# Title: HIV pre-exposure prophylaxis adherence among female sex workers in Mutare urban, Zimbabwe

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***Abstract***

*Pre-exposure prophylaxis (PrEP) for HIV is a strategy that has been recently engineered to prevent individuals who are human immunodeficiency virus (HIV)-negative but are at high risk of being infected with HIV. Sex workers are one of the vulnerable groups that are targeted by PrEP, however effectiveness of PrEP is realised when there is maximum adherence. Empirical evidence from Mutare Urban district revealed that for the period April to November 2019, the adherence rate was 22 % (NAC, 2019).Therefore, this study sought to unearth the reasons why sex workers were not adhering to PrEP. A 1:1 unmatched case-control study was carried out in Mutare urban. The source population of this study was all female sex workers registered under NAC key population programs in two sites namely Forbes and Sakubva residing in Mutare urban. A total sample size of 64 participants calculated using Epi info 7 was used for this study. Participants were identified from records at the study sites and systematic sampling was done for both controls and cases. Proportional selection of participants was done for the two centres. Data was collected using an interviewer administered structured questionnaire and a key informant interview guide was used to interview health service providers. Data was analysed using Epi info version 7. A multivariate analysis showed age [AOR = 2.14, 95% CI (1.08 – 3.34)], household expenditure per month [AOR = 18.77, 95% CI (3.13 – 11.21)], consistent use of condoms [AOR = 11.78, 95% CI (1.03 – 13.41)], alcohol use [AOR = 2.55, 95% CI (1.01 –5.32)], experienced side effects [AOR = 16.06, 95% CI (5.71 – 22.56)] and satisfaction with health service provision [AOR = 10.01, 95% CI (2.32 – 43.25)] to be statistically significant predictors of uptake of PrEP services. There is need for tailor made interventions for young sex workers, furthermore use of mobile applications to remind clients, provision of safety nets and continued health education to both the female sex workers and the community at large to reduce stigmatization.*

***Key Words:*** *Pre-exposure prophylaxis, adherence*

## Introduction

The leading cause of global morbidity and mortality is Acquired Immune-Deficiency Syndrome (AIDS) and 36.7 million people are living with Human Immuno-deficiency Virus (HIV). Annually an average of 1.1 million people die from HIV and AIDS. The last 15 years has seen tremendous progress being made against AIDS and this has led to a global commitment to end the epidemic by 2030[1].

One of the prevention intervention methods that was recommended by the World Health Organisation (WHO) in September 2015 was the offering of oral pre-exposure prophylaxis (PrEP) as part of combination HIV prevention approaches for people at substantial risk of HIV infection. Substantial risk was found to be more in the key populations' and these include sex workers, people who inject drugs, transgender people, prisoners, gay men and other men who have sex with men. Sex workers are 10 times more likely to acquire HIV. Globally, key populations and their sexual partners accounted for 36% of the new HIV infections in 2015[1].

HIV PrEP prevents individuals who are human immunodeficiency virus (HIV)-negative but are at high risk from being infected by HIV. PrEP currently involves the use of two coformulated antiretroviral drugs, teno-fovir disoproxil fumarate and emtricitabine (TDF/FTC; brand name Truvada), taken as a combined oral tablet by HIV-negative people to reduce the risk of HIV infection[2]. Randomized clinical trials of PrEP for HIV prevention have widely divergent efficacy estimates, ranging from 0% to 75% and studies have attributed this to different factors with adherence being the most cited deterrent[3].

Globally, there has been a general high acceptability of PrEP among different targeted population groups including female sex workers (FSWs) yet there is a steady increasing trend of PrEP defaulting in Low to Medium Income Countries (LMICs) including Zimbabwe. Currently, PrEP is being supplied on a monthly basis in Mutare urban sites and according to the Centre for Sexual Health and HIV/AIDS Research Zimbabwe IN 2019, a person is classified a defaulter when they have missed one clinical appointment. In Zimbabwe, female sex workers constitute one of the most vulnerable sub-groups to HIV who have embraced PrEP, however empirical evidence provided by the National Aids Council (NAC) for Mutare urban district has revealed that for the period April to November 2019, the adherence rate is 22 %[4]. Information regarding the reasons to this high defaulter rate is not

readily available. This study seeks to determine the factors attributable to this high defaulter/none adherence rate and make recommendations to PrEP programmers that can be of help in increasing adherence.

PrEP was adopted in Zimbabwe around 2017 and it's still being piloted in a few centres across the country. Several studies have reported the potential benefits of integrating PrEP into HIV prevention programmes for female sex workers (FSWs). Empirical evidence for the biological effectiveness of PrEP in women who can adhere to daily dosing is strong from different research designs that have been employed in PrEP studies. Women require 6 or 7 daily oral Truvada/week to be adequately protected from HIV infection[2].

Current combination prevention approaches enable many FSWs to remain HIV-free, yet in developing countries like Zimbabwe, some FSWs are unable to mitigate their risk. PrEP becomes a handy approach that could help FSWs to reduce risk of getting infected. The effectiveness of HIV PrEP depends on adherence, which requires retention in PrEP care[5]. The success of the PrEP initiative heavily depends on the perception of their risk to infection by the FSWs, their attitude towards a change in status, their motivation and ability to take PrEP daily and to attend health services for prescription refill and clinical monitoring[6].

PrEP adherence is low among female sex workers registered on PrEP in Mutare urban, with an adherence rate of 22%[4]. Evidence shows that, when taken consistently and correctly, PrEP reduces the chances of HIV infection to near-zero. If non –adherence is not addressed, the risk of spread of HIV will persist and Zimbabwe will not reach its set target of zero new infections by 2030. Henceforth, this research sought to assess the causes of non-adherence to PrEP among female sex workers with the aim to inform better programming.
The purpose of the study was to determine the risk factors related with poor adherence to PrEP among female sexual workers in Mutare urban from April to November 2019.

**Conceptual framework**

The study conceptual framework was developed guided by the World Health Organization social determinants of health framework as shown below in the figure below.

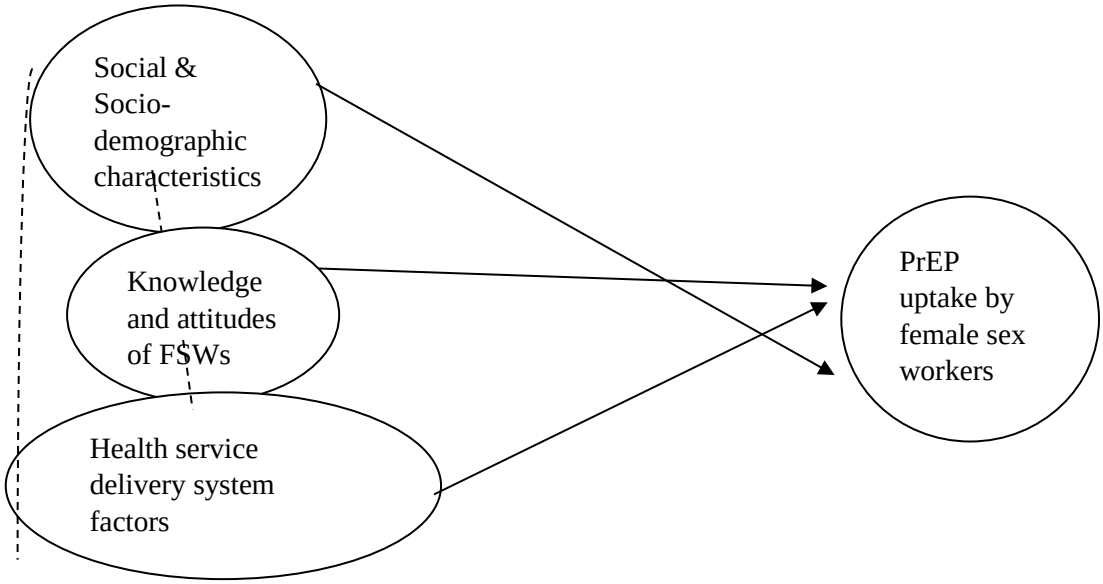


**Figure 1: Study conceptual framework**

According to the framework above, adherence to medication especially in the vulnerable groups is determined by a number of structural and social health determinants. Social and socio-demographic characteristics have a huge impact on adherence to medication. For example health promoting factors that are found in one's living and working conditions, such as the distribution of income, wealth, influence, and power, influence adherence to PrEP. Socio-demographic characteristics e.g. age, class, occupation and level of education determine adherence to prEP. Furthermore, behavioural aspects such as attitudes coupled with knowledge level of an individual also determine adherence and none adherence to medication. Structural determinants e.g. policies that are supportive and health service provision availability determine adherence to PrEP. These structural and social health determinants must be considered when providing treatment and care for the vulnerable populations.

**Adherence rates for PrEP**

Clinical trials of PrEP have used several measures and indicators to estimate adherence to PrEP medication, including participant reports of missed doses, clinic based pill counts of unused medication, and blood levels of the antiretroviral medication[2].

A study conducted in China reported median adherence rate was 64.29%[7]. A similar observational study on challenges in translating PrEP interest into uptake among young black men reported that 63(34%) of those initiated on PrEP subsequently discontinued PrEP[8]. Another study in New York reported a 6 months retention rate of 42% among individuals prescribed PrEP between 2011 and 2015 in a large academic health system in the Bronx, New York[8]. A study in Peru examined PrEP acceptability among female sex workers, male-to-female transgendered persons, and men who have sex with men[9]. Conjoint analysis revealed that PrEP acceptability ranged from 19.8 to 82.5% which was also a wide variation[9].

**Structural and social factors for Poor Adherence to PrEP**

Socio-demographical factors that have been associated with adherence rates to PrEP include age. A study in East-Africa reported an association between young age <25 and a PrEP adherence <80%[3]. Younger and newer entrants to sex work were less likely to take PrEP every day[10]. In concurrence another study where younger MSM <25 were reported to be less adherent to PrEP whilst self-reported excellent adherence was associated with being over 25 years old[11]. Similar findings were reported in the VOICE trial done by the World Health Organisation (WHO) in 2001, lower drug concentrations and higher HIV incidence was demonstrated in younger, unmarried women compared to those over 25 and married[12].

Alcohol use was found to be a cause of non-adherence in several studies[3; 13-17]. In a narrative review Haire (2015) found PrEP-related stigma to be a significant social harm that can arise from PrEP research participation as reported by trial participants from a range of different trial sites, different trial populations, and spanning different continents[18]. In concurrence is a study in San Francisco which found that stigma was the most commonly reported social harm arising from study participation. The participants reported feeling stigmatized by medical providers, friends, and sex partners[11]. Fear of stigma and family reaction associated with PrEP use and being labelled HIV-positive or promiscuous were also findings reported in other studies[3;17].

This concern about being stigmatized in association with high-risk sex (also called "promiscuity") was echoed in a PrEP acceptability study conducted in Lima, Peru that enrolled MSM, FSW, and male-to-female transgendered women[19]. Similar findings were also reported in other studies[20-24].

Behavioral factors including sexual risk behaviors were also reported to lead to poor adherence[16]. In concurrence is a study by[3] where poor adherence was linked to reports of no sex or sex with another person besides the study partner , furthermore women in a polygamous marriage had an adherence rate >80%[3].

Low risk perception was also found to be a contributing factor towards non-adherence. A randomized, double-blind, placebo-controlled trial by[21] reported that most women in the study perceived themselves to be at no or low risk for HIV infection in the coming month, at the baseline visit (70.0%) and at the last regular follow-up visit (74.8%). In concurrence is Sidebottom, Ekström, and Strömdahl, (2018) who reported low risk perception as being associated with low adherence in their systematic review study[25].

**Knowledge**

A cohort study in China done by Qu et al., (2018) reported no significant correlation between adherence to PrEP and information, motivation and behaviour skills. This is in contrast to Pacífico de Carvalho, Mendicino, Cândido, Alecrim, and Menezes de Pádua (2019) where he found low to moderate knowledge about PrEP has been reported in many studies and associated with non-adherence in a narrative of PrEP studies[24]. A cross sectional study conducted in China by Poon et al., (2019) showed that FSWs that demonstrated greater HIV knowledge through having been tested or having greater decision-making involvement in condom use had higher adherence.

The main cited objective reasons for non-adherence were forgetting to take medicine (70%), pressure of work (29%), fear of side effects (28%) and 'too much trouble' (19%) by[13]. This is similar to findings by Qu et al., (2018) among MSM in China, where 'forgetting to take medicine' (70.21%), 'too busy' (29.08%), 'worrying about side effects' (28.01%), and 'too much trouble' (18.44%)[23]. In further concurrence is Liu et al., (2014) where reported common adherence barriers included forgetting to take the medication (45%), experiencing a change in daily routine (24%), being busy (23%), away from home (19%), or too tired (10%), medication cost (8%), trouble refilling medications (7%), not wanting to take the medication (6%), and being depressed, overwhelmed, or angry (6%)[11]. In a systematic review on PrEP adherence Muchomba et al., (2012) reported low medication adherence was related to 'forgetting medication' and 'worried about potential side effects'. In a study of PrEP in Kenya, the

common causes of low medication adherence were 'away from home' (12%) and 'forgot to take drug' (8%) (Mutua, Sanders, Mugo, Anzala, Haberer, Bangsberg, & Fast, 2012).

**Clinical related factors**

Health delivery system factors that have been associated with non-adherence to PrEP include stigmatisation of health services due to fear of the authorities[23]. Ojeda et al., (2019) reported an association between PrEP adherence and staff-client interactions that led to poor adherence[5]. This is similar to findings by Pacífico de Carvalho et al., (2019) were poor client interaction with healthcare workers was reported to be a barrier to PrEP adherence[24]. How clinicians view PrEP and people who seek PrEP also affects uptake, as does the adherence support that patients receive.

Daily PrEP use was not preferred by most FSWs interviewed in most studies with FSWs preferring intermittent use of PrEP or injectable PrEP[5;24]. This is similar to findings by Footer et al., (2019) where better privacy with injections increased adherence with reduced dosing schedules, from longer lasting PrEP[6].

Facilitators included perceived reduction of HIV risk, fear of HIV/AIDS and reduced dependence on partners[24]. A key facilitator theme identified by black MSM included gaining PrEP awareness from social and sexual networks[26]. Facilitators to adherence were potential for covert use, sex without condoms, and anxiety-less sex.

Thigpen, Kebaabetswe, Paxton, Smith, Rose, and Segolodi (2017) reported adherence to be affected by actual side effects (adverse effects) to the drugs such as nausea, diarrhoea and dizziness amongst many others[27]. In concurrence are findings by Jessica et al., (2013) in a study in Misisipi where perceived and actual side effects were reported to lead to lower adherence to PrEP[3].

**Methodology**

*Research design*

A 1:1 unmatched case-control study was carried out to solicit more information on pre-exposure prophylaxis adherence in Mutare urban.

*Study setting*

This study was carried out in Mutare urban district, Zimbabwe. The district is about 300 km to the east of Zimbabwe's capital, Harare and is bordered by Makoni District on the north, Chipinge district south, Mutasa and Buhera districts on the east and west respectively. The latest data based on 2012 census projections showed that its' population is approximately 188,243 urban and rural population approximately 260,567, (Zimbabwe National Statistical Agency[28]. Study sites are limited in Mutare, therefore the study was carried out at 2 selected sites, Forbes and Sakubva which implement sex work programs under NAC.

*Study population*

The source population of this study were all female sex workers registered under NAC key population programs in the two sites namely Forbes and Sakubva residing in Mutare urban. A total of 2354 sex workers are registered under the sex work project between the two sites. Between April and November 2019 a total of 225 female sex workers have been enrolled on PrEP in the two sites, with Forbes having 79 and Sakubva 146 clients[4].

*Case definition***:** Any female sex worker from study sites who has been on PrEP for more than a month and has defaulted PrEP.

*Control definition*: Any female sex worker from study sites who has been on PrEP for more than a month has not defaulted PrEP.

*Key informants***:** Key informant interviews were randomly done to health workers on duty at the selected centres who consented to participant.

*Inclusion Criteria*

All female sex workers aged 19 and above who were registered on the PrEP programme under NAC namely Forbes and Sakubva sites were included in the study. Furthermore, the female sex workers had to be permanent residents of Mutare Urban district. Health professionals participating in the PrEP program, willing and able to give informed consent to take part were included in the study.

*Exclusion Criteria*

All female sex workers aged 17 years and below were excluded in the study. Furthermore, female sex workers who were either very ill or mentally challenged were excluded. In addition, female sex workers living outside Mutare Urban district were not considered for the study. Finally, female sex workers who were unwilling to participate or incapacitated to give consent were excluded from the study.

*Sample size*

The sample size was calculated in Epi info 7 using following assumptions: A 22% PrEP adherence rate in Mutare urban (NAC, 2019), a significance level of 0.05, power of 0.8. A total sample size of 64 participants was used for this study. Henceforth, cases were 32 and controls 32.

*Sampling Procedure*

Participants were identified from records at the study sites, and systematic sampling was done for both controls and cases. Proportional selection of participants was done for the two centres since they had different numbers of participants. Therefore, 42 participants from Sakubva site and 22 from Forbes site were selected. A sampling interval of 4 was calculated by diving the total population by the required sample size (225/64). If any of the selected participants refused to participate or was not found, the next subsequent participant was enrolled and the interval was applied for selection of the next participant. Health workers who were available at the health facility and who consented to participate in the study were conveniently selected.

*Data collection instruments*

The investigator used a structured questionnaire to collect information on demography, knowledge on PrEP, factors associated with service utilisation and other relevant information using interviewer-administered structured questionnaires. A key informant guide was used to interview health professionals in PrEP implementation.

*Dependent variable*

In this study, adherence to PrEP (coded as poor or good) was the dependent variable. This was ascertained through measuring variables such as pill count and resupply date turnout.

*Independent variables*

The demographic and socio-economic characteristics of the female sex workers, knowledge, attitudes, behaviours and health systems factors were the independent variables. This included the age, education level, and occupation, marital status of the female sex workers, religion, health facility utilisation (health-seeking behaviour), place of residence (rural-urban) and communication methods used.

*Pretesting of Instruments*

The questionnaire was evaluated for test-retest reliability using 4 cases and 4 controls. The sample was randomly selected at the study sites and they were excluded from the larger study sample. The test-retest assessments was carried out 5 days apart and participants were not told that they would be re-tested to minimise bias. Item completion of the questions and percentage agreement between test–retest assessments was calculated for each question and the range was above 90%. Based on these results the questionnaire was adopted for use in the study. Face and construct validity was enhanced through subjecting the questionnaire to review by experts in public health and aligning the research instrument to the conceptual framework that predicted PrEP adherence. Furthermore, back translating the local language questionnaire to English to ensure reliability.

*Data collection procedure*

Details for the randomly selected participants was obtained from the clinic records and the interviewer contacted each selected participant to book an appointment to meet with them. A written informed consent was obtained from those participants who volunteered to participate in the study. Following a written informed consent, participants were interviewed in a private and confidential space using a household interviewer-administered structured questionnaire. The place of interview was of the participants' choice either at the clinic or at home. The key informant interview guide was used to interview Health service providers at the selected sites to explore possible barriers and enablers to PrEP adherence.

*Data analysis and organisation*

In this analysis, Epi info version 7 was used for capturing, cleaning and tabularisation of all the data collected using questionnaires. Univariate analysis was employed to describe distribution of social determinants by characteristics of participants. In order to determine the association between adherence to PrEP and independent variables, a bivariate analysis was conducted. To determine the predictors of adherence to PrEP, multivariate logistic regression analysis was performed to generate Odds ratios including all the factors that showed a significant association with the outcome variable. Thematic analysis was used to analyse qualitative data.

*Ethical cconsiderations*

The investigator obtained ethical approval from the Ethics Committee of Africa University (AUREC). The permission to collect data was also sought from National AIDS Council Mutare. A written consent was obtained from all participants prior to each interview session. All the participants were assured that they can withdraw from the process whenever they want with no disadvantage to their care. Privacy and confidentiality was maintained throughout the study process. Measures to ensure confidentiality included telling clients that no information shall be shared to other people and privacy was maintained, no names were used on the questionnaires but were coded using numbers. Furthermore, collected data was kept in a safe and locked cupboard.

**Results and Discussion**

The mean age for cases was 26 whilst for controls it was 35 combined mean age was 31 years. Interquartile range for the age was Q1=8.25 and Q3=24.8. Most of the cases and controls were not married, 5(16%) constituted the married for both groups. The majority of cases and controls stayed in the high density 27(84%) and 16(50%) respectively. Residence in low density was 1(3%) for cases and 4(12%) for controls. Most of the cases and controls had attended secondary school as the highest level 24(75%) and 16(50%) respectively. However, more controls had attended tertiary level 13(41%) compared to cases 2(6%). Most of the participants were Christians for both cases and controls 27(85%) and 26(81%) respectively, whilst a few were from the traditional religion 2(6%) for both cases and controls. More controls 20(72%) had an average monthly expenditure of <100USD compared to cases 7(22%). However, more cases 25(78%) had average monthly expenditure of >100USD compared to controls 12(38%).

***Table 1: Demographic characteristics of participants***

| Variable | Category | Case N=32<br>n (%) | Control N=32<br>n (%) |
|---|---|---|---|
| | 19-24 | 24 (75) | 12 (38) |
| | 25& above | 8 (25) | 20 (72) |
| Marital status | Married | 5(16) | 5 (16) |
| | Not married | 27(84) | 27(84) |
| Place of residence | High density | 27(84) | 16(50) |
| | Low Density | 1(3) | 4(12) |
| | Medium density | 4(13) | 12(38) |
| Level of education | Primary | 6(19) | 3(9) |
| | Secondary | 24(75) | 16(50) |
| | Tertiary | 2 (6) | 13(41) |
| Religion | Christian | 27(85) | 26(81) |
| | Muslim | 0 | 0 |
| | Apostolic | 3(9) | 4(13) |
| | Traditional | 2(6) | 2(6) |
| Average monthly household expenditure | <100USD | 7(22) | 20(72) |
| | >100USD | 25(78) | 12(38) |

***Table 2: Demographic characteristics associated with PrEP uptake***

| Variable | Category | Case N=32 n (%) | Control N=32 n (%) | OR(95%CI) | P value |
|---|---|---|---|---|---|
| | 19-24 | 24 (75) | 12 (38) | 5(1.7 ,14.6) | 0.001* |
| | 25& above | 8 (25) | 20 (72) | | |
| Marital status | Married | 5(16) | 5 (16) | 1(0.26, 3.86) | 0.5 |
| | Not married | 27(84) | 27(84) | | |
| Place of residence | High density | 27(84) | 16(50) | 6.8(0.69;65.7) | 0.05 |
| | Low Density | 1(3) | 4(12) | | |
| | Medium density | 4(13) | 12(38) | | |
| Level of education | Primary | 6(19) | 3(9) | 9.8(1.93;49.1) | 0.011* |
| | Secondary | 24(75) | 16(50) | | |
| | Tertiary | 2 (6) | 13(41) | | |
| Religion | Christian | 27(85) | 26(81) | 1.2(0.34;4.59) | 0.38 |
| | Muslim | 0 | 0 | | |
| | Apostolic | 3(9) | 4(13) | | |
| | Traditional | 2(6) | 2(6) | | |
| On average, how much is the usual household expenditure in a month? | <100USD | 7(22) | 20(72) | 0.2(0.06;0.51) | 0.0006* |
| | >100USD | 25(78) | 12(38) | | |

*The * represents statistically significant results*

The table above shows the following factors were found to be significant, age [OR = 5, 95% CI= (1.7 – 14.6)] meaning younger sex workers aged 19-24 were 5 times more likely not to adhere to PrEP compared to their older counterparts aged 25>. Thirty-six (56%) of the participants were FSWs 19-24 years of age and two thirds of these were cases. Younger women (19-24 years) were 5 times more likely to be cases compared with their older counterparts (>25 years) [OR =5, p=0.001]. This finding is in concurrence to a similar study in East-Africa by Jessica et al., (2013) which revealed an association between young age and a PrEP adherence <80%. It also concurs with Fearon et al., (2019) where the study reported younger and newer entrants to sex work being less likely to take PrEP every day[10]. In the VOICE trial by WHO, lower drug concentrations and higher HIV incidence was demonstrated in younger, unmarried women compared to those over 25 and married.

This could be explained by the fact that young women have less experience in the profession resulting in less appreciation of some of the unique challenges that FSWs often experience with abusive sexual partners, who use sexual, gender based violence, to demand and force FSWs to engage in unprotected sex because they claim they have paid for the service, resulting in FSWs being infected with HIV.

Similarly, young women are still experimenting with sexuality and are generally less likely to adhere to one way of managing their sex life. There is also some stigma and discrimination associated with taking up of antiretroviral drugs which often results in social isolation and social labelling which is less likely to be tolerated by younger women compared to the more mature FSWs. There is also a general feeling and belief that one only takes medication (ART) when sick and this could also have contributed to the poor uptake of PrEP by age. It is then critical that social behaviour change communication and promotional strategies be tailor made to reach out to specific age-groups of FSWs for maximum impact and effectiveness.

As expected, level of education was significantly associated with PrEP uptake [OR = 9.8, p=0.011]. Adherence to PrEP increased with level of education. Twenty-nine (91%) of the control had either secondary or tertiary education compared to 75% among the cases with only 2(6%) of the cases having tertiary education. Similar studies, have also reported a similar trend (Qu et al., 2018 and Poon et al., (2019). Programs might need to consider more user-friendly participatory approaches of mobilising less educated FSWs on PrEP to improve uptake.

In this study, household expenditure rates of FSWs were significantly associated with PrEP adherence. Spending above 100USD per month reduced the odds of adherence to PrEP by 80% [OR=0.2, 95% CI (0.06; 0.51). Twenty-five (75%) of the FSWs who were cases spend above 100USD per month. High cost of living was significantly

associated with riskier behaviours, as FSWs would do anything possible to meet their cost of living demands. A study in Kenya had a contrasting result on this, showing more adherence among those who are in higher wealth quintiles and this was associated with more emancipation and empowerment[14]. There is high need for the government and other related organisations that support women Sexual and reproductive rights to improve social safety nets for FSWs to reduce the likelihood of continual transmission of HIV through unprotected sex and to improve adherence to PrEP. In other countries, governments and Civil Society Organisations have designed income generating projects to economically empower FSWs and reduce their chances of engaging in very risky sexual behaviours.

***Table 3: Knowledge of PrEP***

| Variable | Category | Case N=32 n (%) | Control N=32 n (%) |
|---|---|---|---|
| Define PrEP | Correct | 20(63) | 28(88) |
| | Incorrect | 12(37) | 4(12) |
| For how long should one take PrEP? | Correct | 24(75) | 30(94) |
| | Incorrect | 8(25) | 2(6) |
| Why is adherence to PrEP important? | Correct | 25(78) | 27(84) |
| | Incorrect | 7(22) | 5(16) |

The majority of controls 28(88%) were able to define the meaning of PrEP compared to cases 20(63%). Most of the cases 24(75%) and controls 30(94%) knew the duration and frequency of taking PrEP. The importance of adhering to PrEP was correctly reported by 25(78%) and 27(84%) of the cases and controls respectively.

***Table 4: Knowledge factors associated with PrEP adherence***

| Variable | Category | Frequency | | OR(95%CI) | P value |
|---|---|---|---|---|---|
| | | Case N=32 n (%) | Control N=32 n (%) | | |
| Define PrEP | Correct | 20(63) | 28(88) | 0.24(0.06, 0.85) | 0.01* |
| | Incorrect | 12(37) | 4(12) | | |
| For how long should one take PrEP? | Correct | 24(75) | 30(94) | 0.2(0.04, 1.0) | 0.02* |
| | Incorrect | 8(25) | 2(6) | | |
| Why is adherence to PrEP important? | Correct | 25(78) | 27(84) | 0.66(0.18, 2.35) | 0.27 |
| | Incorrect | 7(22) | 5(16) | | |

The results revealed that correct knowledge on PrEP reduced the odds of non-adherence to PrEP by 76% [OR=0.24, 95%CI= (0.06; 0.85), p=0.01] and this was a significant finding. Correct knowledge on the duration one is expected to take PrEP also reduced the odds of non-adherence by 80% [OR=0.2, 95%CI= (0.04; 1), p=0.02] and this was also a significant finding. Having the knowledge of why adherence was important was found to reduce non-adherence by 24% [OR=0.66 95% CI= (0.18, 2.35)], this finding was however insignificant. This finding is similar to a study by[23] which reported that low to moderate knowledge about PrEP resulted in poor adherence to PrEP among FSWs. In contrast is a study in China done by Qu et al., (2018) which found no association between adherence to PrEP and information, motivation and behaviour skills. The two highlighted results point to the need to intensify correct and consistent information on PrEP to FSWs. Health service providers should make use of all opportune moments through the use of a supermarket approach to foster and enhance correct knowledge on PrEP for increased adherence.

***Table 5: Reasons for missing dose (Cases only)***

| Reason (N=32) | n | % |
|---|---|---|
| I forgot | 28 | 88 |
| I decide to stop altogether | 12 | 38 |
| I had a bad side effect to PrEP | 20 | 63 |
| I did not have my tablets with me | 11 | 34 |
| I was stigmatized | 21 | 66 |
| Fear of stigmatization | 19 | 59 |
| I am not convinced I needed PrEP | 13 | 41 |
| I lost my PrEP tablets | 2 | 6 |
| I decided to give myself a break from PrEP | 14 | 44 |
| I am not currently having sex so need for PrEP? | 0 | 0 |
| I don't like the idea of taking PrEP all the time | 29 | 91 |

A univariate analysis of the reasons why the cases were defaulting PrEP was done and the most reasons that were mentioned were forgetfulness 28(88%), experienced side effects to PrEP 20(63%), stigmatisation by either or friends ,family and sexual partners 21(66%), fear of stigmatisation 19(59%) and not liking to take medication daily 29(91%). This finding concurs with findings of similar studies done by[11-13] who all reported the same behavioural and attitudinal factors to be related with poor adherence to PrEP.

This study found experiencing stigmatisation (66%) and fear of stigmatisation (59%) to contribute to low adherence. This finding concurs with findings by[3;17] where fear of stigma and family reaction associated with PrEP use, being labelled HIV-positive or promiscuous, lack of social support, unplanned travel, fear of disclosure to other FSWs and clients to be associated with poor PrEP adherence. Programs targeting FSWs should intensify in addressing the harmful social norms, practices and negative perceptions from communities that increase the chances of defaulter rate. A lot is still to be done through educational programmes to normalise PrEP.

***Table 6: Sexual behaviours***

| Variable | Category | Case N=32 n (%) | Control N=32 n (%) |
|---|---|---|---|
| Consistent use of condoms | Yes | 20(63) | 5(16) |
| | no | 12(37) | 27(84) |
| Drug and Alcohol use | Yes | 27(84) | 18(56) |
| | No | 5(16) | 14(44) |

Table above shows that most of the cases 20(63%) reported consistent condoms use whilst 12(37%) did not use condoms consistently. Majority of the controls 27(84%) reported non-consistent use of condoms whilst 5(16) reported consistent condom use. Drug and alcohol use was reported by 27(84%) of cases and 18(56%) controls.

***Table 7: Sexual behaviours factors associated with PrEP uptake***

| Variable | Category | Case N=32 n (%) | Control N=32 n (%) | OR (95%CI) | P value |
|---|---|---|---|---|---|
| Consistent use of condoms | Yes | 20(63) | 5(16) | 9 (2.73, 29.67) | 0.001* |
| | no | 12(37) | 27(84) | | |
| Drug and Alcohol use | Yes | 27(84) | 18(56) | 4 (1.29, 13.7) | 0.008* |
| | No | 5(16) | 14(44) | | |

Table above shows both sexual behaviours to have a significant association with PrEP uptake, consistent use of condoms [OR=9, 95%CI= (2.73, 29.67)] meaning those that used condoms consistently were 9 times less likely to adhere to PrEP, and those that consumed alcohol were 4 times less likely to adhere to PrEP [OR=4, 95%CI = (1.29; 13.7)]. Poor behaviours and low risk perception were also contributing to poor adherence to PrEP among FSWs in Mutare urban. This is in concurrence with findings by Van Damme et al., (2012) where low risk perception contributed to non-adherence to PrEP[21]. Alcohol use increased the odds of non-adherence by 300%. This means that substance abuse remain one of the key distractors to the elimination of HIV transmissions through FSWs. Substance abuse has been reported to be associated with poor adherence in many programs as it increases the chances of forgetfulness and often gives FSWs false courage to take risky sexual behaviours. This finding is

similar to findings by[3;17] also reported that substance abuse led to poor adherence. Continuous awareness raising on the consequences of alcohol use among FSWs will ultimately reduce non-adherence levels to minimal.

FSWs who consistently used condoms were 9 times less likely to adhere to PrEP [OR= 9, P=0.001] in this study. This finding contrasts with Poon et al., (2019) who reported greater HIV knowledge through having been tested or having greater decision-making involvement in condom use had higher adherence. This finding further contrasts with Baral et al., (2012) where condom use was reported as a facilitator to adherence. The differences might be attributed to study settings. It stands to reason that some of these FSWs do a cost benefit analysis of the two options and condoms provide glaring advantages. Condoms are also easily available locally in their places of residence and one can get lots of them for free as well from organisations like Zimbabwe National Family Planning Council (ZNFPC) or Population Services Zimbabwe (PIZ) and Ministry of Health and Child Care. FSWs do not need to be in any registered and monitored through various tests to use condoms and this gives them a lot of control especially when they use female condoms. This could explain why those who are consistently use condoms, often default pre-exposure prophylaxis because to them it will be duplication of effort, using a less effective method which has possibility of side effects. Condoms also provide more advantages, including pregnancy prevention and prevention of other sexually transmitted diseases due to its dual protections. All these benefits are not found in pre-exposure prophylaxis.

***Table 8: Clinical and Health service delivery***

| Variable | Category | Case N=32 n (%) | Control N=32 n (%) |
|---|---|---|---|
| Perceived rating of health services | Good | 17(53) | 27(84) |
| | Poor | 15(47) | 5(16) |
| Time taken to get served | <1hr | 29(91) | 31(97) |
| | >1hr | 3(9) | 1(3) |
| Experienced side effects of PrEP | Yes | 20(63) | 7(22) |
| | No | 12(37) | 25(78) |

Table 8 above shows that health services were rated as good by 17(53%) cases and 27(84%) of the controls. Forty seven percent of the cases rated health services as poor whilst 5(16%) of the controls reported poor services. Majority of both cases and controls reported taking less than 1 hour to get served 29(91%) and 31(97%) respectively. Majority of cases 20(63%) reported having experienced side effects to PrEP compared to 7(22%) of controls.

***Table 9: Clinical and health delivery factors associated with PrEP uptake***

| Variable | Category | Case N=32 n (%) | Control N=32 n (%) | OR (95%CI) | P value |
|---|---|---|---|---|---|
| Perceived rating of health services | Good | 17(53) | 27(84) | 0.21 (0.07;0.68) | 0.004* |
| | Poor | 15(47) | 5(16) | | |
| Time taken to get served | <1hr | 29(91) | 31(97) | 0.32 (0.03;3.17) | 0.18 |
| | >1hr | 3(9) | 1(3) | | |
| Experienced side effects of PrEP | Yes | 20(63) | 7(22) | 6 (1.98;17.9) | 0.001* |
| | No | 12(37) | 25(78) | | |

The table above shows the clinical and health service delivery factors associated with PrEP uptake. Poor satisfaction with health services is likely to reduce adherence by 79% [OR=0.21, 95%CI= (0.07; 0.68)]. Those who had experienced side effects were 6 times less likely to adhere to PrEP [OR=6, 95%CI= (1.98; 17.9)]. Both findings were found to be significantly associated with PrEP uptake whilst time taken to get served reduced non-adherence by 68% [OR=0.32, 95%CI = (0.03; 3.17)], however this finding was found to be insignificant. The majority of the cases in this study (91%) reported not liking to take medication every day and this has led to poor adherence. This concurs with findings by[5;24] who reported daily PrEP use was not preferred by most FSWs interviewed with FSWs preferring intermittent use of PrEP or injectable PrEP. This is similar to findings by[6] where better privacy with injections increased adherence with reduced dosing schedules, from longer lasting PrEP.

***Table 10: Predictors of adherence to PrEP***

A forward stepwise regression analysis was done and the following results were obtained.

| **PrEP uptake** | **(AOR)** | **z** | **95% CI** | **P value** |
|---|---|---|---|---|
| Age | 2.14. | 1.15 | 1.08 – 3.34 | 0.01* |
| Level of education | 0.96 | -0.05 | 0.17 – 5.33 | 0.962 |
| Knowledge of PrEp Definition | 2.64 | 1.08 | 0.46 – 15.30 | 0.279 |
| Duration of taking PrEP | 3.91 | 1.92 | 0.95 – 14.90 | 0.051 |
| HH expenditure per month | 18.77 | 3.21 | 3.13 – 11.21 | 0.001* |
| Consistent use of Condoms | 11.78 | 1.99 | 1.03 – 13.41 | 0.037* |
| Alcohol use | 2.55 | 1.61 | 1.01 – 5.32 | 0.010* |
| Experience side effects | 16.06 | 0.82 | 5.71 – 22.56 | 0.013* |
| Satisfaction levels with health service | 10.01 | 3.09 | 2.32 – 43.25 | 0.002* |

*The * represents statistically significant results.*

All factors that had a statistical significant association with uptake of PrEP services were controlled for and these included age of the FSW, level of education, household expenditure per month Knowledge of PrEP definition, , duration of taking PrEP, consistent use of condoms, alcohol use, experiencing side effects and overall satisfaction levels with health service provision. Only age [AOR = 2.14, 95% CI=(1.08 – 3.34)], household expenditure per month [AOR = 18.77, 95% CI= (3.13 – 11.21)], consistent use of condoms [AOR = 11.78, 95% CI=(1.03 – 13.41)], alcohol use [AOR = 2.55, 95% CI = (1.01 –5.32)], experienced side effects [AOR = 16.06, 95% CI= (5.71 – 22.56)] and satisfaction with health service provision [AOR = 10.01, 95% CI = (2.32 – 43.25)] were statistically significant predictors of uptake of PrEP services. This means that mobilization strategies for FSWs should be age specific, economic empowering and continuously engage FSWs through customer satisfaction survey. Research should continue to find more efficacious methods of reducing side and adverse effects to promote PrEP adherence.

**Conclusion**

The social and structural determinants found to be associated with low PrEP uptake include some demographic characteristics such as being a sex worker aged between 18-24, having a household expenditure above 100USD and level of education. In addition, low knowledge levels among the defaulters, some sexual behaviours like alcohol use and consistent condom use were found to contribute to low pre-exposure prophylaxis uptake. Furthermore, low pre-exposure prophylaxis uptake was found to be significantly associated with poor perceived health services and social factors such as stigma associated with PrEP uptake.

The challenges noted in this study require structural changes in service provision and there is need to consider the social factors of each individual rather than a bracket fit all approach. There is need to provide better contextualised individualised services. This means that mobilization strategies for FSWs should be a combination of interventions that build self-efficacy, are age specific, economically empowering and should promote social cohesion. Furthermore, continuously engage FSWs through customer satisfaction survey to facilitate continuous improvements on individualized adherence support. Research should continue to find more efficacious methods of reducing side and adverse effects to promote PrEP adherence.

It is therefore of high importance that programmers take into cognisance the social and structural determinants at play so that they can understand the rates at which people are able to adhere to PrEP and address the barriers preventing adherence to ensure the long-term success of the PrEP intervention.

**Recommendations**

From the findings of the study several recommendations have been drawn. In order to increase adherence to PrEP programmers need to use a holistic approach.

- Program implementers need to use electronic reminders e.g. bulk texts everyday which is cheaper and can help in increasing adherence. The study also recommends the offering of psychosocial support virtually, for example through formation of WhatsApp group, where motivational messages can be sent and they share their experiences and ask questions anytime without necessarily having to visit the clinic since some clients find health facilities stigmatising.
- Programmers need to reframe PrEP access as a positive and responsible option to help people remain HIV-negative. Henceforth, there is need to redress PrEP-related stigmas and the study recommends intensification of health promotion campaigns using social marketing strategies. The target audiences should be clinicians, HIV-affected communities, and people at high risk of HIV who might benefit from PrEP access.
- Non adherence is experienced in the younger female sex workers more compared to the older FSWs. Therefore, there is need for development of differentiated interventions addressed to the young female sex workers since their needs are different from the older rather than a one blanket fits all approach by programmers.
- Most of the sex workers sited being discouraged to take PrEP by fellow sex workers leading them to default. The study further recommends targeted involvement of the female sex work ring leaders in programmes, so that they can be role models that lead and encourage their followers to adhere to PrEP. The study discovered some of the ring leaders are above 50-60, therefore they are not so forthcoming in being known and they will not come to open meetings. However, as programmers let us take services to where they are rather than waiting for them to come to us.

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