosexual relationship was 4 years, the mode was 2 years and the standard deviation was 4.06. The maximum number of years was 14 years.

Table 3. Respondents' statistics on the length of time on serodiscordant relationship.

Statistics on the length of time on serodiscordant relationship	
N	51
Mean	4.1157
Mode	2.00
Std. Deviation	4.05733
Minimum	0.00
Maximum	14.00

Effect of duration in years of being in HIV discordant

relationship on adherence to PrEP pills intake;

A binary logistic regression was performed to ascertain the effects of duration in serodiscordant relationship and partner’s HIV status on the likelihood that participants adhered to intake of PrEP pills. The regression model was statistically significant,  $\chi^2 (7) = 15.248, p = 0.04$ . Increase of the years of being in a serodiscordant relationship was associated with an increased likelihood to adhere to intake of PrEP pills.

ii. Number of the respondents receiving partners support on adherence to intake of PrEP drugs.

Majority of the respondents (80%) (n=41) received adherence support from their partners.

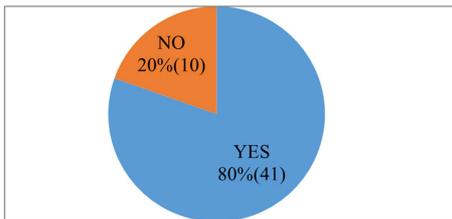


Figure 2. Number of respondents who received adherence support from their partners.

iii. Plan for remembering to take PrEP pill everyday as stated by the respondents.

Most of the respondents 58% (n=29) used alarms as a reminder to take PrEP, 26% (n=13) reported that they had registered in their mind. There were those who were reminded by watching 9pm television news, motivation from fear of being infected and positive impact of HIV prevention.

Table 4. Respondents’ plan for remembering to take PrEP pill every day.

Plan for remembering to take PrEP pill every day	Frequency	Percentage
Positive impact of HIV prevention	1	2.0
Alarm	29	58.0
Fear of being infected by HIV	1	2.0
Registered in mind	13	26.0
Noting down	2	4.0
Watching news	4	8.0
Total	50	100.0

Effect of receiving support when taking PrEP pills on adherence to intake of PrEP medication;

The respondents that engaged their partners in adherence support and had a plan of remembering to take their PrEP pill were found to have good adherence to intake of PrEP pills.

iv. Number of respondents that engaged in protected sex (used condoms) after taking a break from use of PrEP pills.

Most of the respondents (72%) (n=36) engaged in protected sex after they stopped taking PrEP medication.

Table 5. Respondents that engaged in protected sex after they stopped taking PrEP.

Engaged in protected sex (used condoms) after stopping taking PrEP	Frequency	Percentage
No	14	28.0
Yes	36	72.0
Total	50	100.0

v. Respondents’ frequency of doing a HIV test.

Majority of the respondents (96%) (n=48) had a HIV test done after every 3 months.

Table 6. Respondents’ frequency of doing a HIV test.

Frequency of doing a HIV test	Frequency	Percentage
After 3 months	48	96.0
Once a year	1	2.0
2 times since 2016	1	2.0
Total	50	100.0

Effect of behavioral factors on adherence to intake of PrEP pills;

A binary logistic regression was performed to ascertain the effects of engaging in protected sex (used condoms) after taking a break from use of PrEP and frequency of doing a HIV test on the likelihood that participants adhered to intake of PrEP pills. The regression model was statistically significant,  $\chi^2 (7) = 22.551, p = 0.04$ . Engaging in protected sex (used condoms) after taking a break from use of PrEP and increased frequency of doing a HIV test significantly increased adherence to intake of PrEP pills.

vi. Number of respondents that reported side effects after intake of PrEP pills.

A bigger proportion of the respondents (58.3%) (n=30) experienced side effects after using PrEP medication for the first 3 months.

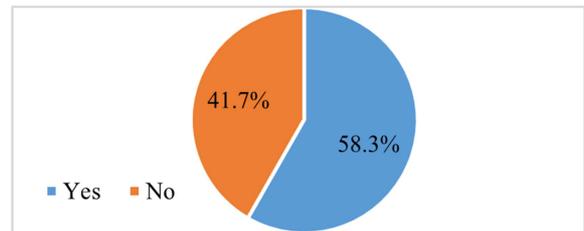


Figure 3. Number of respondents that experienced side effects after PrEP pills intake.

Effect of PrEP pills side effects on adherence to intake of PrEP pills;

A binary logistic regression was performed to ascertain the effects of side effects on the likelihood that participants adhered to PrEP medication. The regression model was statistically significant,  $\chi^2 (1) = 21.910, p = 0.003$ . Increase in chance of encountering a side effect was associated with a reduction in adherence to PrEP medication.

vii. Importance of taking PrEP as stated by the respondents

Most of the respondents (73.1%) (n=38) stated that using PrEP had benefited them by being safe from acquiring and getting HIV infection, 9.6% (n=5) stated PrEP had helped them to enjoy unprotected sex with their HIV infected partner, 7.7% (n=4) stated PrEP had helped them to conceive and remained HIV negative, 7.7% (n=4) stated it had helped them to sustain their marriage and 1.9% (n=1) stated they had improved confidence of remaining protected from getting HIV infected.

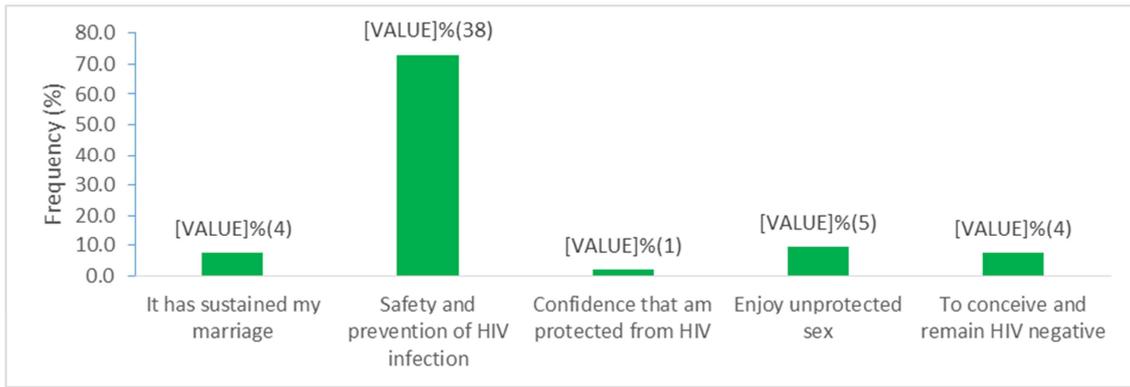


Figure 4. Benefits of PrEP as stated by the respondents.

Effect of attitude on adherence to intake of PrEP pills;

Attitude factors were assessed to determine their association with adherence to PrEP pills. Most of the respondents (73.1%) (n=38) who showed they had knowledge on PrEP were found to have good adherence to intake of PrEP pills.

viii. Number of respondents who had a sexual partner outside their marital partner

Majority of the respondents did not have any sexual partner outside their marital partners (88.2%) (n=45) while 11.8% (n=6) had sexual partners outside their marital partners. The number of sexual partners outside marital partners stated was 1. All individuals who had extra marital affairs stated that they knew the HIV status of their sex partners.

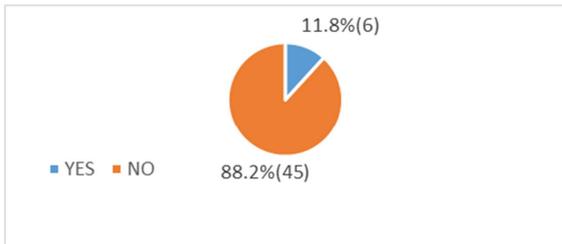


Figure 5. Respondents who had a sexual partner outside marital partner.

ix. Number of respondents that used alcohol and other substances of abuse

A small group of the respondents at 19.6% (n=10) took alcohol or any other substance that affects mental judgement while 78.4% (n=40) reported that they did not take alcohol or any other substance of abuse.

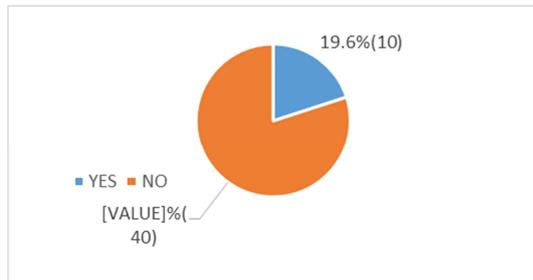


Figure 6. Respondents who took alcohol or any other substance.

Association between social factors and adherence to intake of PrEP pills;

Chi-square analysis was done to determine the significance of the association between social factors and adherence to PrEP medication among serodiscordant couples. Having a sexual partner outside marital partner (p value = 0.04) and taking alcohol or other factors that impairs judgement (p value = 0.05) significantly reduced adherence to intake of PrEP pills.

3.2.3. Adherence to Time of PrEP Pills Intake

Most of the respondents (58%) (n=30) took prep at 9pm, 20% (n=10) took at 10pm and 12% (n=6) at 8pm. A few of the respondents took their pills in the morning hours. Majority (96%) (n=49) of them were consistent with their time of taking PrEP pills.

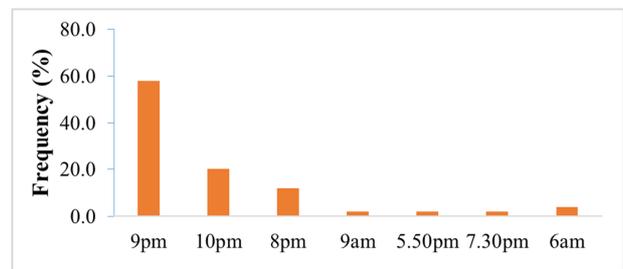


Figure 7. Respondents' time of taking PrEP pills.

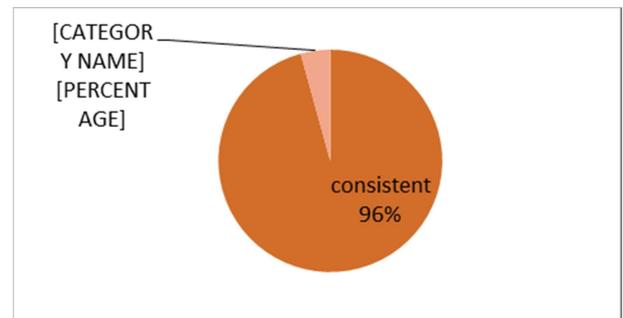


Figure 8. Respondents who were consistent in time of taking PrEP pills.

3.2.4. Respondents Adherence to Scheduled Clinic Appointments

Majority of the respondents (80%) (n=40) stated that they did not miss their clinic appointments while 20% (n=11)

missed their appointments. Checklist results from the respondents' files on adherence to clinic appointment showed that out of the 11 respondents who missed their scheduled clinic appointments; 81.9% (n=9) of all the respondents had missed one appointment while the remaining 18.2% (n=2) had missed two appointments.

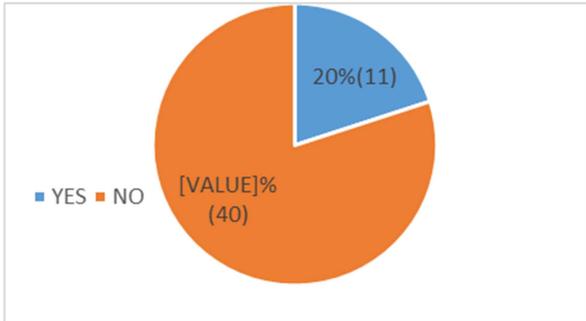


Figure 9. Respondents who missed their clinic appointments.

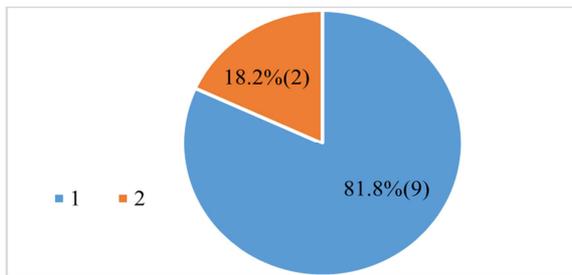


Figure 10. Number of missed appointments by the respondents.

Association between missing clinic appointments and adherence to intake of PrEP pills;

Missing clinic appointments was not found to significantly influence adherence to intake of PrEP pills (p value=0.65).

**3.2.5. Checklist Analysis of Laboratory Investigations Done from the Respondents Files**

The HIV status of all the 51 respondents remained negative, hence there was no seroconversion. The only baseline laboratory investigations done to only three respondents were liver function test (16.7%) (n=1) and hepatitis B and C screening (33.3%) (n=2).

Table 7. Baseline investigations done to all the respondents.

Baseline investigations done	Frequency	Percentage
ALT	1	16.7
Liver function test	1	16.7
Hepatitis B screening	2	33.3
Hepatitis C screening	2	33.3
Total	6	100.0

**4. Discussion**

The higher proportion of females 53% contradicted observation made by [15] that in sub Saharan Africa the majority of index case of serodiscordant couples are believed to be more men than women. The bigger respondents' proportions of self-employed (56.9%) and primary level of

education (39.2%) were attributed to the big catchment population of the clinic being Kibra slums with majority in informal employment. Having a bigger proportion of the respondents being in their reproductive age of between 30-39 years (38%), contributed to a small proportion (7.7%) seeking PrEP drugs in order to conceive and bring forth their own HIV uninfected children. Employment status did not significantly influence adherence, which was attributed to the fact that all the CCC services are offered for free, so there were no major financial challenges encountered when accessing the PrEP services. This was in contrary to observation made from a study done at Kilifi and Kangemi on homosexual partners using PrEP, which concluded that participants who had good source of income had a higher adherence than the unemployed participants [13]. The finding also contradicted observation made by [6] that economic factors have also a role in adherence because it have been shown those clients who are employed have good adherence to oral PrEP than the unemployed ones. Males were 1.01 times more likely to adhere to PrEP medication than females and paradoxically females are known to seek more medical attention and adhere to medical advice than males.

The adherence to PrEP pills intake (89.4%) recorded was much higher when compared with the values given by [7] of more than 70% as having high drug adherence, 41%-70% moderate adherence and less than 40% as low adherence. 80% of the respondents who missed taking their pills, missed between 1 to 2 pills per month against a recommendation by WHO of taking about 4 to 7 doses on average per week which is adequate dose to protect them from acquiring HIV infection during the periods that they were highly exposed to HIV infection [4].

The mean length time of being in a serodiscordant heterosexual relationship was 4 years. The study established that the longer the period the discordant partner stayed in their relationship the more adherence to PrEP medication registered, which was as a result of the couple accepting their HIV discordant status and willingness to care and support each other.

The respondents (56%) who did not use a condom when using PrEP demonstrated good adherence than the respondents who were using PrEP and condom at the same time. This was attributed to the greater risk posed of HIV infection acquisition by the individuals who were using PrEP only, if they did not exercise good adherence to treatment. This showed a similarity with some studies which were done in United States of America (USA) that demonstrated individuals in HIV discordant heterosexual relationship did not embrace correct and consistent use of condoms hence putting the HIV negative individual in these relationships into more risk of contracting HIV infection from the HIV positive partner [5]. However this contradicted a finding from a study done in Kenya, a site at Thika that analyzed 96 HIV uninfected individuals sexual behavior change and adherence to PrEP which observed that there was no correlation of unprotected sex with PrEP use [10]. The respondents (80%) that engaged their partners in adherence

support and had a plan of remembering to take their PrEP pill were found to have good adherence to PrEP. This was attributed to good sensitization on use of PrEP by the health care providers. The respondents (72%) who engaged in protected sex (used condoms) after taking a break from use of PrEP and those who had a HIV test done frequently (96%), registered high adherence to PrEP medication attributed to the motivation of remaining HIV uninfected.

Most of the respondents (58.3%) experienced side effects after using PrEP medication for the first 3 months. Some of the respondents (30.8%) taking PrEP medication experienced headaches, followed by nausea (17.3%), dizziness (9.6%) among many other side effects that were reported. Increase in chance of encountering PrEP pills side effects was associated with a reduction in adherence to PrEP medication. The same scenario was registered by a study done at Thika which demonstrated willingness of taking PrEP drugs by HIV uninfected individuals in serodiscordant sexual relationship, 90% of them indicated they were willing to take PrEP on long term basis, however side effects experienced when taking PrEP drugs was their main concern [15]. World Health Organization (WHO) officials in a meeting to address PrEP adherence highlighted side effects as one of the factors that deter good adherence, hence some clients may opt out completely from the oral PrEP program or reduce their adherence levels especially when the adverse effects are severe [4].

Most of the respondents (73.5%) who showed that they had knowledge on PrEP and those who demonstrated confidence in PrEP safety in prevention of HIV infection (70.3%) were found to have good adherence to PrEP medication. This demonstrated the importance of continuous health education to the clients taking PrEP regarding its use and importance.

Majority of the respondents did not have any sexual partner outside their marital partners (88.2%). The number of sexual partners outside marital partners stated was 1. All individuals who had extra marital affairs stated that they knew the HIV status of their sex partners. A small group of the respondents (19.6%) took alcohol or any other substance that affects mental judgement while 78.4% reported that they did not take alcohol or any other substance of abuse. Having a sexual partner outside marital partner and taking alcohol or other factors that impairs judgement significantly reduced adherence to intake of PrEP pills. These results were congruent with [10] who highlighted lifestyle factors like excess alcohol intake, injectable drug abuse, multiple sexual partners, engaging in transactional sex are all attributed with increased HIV infection since some may interfere with the intellect judgement when engaging in sex and also reduce adherence to PrEP drugs.

Adherence to time of taking oral PrEP consistently was assessed and majority of the respondents (96%) were consistent with their time of taking PrEP. Most of the respondents (58%) took PrEP at 9pm, 20% took at 10pm and 12% at 8pm. This was possible because majority of the respondents had a time reminder of when to take the PrEP

pills and they had overcome stigma associated with PrEP use.

Majority of the respondents (80%) stated they did not miss their clinic appointments while 20% missed some of their appointments. Missing clinic appointments was found not to significantly influence adherence to PrEP medication. Despite some respondents missing their clinic appointments they did not miss their PrEP pills attributed to the respondents getting extra pills enough to cover them for some days in case they did not make to the clinic on the scheduled appointment day. Other respondents preferred coming early to the clinic to refill their PrEP before their scheduled appointment if the appointment day coincided with the days they had other engagements. This demonstrated flexibility of the health care providers in service provision which contributed to the high overall PrEP adherence levels recorded in the clinic. It also ensured that all the clients felt cared for and were accommodated in facilitation of meeting their different daily engagements which also boosted confidence with the clinic's services hence improving overall PrEP adherence.

Checklist assessment of clinic appointments from the respondents' files revealed that, the only baseline laboratory investigations done to only three respondents were liver function test and hepatitis B and C screening. Lack of baseline investigations could be a potential risk of missing adverse effects to PrEP drugs especially from TDF which can impair the renal function. The HIV status of all the 51 respondents remained negative, with nil sero conversion reported. This demonstrated the effectiveness of PrEP pills when there is good adherence to PrEP use.

The study used self-report method from the respondents to inform on adherence levels. Despite the obvious bias in self-reporting, it remains the most efficient, fast and cost effective method of monitoring oral PrEP adherence [4].

## 5. Conclusions

The overall adherence for the different levels (intake, timing, and appointments) was over 70% minimum requirement WHO categorization of having good adherence to oral PrEP. The key determinants of the adherence observed were being a male, being older in age, having higher education, longer period of being in discordant status, receiving partners support, use of condom after PrEP break, use of reminders (alarm) and higher frequency of HIV testing. However side effects, alcohol use and extra marital sex were associated with low adherence across all levels. The results obtained from use of PrEP in the clinic demonstrated that PrEP was very effective since there were no respondents sampled seroconverted to being HIV positive.

## 6. Recommendations

- i The oral PrEP enrollment package should include laboratory monitoring services so as to ensure quality care and continued patient evaluation for any known complications of treatment. Therefore the hospital

administration should negotiate with the PrEP program sponsors to support the cost of all laboratory investigations in all the clients taking oral PrEP in the clinic.

- ii The positive determinants of good adherence should be upheld and negative determinants should be addressed. In management of these clients there is need to look out for determinants that promote adherence that include maturity in age, being a male, level of education, use of reminders like alarm, frequency of HIV testing, condom use after PrEP break, length of being in discordant status and partners support. Programs should be initiated to create awareness on the effects of bad social habits like alcoholism and extra marital affairs.
- iii The NASCOP campaigns towards HIV prevention and use of oral PrEP should equally target both males and females population in the country, rather than the current trend of campaigns which targets males more than females.
- iv Further research is needed to explore why men were more likely to have more adherence to intake of oral PrEP than females and the influence of health care providers to overall adherence to PrEP services.

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## References

- [1] Unaid. UNAIDS DATA 2018. 2018.
- [2] National AIDS & STI Control Programme (NASCOP). Guidelines on Use of Antiretroviral Drugs for Treating and Preventing HIV infection in Kenya, 2018 Edition. 2018.
- [3] National AIDS & STI Control Programme M of HK. Pre Exposure Prophylaxis for HIV (Oral PrEP) – NASCOP. NASCOP 2018. <https://www.nascop.or.ke/?p=2709> (accessed December 20, 2018).
- [4] World Health Organization (WHO). Consultation on Pre-exposure Prophylaxis (PrEP). Meeting Report. Miami, USA 2014. Available from: <https://www.who.int/hiv/pub/prep/consultation-prep-adherence/en/>
- [5] McMahon JM, Myers JE, Kurth AE, Cohen SE, Mannheimer SB, Simmons J, et al. Oral pre-exposure prophylaxis (PrEP) for prevention of HIV in serodiscordant heterosexual couples in the United States: opportunities and challenges. *AIDS Patient Care and STDs* 2014; 28: 462–74. doi: 10.1089/apc.2013.0302.
- [6] Zheng Z, Li Y, Jiang Y, Liang X, Qin S, Nehl EJ. Population HIV transmission risk for serodiscordant couples in Guangxi, Southern China: A cohort study. *Medicine* 2018; 97: e12077. doi: 10.1097/MD.00000000000012077.
- [7] Desai M, Field N, Grant R, McCormack S. Recent advances in pre-exposure prophylaxis for HIV. *BMJ (Clinical Research Ed)* 2017; 359: j5011. doi: 10.1136/bmj.j5011.
- [8] Van Damme L, Corneli A, Ahmed K, Agot K, Lombaard J, Kapiga S, et al. Preexposure Prophylaxis for HIV Infection among African Women. *New England Journal of Medicine* 2012; 367: 411–22. doi: 10.1056/NEJMoa1202614.
- [9] Marrazzo JM, Ramjee G, Richardson BA, Gomez K, Mgodini N, Nair G, et al. Tenofovir-Based Preexposure Prophylaxis for HIV Infection among African Women. *New England Journal of Medicine* 2015; 372: 509–18. doi: 10.1056/NEJMoa1402269.
- [10] Curran K, Baeten JM, Coates TJ, Kurth A, Mugo NR, Celum C. HIV-1 prevention for HIV-1 serodiscordant couples. *Current HIV/AIDS Reports* 2012; 9: 160–70. doi: 10.1007/s11904-012-0114-z.
- [11] Tobin SC. VOICE reveals the need to improve adherence in PrEP trials. *AIDS* 2015; 29: N9. doi: 10.1097/QAD.0000000000000693.
- [12] Haberer JE. Current concepts for PrEP adherence in the PrEP revolution: from clinical trials to routine practice. *Current Opinion in HIV and AIDS* 2016; 11: 10–7. doi: 10.1097/COH.0000000000000220.
- [13] Mugo PM, Sanders EJ, Mutua G, van der Elst E, Anzala O, Barin B, et al. Understanding Adherence to Daily and Intermittent Regimens of Oral HIV Pre-exposure Prophylaxis Among Men Who Have Sex with Men in Kenya. *AIDS and Behavior* 2015; 19: 794–801. doi: 10.1007/s10461-014-0958-x.
- [14] Charan J, Biswas T. How to calculate sample size for different study designs in medical research? *Indian Journal of Psychological Medicine* 2013; 35: 121–6. doi: 10.4103/0253-7176.116232.
- [15] Heffron R, Ngure K, Mugo N, Celum C, Kurth A, Curran K, et al. Willingness of Kenyan HIV-1 serodiscordant couples to use antiretroviral based HIV-1 prevention strategies. *Journal of Acquired Immune Deficiency Syndromes* (2012) 61 (1) 116-119 n.d. doi: 10.1097/QAI.0b013e31825da73f.