

Original Research Article

Uptake, adherence and retention of daily oral Pre-Exposure Prophylaxis among Female Sex Workers in the Greater Gaborone City, Botswana

Abstract

Introduction: Female sex workers are estimated to be 30 times more likely to be living with Human Immuno-virus than other women of reproductive age and face an increased burden of sexually transmitted infections. Pre-Exposure Prophylaxis was introduced in Botswana in 2018 as an addition to combination-prevention strategies. Since then, no study was carried out to assess the efficiency of PrEP as an intervention. This study aimed to assess the uptake, adherence and retention of daily oral Pre-Exposure Prophylaxis among female sex workers in the Greater Gaborone City, Botswana.

Methods: Retrospective, quantitative cross-sectional study was carried out Between August 2018 and May 2020. Purposive sampling was used to select the study site and exhaustive sampling was used to select recorded participant's data. Descriptive statistics using Statistical Package for the Social Sciences (version 26), frequency and proportions were used to organise and analyse the data. Multiple regression analyses were performed to assess association between variables and $p = .05$ was considered significant.

Results: 207 Female sex workers participated in the study. Adherence to Pre-Exposure Prophylaxis was high (72.9%) but retention was low (16.9%). Unemployed female sex workers adhered more to Pre-Exposure Prophylaxis and age group 18-29 was less likely to be retained in the programme. Perception of no longer at substantial risk to Human Immuno-virus infection, loss of interest to continue with Pre-Exposure Prophylaxis, drug side effects and busy life schedules were major reasons for non-retention.

Conclusions: Lack of motivation challenged effective Pre-Exposure Prophylaxis retention. Widespread messaging to communities and Pre-Exposure Prophylaxis scale-up are necessary to generate demand and support for Pre-Exposure Prophylaxis uptake among Female sex workers.

Keywords: Pre-Exposure Prophylaxis, Medication uptake, Medication adherence, retention to care, female sex workers, Human Immuno-virus

1 INTRODUCTION

Female sex workers (FSWs) are estimated to be 30 times more likely to be living with Human Immuno-virus (HIV) than other women of reproductive age and face an increased burden of sexually transmitted infections. In 2019, the Joint United Nations Programme on HIV/AIDS estimated a mean HIV prevalence of 36% among sex workers. The World Health Organisation (WHO) estimated the risk of HIV infection among sex workers was 21 times higher than for adult women aged 15–49 years [1], and accounted for 6% of global HIV infections in 2018 [2]. Among females aged 15 years and above, FSWs contributed 18% of all HIV infections [3]. Many studies have reported that Oral pre-exposure prophylaxis (PrEP) with daily tenofovir disoproxil fumarate (TDF) and emtricitabine (FTC) is effective at reducing sexual HIV acquisition [4–6]. However, prevention effectiveness is reliant on daily adherence prior to and during periods of sexual activity [7,8]. Regardless of the global efforts to expand optimal access to HIV prevention, treatment and care, FSWs continue to experience a significant HIV burden [9].

In sub-Saharan Africa, HIV prevalence is 3–10 times higher among FSWs compared to the general population [10]. In Botswana, the second Behavioural and Biological Surveillance Survey estimated the HIV prevalence of 51.3% and incidence of 2.9% amongst FSWs [11]. Hence, the need for efforts to expand optimal access to HIV prevention.

The iPrEx study was the first to offer oral pre-exposure prophylaxis (PrEP) to 2,500 men who have sex with men at 11 sites in six countries Brazil, Ecuador, Peru, South Africa, Thailand and USA. The study reported that among HIV-negative gay men who were given PrEP the HIV infection declined by 44% compared with men taking a placebo; and the risk of infection among participants who took PrEP as prescribed declined by 99% [12]. Studies offering oral PrEP at six hospitals in France and Canada reported 86% reduction in the HIV infection rate compared to those taking a placebo [13]. Similarly, the Partners PrEP Trial among heterosexual couples in which one partner was living with

HIV across Kenya and Uganda reported 62% reduction of the risk of HIV infection among those who took oral tenofovir and 73% among those who received Truvada [14].

Studies have also examined whether people on PrEP are less likely to use a condom, which could lead to an increase in sexually transmitted infections (STIs) including HIV [15,16,17]. The PROUD Study in the United Kingdom reported no difference in condom usage or levels of STIs between people receiving PrEP and those who did not [15]. On the contrary, the evidence reviews which analysed twenty PrEP studies and trials among gay men and men who have sex with men reported high rates (33 – 100%) of STIs among people on PrEP [16,17]. It was concluded that, if people are engaging in high-risk sex that increases their likelihood of contracting an STI, they are also likely to be exposed to HIV and so would greatly benefit from PrEP, along with interventions designed to increase condom use [16,17].

Studies have recommended PrEP for all people at high-risk of HIV infection where oral PrEP tablet is taken once daily for HIV-negative people to block the acquisition of HIV [18,19]. In a study among men who have sex with men and transgender women in Brazil, several strategies to increase PrEP adherence, including SMS reminders and engagement through social media were used [20]. The study showed the uptake of oral PrEP increased over 50%, and notable increases in awareness of the service and knowledge of high-risk sexual behaviour among participants [21]. The uptake of oral PrEP has been most successful among couples and female sex workers in Kenya and similar successes have been reported in Zimbabwe and South Africa [22,23].

Many people who could benefit from PrEP however, are still unaware of its existence. In a study of awareness and acceptability of PrEP among men who have sex with men in United Kingdom, only 34.5% were aware of PrEP; but men who tested for HIV every six months were more likely to be aware of PrEP [24,25] Understanding the rates of adherence to PrEP and addressing the barriers preventing adherence are necessary to the long-term success of PrEP [26].

PrEP was integrated in the Botswana HIV and TB Treatment Guideline in 2016. A Technical Working Group (TWG) was established by the Ministry of Health and Wellness to conduct formative discussions with various high-risk populations in six selected districts including Gaborone, and other major towns in the country. The report of the TWG [27] indicated over 80% of FSWs who believed

they would adequately adhere to PrEP faced challenges including safety and efficacy of PrEP due to other on-going medical interventions and strict adherence. More than 50% anticipated challenges of uptake due to the need for quarterly HIV testing, and over 40% perceived challenges of uptake due to the need for monthly medication pick-ups and the possibility of developing side effects. Previous report in Botswana have indicated that 52% of FSWs perceived themselves to be at high risk of HIV infection; inconsistent use condoms (39.6%), having multiple partners (36.9%) and 6.6% had low knowledge of PrEP. After receiving more information about PrEP, 85% of FSW were willing to take PrEP [28]. The report reiterates that PrEP was introduced in Botswana as an addition to combination-prevention strategies for FSWs. Since then, no study was carried out to assess the efficiency of PrEP as an intervention in these target groups. This study aimed to assess the proportion of FSWs who were eligible and enrolled on PrEP; describe the characteristics of FSWs who enrolled, adhered, remained on PrEP six months and above and to assess the reasons for non-adherence and the association between PrEP adherence, retention and demographic characteristics.

2 METHODS

2.1 Study setting, design and population

Gaborone is the capital and largest city in Botswana. The population of Gaborone is approximately 232,000 with more than 10% of the population living in the capital [29]. It is cosmopolitan with its habitants engaged in small- and large-scale businesses, tourism, entrepreneurship, entertainment and other livelihood activities. The study site is located in Gaborone and was chosen because it is centrally placed for socio-economic opportunities and its surrounding areas are convenient for purposes of FSWs.

The study was a quantitative retrospective cross-sectional and purposive sampling technique was used to select study site whereas exhaustive sampling was used to select recorded data of female sex workers. Data was extracted from the records by the Principal Investigator. The target population were all FSWs who were screened for eligibility and enrolled for daily oral PrEP between August 2018 and March 2020. In this study, FSWs were defined any woman who is 18 years of age or

older who receives money or incentives in exchange for sex from time of inception of the transaction [30,31].

2.2 Ethical considerations

Ethical issues in this included access to client's sensitive information by the researcher. Therefore, confidentiality was assured by ensuring that client's information was anonymised by not including information that could be used to trace back to the client's identity; records were only available to the researcher and the name of the Service Provider where data was collected was kept confidential. Ethical clearance and permission to conduct the study were granted by the Ministry of Health and Wellness Ethics Review Board.

2.3 Data source and collection tool/Instrument

The data were secondary data collected was from records of FSWs stored at the service provider. The data collected from the records included demographic information, PrEP number or code, date when PrEP was started, date when PrEP was discontinued; nationality, relationship status, education background and records on screening for risk for HIV infection. From the records, the data used by the Center to screen FSWs for substantial risk for HIV infection (eligibility) included acute HIV status, creatinine clearance, Hepatitis B test, venereal disease research laboratory (VDRL) test results for Syphilis and presence of any STI type.

In this study, PrEP uptake is defined as the intake of a daily oral tablet of PrEP by FSWs who were screened for eligibility and got enrolled for PrEP [32]; adherence was defined as being able to take a daily oral tablet of PrEP for a particular risky period of HIV exposure without defaulting [33] and retention was defined as being able to stay on PrEP for at-least 6 months without defaulting [34], for as long as one is still at high risk of contracting HIV. In determining adherence for this study (secondary) data set, data from the records were collected on the number of visits and the duration a client received medication. The records have in addition a section which collected client's information on the reasons for stopping PrEP and the client's HIV status at the time of discontinuation of PrEP which are also vital sets for this secondary study.

2.4 Data Analysis

Only data of adult FSWs aged 18 years and above extracted from the records at the Centre were analysed. The independent variables included age, nationality, relationship status educational background, and employment status while the dependent variables/outcomes were uptake, adherence and retention to PrEP. Analysis was done on Statistical Package for the Social Sciences (SPSS)

version 26 using descriptive statistics such as proportions, tests of association and bivariate and multivariate analyses. Odds ratios were generated from multi-variable logistic regression analysis. Variables that were significantly associated with adherence and retention were identified by computing the 95% confidence intervals and P-value less than .05 were considered statistically significant.

3 RESULTS

3.1 Demographic characteristics

A total of 1,254 FSWs tested by the Service Provider were eligible for PrEP. However, only 207 (16.5%) were enrolled in PrEP. Majority (61.4%) were aged between 18 and 29 years, 79.2% had secondary school education, majority (92.3% and 66.7%) were unmarried and unemployed respectively. Divorcees accounted for 0.5% (Table 1).

Table 1: Demographic characteristics FSWs on PrEP in Greater Gaborone, Botswana

| Demographic characteristics | Number of respondents (n 207) | Proportion (%) |
|------------------------------------|--------------------------------------|-----------------------|
| Educational Background | | |
| None | 2 | 1 |
| Primary School | 3 | 1.4 |
| Secondary School | 164 | 79.2 |
| Tertiary School | 38 | 18.4 |
| Age | | |
| 18-29 | 127 | 61.4 |
| 30-41 | 64 | 30.9 |
| 42-53 | 16 | 7.7 |
| Relationship Status | | |
| Divorced | 1 | 0.5 |
| Married | 15 | 7.2 |
| Single | 191 | 92.3 |
| Employment Status | | |
| Employed | 69 | 33.3 |
| Unemployed | 138 | 66.7 |
| Nationality | | |
| Citizens | 183 | 88.4 |
| Foreigners | 24 | 11.6 |

3.2 Adherence, retention and sero-conversion status

The results of the status of adherence and retention to PrEP programme are shown in Table 2. Majority (93.7%) were young adults; 92.2% were single; 79.5% had secondary education and 66.7%

were unemployed. Adherence to the prophylaxis was high (72.9%) among secondary school leavers. Similarly, single FSWs, unemployed and citizens adhered more to the programme. On the average, retention into the programme was low (16.9%) and high non-retention rates of 89.6%, 83.8%, 83.5% and 84.1% were seen among 18 – 29-year age group, single, secondary school leavers and the unemployed respectively. Information on sero-status was missing for all categories.

Table 2: The pattern of adherence and retention in the PrEP programme among FSWs in Gaborone, Botswana

| Citizens | Adherence | | | | Retention | | | | Sero-status | |
|--------------------------|-----------|-----|------|----|-----------|-----|------|-----|-------------|------|
| | n | Yes | % | No | % | Yes | % | No | | % |
| Age | | | | | | | | | | |
| 18 - 29 | 135 | 85 | 63 | 50 | 37 | 14 | 10.4 | 121 | 89.6 | None |
| 30 - 41 | 59 | 54 | 91.5 | 5 | 8.5 | 15 | 25.4 | 44 | 74.6 | None |
| 42 - 53 | 13 | 12 | 92.3 | 1 | 7.7 | 6 | 46.2 | 7 | 53.8 | None |
| Marital status | | | | | | | | | | |
| Divorced | 1 | 1 | 100 | 0 | 0 | 1 | 100 | 0 | 0 | None |
| Married | 15 | 13 | 86.7 | 2 | 13.3 | 3 | 20 | 12 | 80 | None |
| Single | 191 | 137 | 71.7 | 54 | 28.3 | 31 | 16.2 | 160 | 83.8 | None |
| Education status | | | | | | | | | | |
| None | 2 | 2 | 100 | 0 | 0 | 1 | 50 | 1 | 50 | None |
| Primary | 3 | 3 | 100 | 0 | 0 | 2 | 66.7 | 1 | 33.3 | None |
| Secondary | 164 | 114 | 69.5 | 50 | 30.5 | 27 | 16.5 | 137 | 83.5 | None |
| Tertiary | 38 | 32 | 84.2 | 6 | 15.8 | 5 | 13.2 | 33 | 86.8 | None |
| Employment status | | | | | | | | | | |
| Employed | 69 | 60 | 87 | 9 | 13 | 13 | 18.8 | 56 | 81.2 | None |
| Unemployed | 138 | 91 | 65.9 | 47 | 34.1 | 22 | 15.9 | 116 | 84.1 | None |
| Nationality | | | | | | | | | | |
| Citizens | 183 | 129 | 70.5 | 54 | 29.5 | 32 | 17.5 | 151 | 82.5 | None |
| Foreigners | 24 | 22 | 91.7 | 2 | 8.3 | 3 | 12.5 | 21 | 87.5 | None |

3.3 Association of adherence and retention with demographic characteristics

The results of the association of the variables with adherence and retention are presented in Table 3. At 95% CI, employed FSWs were 2.4 likely to adhere to PrEP ($P < .049$) and the younger age group (18 - 29 years) significantly associated with retention ($P < .001$).

Table 3: The association of demographic variables with adherence and retention to PrEP programme among FSWs in Gaborone, Botswana.

| Demographic factors | n | Adherence | | | Retention | | |
|---------------------|-----|-----------|-------------|---------|-----------|-----------|---------|
| | | AOR | 95% CI | p-value | AOR | 95% CI | p-value |
| Age group | | | | | | | |
| 18-29 years | 135 | 0.21 | 0.03 - 1.76 | 0.149 | 0.12 | 0.03-0.41 | 0.001** |

| | | | | | | | |
|-------------------------------|-----|------|-------------|--------|------|------------|-------|
| 30-41 years | 59 | 0.95 | 0.09 - 9.37 | 0.962 | 0.4 | 0.11- 1.43 | |
| 42-53 years | 13 | 1 | | | 1 | | |
| Educational background | | | | | | | |
| Secondary | 169 | 0.44 | 0.16 – 1.19 | 0.104 | 1.47 | 0.50-4.32 | 0.48 |
| Tertiary | 38 | 1 | | | 1 | | |
| Marital status | | | | | | | |
| Single | 192 | 2.14 | 0.36 – 12.7 | 0.401 | 1.19 | 0.27-5.28 | 0.823 |
| Married | 15 | 1 | | | 1 | | |
| Employment status | | | | | | | |
| Employed | 69 | 2.36 | 1.04 – 5.57 | 0.049* | 0.94 | 0.41- 2.19 | 0.89 |
| Unemployed | 138 | 1 | | | 1 | | |
| Nationality | | | | | | | |
| Citizens | 183 | 0.49 | 0.10 – 2.40 | 0.486 | 2.57 | 0.66-10.08 | 0.176 |
| Foreigners | 24 | 1 | | | 1 | | |

OR = Odd ratio, CI = confidence interval, *P<.05, **P<.001, 1 = reference group

3.4 Reasons for discontinuation from PrEP programme

The reasons for discontinuation from the programme were not indicated in 50 (24.2%) of the client's records. However, 18.4%, 14.0% and 12.6% had perceived that they were no longer at substantial risk to HIV infection, side effects and no longer interested in the programme respectively. Lack of knowledge of PrEP accounted for 8.2% of the reasons for discontinuation from the programme (Table 4).

Table 4: Reasons for discontinuation from PrEP programme as given by FSWs in Gaborone, Botswana

| Reasons | Frequency | Percent |
|--|------------|--------------|
| Busy lifestyle | 24 | 11.6 |
| Fell pregnant | 1 | 0.5 |
| Felt lazy for refill | 1 | 0.5 |
| Forgot to take medication | 1 | 0.5 |
| Lack of funds to travel for medical checks | 3 | 1.4 |
| Lack of knowledge about PrEP | 17 | 8.2 |
| No longer at substantial risk | 38 | 18.4 |
| No longer interested | 26 | 12.6 |
| Relocation | 17 | 8.2 |
| Side effects | 29 | 14.0 |
| No answer | 50 | 24.2 |
| Total | 207 | 100.0 |

4. DISCUSSION

Global studies have reported barriers to adherence to PrEP including poor knowledge of PrEP, doubts about its effectiveness, fear of side effects, perception of low risk to HIV risk, and adherence to

multiple medications were reported as major barriers to PrEP uptake and adherence [35,36]. In this study, uptake of PrEP was low among the eligible FSWs enrolled to PrEP. This is a very insignificant proportion and is a major concern because the reasons for such low uptake are not very clear. Based on the results of this study, it can be argued that the low uptake of PrEP could have resulted from the perceptions of some FSWs being not at risk and low knowledge about the benefits of PrEP in this high risk to HIV infection population. The Treatment and Prevention for FSWs Demonstration Project (TAPS) in South Africa [36] has reported that PrEP uptake was more among younger FSWs, a finding supported by this study where the age group 18 – 29 enrolled more into PrEP compared to other age group categories. We attributed the relatively high PrEP uptake in this age category to the efforts the Government and other key stakeholders in the strategic campaigns on HIV infection prevention which have motivated the young age population to enrol into the programme.

The older clients enrolled less compared to the younger age groups. The finding of low uptake of PrEP among the older age group was not expected, however, we have attributed the finding to perceptions and attitudes of the older FSWs towards new medications, past experiences including stigma and false confidence on the knowledge of HIV infection which have also been observed in other studies in the region [37].

We found high adherence to PrEP among participants with secondary education. This finding is encouraging and could partly be explained by the role of education in empowering FSWs to access information on PrEP than those with primary education only and those who never went to school.

Similar finding was reported in a study on FSWs in Baltimore, South Africa where PrEP education was indicated as a potential strategy to increase adherence to PrEP [38]. Similarly, the study reported that some sex workers were willing to use PrEP if it had limited side effects and could be used intermittently. The report concluded that there is need for transparency to provide information on known and unknown PrEP side effects, guidance on intermittent use, and proper counselling on medication adherence and management for those initiating PrEP [38]. Previous studies have also shown that innovative educational training strategies resulted in better HIV risk assessment and can overcome many barriers to PrEP prescription [39,40]. Only a small proportion (14%) of the FSWs in this study have indicated lack of knowledge about PrEP as a reason for non-adherence and non-

retention. The finding suggests that FSWs are aware of PrEP as a potential preventive measure for HIV infection and the low adherence is likely to be due to other reasons not elicited in this study. Further studies are needed to explore other reasons for low retention among FSWs in the Greater Gaborone, Botswana.

Studies in the sub-Saharan Africa have shown that unemployment, extreme poverty and material insecurity are strong drivers of sex work and render HIV prevention and PrEP adherence a lower priority when compared with the demand for meeting basic needs for many women [41]. In this study, adherence to PrEP was 87% and 66% among employed and unemployed FSWs respectively. The high adherence rate among employed FSWs could be explained by level of education and socio-economic status which enables them to plan, afford transport fare and allocate some time to attend to their health. The low adherence among unemployed FSWs might be related to heavy domestic chores and the demand for daily basic needs to sustain livelihoods.

Successful PrEP intervention is dependent on adherence and remaining in PrEP care. Studies have reported successes of uptake and low retention rates among FSWs [42,43]. We recorded an overall 16.9% PrEP retention compared to 72.9% overall adherence. Our finding is similar to a study in Kenya which reported only 14.0% retention among FSWs [44]. Although secondary school leavers and employed FSWs have high adherence rates [44], both have very low retention to the PrEP programme. These findings suggest that education and employment status do not successfully influence adherence and retention in PrEP programme.

Studies have given reasons for lost to follow-up include mobility (moved out of the area and traveling) and pregnancy [45,46]. We found the reasons for not wanting to continue included pregnancy (0.5%) and relocation to other locations were stated by 8.2% of clients. Perception of no longer at risk of HIV infection and loss of interest were common however common reasons for loss to follow-up. Our findings support previous reports [36,47]. Since HIV is still present as indicated by high incidences especially among young people, the perception of no longer at risk to HIV infection suggests a breakdown in dissemination of correct information about HIV and its preventive measures. Loss of interest on the other hand suggests a decline in the motivation to continue in the programme

which could also explain the low enrolment rate of 16.5% of the eligible FSWs we found in this study.

5. CONCLUSION

In this study, PrEP uptake, adherence and retention were associated with individual demographic factors. Lack of motivation (not being interested to continue with PrEP, and busy lifestyle) and lack of knowledge on the benefits of adherence to PrEP should be mitigated to prevent further HIV transmissions. Daily oral PrEP is a promising approach and effective addition to combined HIV prevention which significantly reduces HIV risk. Therefore, effort be directed at providing communities with accurate and relevant information about PrEP in order to generate demand and support for PrEP use, especially for groups of people at high risk of HIV infection

REFERENCES

1. Case KK, Johnson LF, Mahy M, Marsh K, Supervie V, Eaton JW. Summarizing the results and methods of the 2019 Joint United Nations Programme on HIV/AIDS HIV estimates. *AIDS*. 2019; 33 Suppl 3(Suppl 3): S197-S201. [https://doi: 10.1097/QAD.0000000000002440](https://doi.org/10.1097/QAD.0000000000002440).
2. WHO Fact Sheet. Global HIV, Hepatitis and STIs Programmes; 2019. <https://www.who.int/teams/global-hiv-hepatitis-and-stis-programmes/populations/sex-workers>.
3. Tanser, F, de Oliveira, T, Maheu-Giroux, M, Bärnighausen, T. Concentrated HIV sub epidemics in generalized epidemic settings. *Current Opinion in HIV and AIDS*. 2014; 9(2): 115 - 125. [https://doi: 10.1097/COH.0000000000000034](https://doi.org/10.1097/COH.0000000000000034).
4. Powel VE, Gibas KM, Dubow J, Krakower DJ. Update on HIV pre-exposure prophylaxis: effectiveness, drug resistance, and risk compensation. *Curr Infect Dis Rep*. 2019; 21(8):28. [https://doi: 10.1007/s11908-019-0685-6](https://doi.org/10.1007/s11908-019-0685-6).
5. Krakower D, Maloney KM, Powell VE, Levine K, Grasso C, Melbourne K, et al. Patterns and clinical consequences of discontinuing HIV pre-exposure prophylaxis during primary care. *J Int AIDS Soc*. 2019; 22(2):e25250. [https://doi: 10.1002/jia2.25250](https://doi.org/10.1002/jia2.25250).

6. Celum CL, Delany-Moretlwe S, Baeten JM, vander Straten A, Hosek S, Bukusi EA, et al. HIV pre-exposure prophylaxis for adolescent girls and young women in Africa: from efficacy trials to delivery. *J Int AIDS Soc.* 2019; 22(Suppl4):e25298. <https://doi: 10.1002/jia2.25298>.
7. Corneli AL, Deese J, Wang M, Taylor D, Ahmed K, Agot K, et al. FEM-PrEP: Adherence patterns and factors associated with adherence to a daily oral study product for pre-exposure prophylaxis. *J Acquir Immune Defic Syndr.* 2014; 66(3):324–31.6. <https://doi: 10.1097/QAI.0000000000000158>.
8. Haberer JE, Baeten JM, Campbell J, Wangisi J, Katabira E, Ronald A, et al. Adherence to antiretroviral prophylaxis for HIV prevention: a sub-study cohort within a clinical trial of sero-discordant couples in East Africa. *PLoS Med.* 2013; 10(9):e1001511. <https://doi: 10.1371/journal.pmed.1001511>.
9. Shannon K, Strathdee SA, Goldenberg SM, Duff P, Mwangi P, Rusakova M, et al. Global epidemiology of HIV among female sex workers: influence of structural determinants. *The Lancet.* 2015; 385(9962): 55-71. [https://doi:10.1016/S0140-6736\(14\)60931-4](https://doi:10.1016/S0140-6736(14)60931-4).
10. World Health Organization. Preventing HIV in sex work settings in sub-Saharan Africa. Geneva, Switzerland: WHO, 2011. Available at: <https://www.afro.who.int/sites/default/files/2017-06/hiv-sw-africa-web.pdf>.
11. Ministry of Health and Wellness. Botswana Biological and Behavioural Surveillance Survey (BBSS) of HIV/STI among select Key Populations. 2017.
12. Anderson PL, Glidden DV, Liu A, Buchbinder S, Lama JR, Guanira JV, et al. Emtricitabine-tenofovir concentrations and pre-exposure prophylaxis efficacy in men who have sex with men. *Sci Transl Med.* 2012; 4(151):151ra125. <https://doi: 10.1126/scitranslmed.3004006>.
13. Molina JM, Capitant C, Spire B, Pialoux G, Cotte L, Charreau I, et al. On-Demand Preexposure Prophylaxis in Men at High Risk for HIV-1 Infection. *N Engl J Med.* 2015; 373(23):2237-46. <https://doi: 10.1056/NEJMoa1506273>.

14. Baeten, J, Donnell D, Ndase P, Mugo NR, Campbell JD, Wangisi J, Partners PrEP Study Team. Antiretroviral Prophylaxis for HIV Prevention among heterosexual men and women. *N Engl J Med.* 2012; 367(5):399-410. [https://doi: 10.1056/NEJMoa1108524](https://doi.org/10.1056/NEJMoa1108524).
15. McCormack S, Dunn DT, Desai M, Dolling D, Gafos M, Gilson R, et al. Pre-exposure prophylaxis to prevent the acquisition of HIV-1 infection (PROUD): effectiveness results from the pilot phase of a pragmatic open-label randomised trial. *Lancet* 2016; 387(10013):53-60. [https://doi: 10.1016/S0140-276736\(15\)00056-2](https://doi.org/10.1016/S0140-276736(15)00056-2).
16. Werner RN, Gaskins M, Nast A, Dressler C. Incidence of sexually transmitted infections in men who have sex with men and who are at substantial risk of HIV infection ; a meta-analysis of data from trials and observational studies of pre-exposure prophylaxis. *PLoS One.* 2019; 14(12):e0226209. [https://doi: 10.1371/journal.pone.0226209](https://doi.org/10.1371/journal.pone.0226209).
17. Cairns G. Meta-analysis finds high but variable STI rates in PrEP studies – is PrEP the cause or a potential solution? *Aidsmap*, 11 January 2019. <https://www.aidsmap.com/news/jan-2019/meta-analysis-finds-high-variable-sti-rates-prep-studies-prep-cause-or-potential>.
18. WHO. WHO Expands Recommendation on oral Pre-Exposure Prophylaxis (PrEP) of HIV Infection. (2015). Cited in August 2022. <https://www.who.int/hiv/pub/prep/policy-brief-prep>.
19. Ahmed N, Pike C, Bekker LG. Scaling-up pre-exposure prophylaxis in sub-Saharan Africa. *Current opinion in infectious diseases.* 2019; 32(1):24-30. [https://doi: 10.1097/QCO.0000000000000511](https://doi.org/10.1097/QCO.0000000000000511).
20. UNAIDS. On the Fast-Track to end AIDS by 2030: Focus on location and population'. 24 November 2015. Cited in September 2022. <https://www.unaids.org/en/resources/documents/2015/FocusLocationPopulation>.
21. Hoagland B, Veloso VG, De Boni RB, Madruga JV, Kallas EG, Fernandes NM, Moreira RI, Liu AY, Grinsztejn B. Pre-exposure prophylaxis (PrEP) uptake and associated factors among MSM and TGW in the PrEP Brasil demonstration project. Presented at: 8th IAS Conference on HIV Pathogenesis, Treatment and Prevention. 2015; Jul 18–22; Vancouver, Canada.
22. Busza J, Phillips AN, Mushati P, Chiyaka T, Magutshwa S, Musemburi S, et al. Understanding early uptake of PrEP by female sex workers in Zimbabwe. *AIDS Care.* 2021; 33(6):729–35.

<https://www.tandfonline.com/doi/full/10.1080/09540121.2020.1832192>. Mungo, NR. Taking the leap in PrEP scale-up: a good type of challenge. Presented at the 25th Conference on Retroviruses and Opportunistic Infections (CROI). 4 - 7 March 2018; Boston, Massachusetts, USA.

23. Frankis JS, Young I, Lorimer K, Davis M, Flowers P. Towards preparedness for PrEP: PrEP awareness and acceptability among MSM at high risk of HIV transmission who use sociosexual media in four Celtic nations: Scotland, Wales, Northern Ireland and the Republic of Ireland: an online survey. *Sexually Transmitted Infections*, 2016; 92(4), 279-285. <https://doi.org/10.1136/sextrans-2015-052101>.
24. Thoma BC, Huebner DM. Brief Report: HIV Pre-exposure Prophylaxis Engagement Among Adolescent Men Who Have Sex With Men The Role of Parent-Adolescent Communication About Sex. *J Acquir Immune Defic Syndr*. 2018; 79(4):453-457. <https://doi:10.1097/QAI.0000000000001837>.
25. UNAIDS (2016) 'Prevention Gap Report' [pdf]. Cited August 2022. Available at: [unaids.org/sites/default/files/media_asset/2016-prevention-gap-report_en.pdf](https://www.unaids.org/sites/default/files/media_asset/2016-prevention-gap-report_en.pdf).
26. Ministry of Health and Wellness. HIV Integrated Clinical Care Guidelines Handbook. 2016. https://aidsfree.usaid.gov/sites/default/files/botswana_art_2016.pdf
27. Ministry of Health and Wellness. Pre-Exposure Prophylaxis Feasibility & Implementation Technical Report October. 2017. https://www.avac.org/sites/default/files/u3/Botswana_Feasibility_Implementation.pdf.
28. Scorgie F, Chersich MF, Ntaganira I, Gerbase A, Lule F, Lo YR. Socio-demographic characteristics and behavioural risk factors of female sex workers in sub-Saharan Africa: a systematic review. *AIDS Behav*. 2012; 16(4):920-933. <https://doi: 10.1007/s10461-011-279985-z>.
29. Burton M. Statistician General, Government of Botswana. 2022 Population and housing census preliminary results. <http://www.statsbots.org.bw>.
30. Baral S, Beyrer C, Muessig K, Poteat T, Wirtz AL, Decker MR, et al. Burden of HIV among female sex workers in low-income and middle-income countries: a systematic review and meta-analysis. *Lancet Infect Dis*. 2012; 12(7):538-549. [https://doi: 10.1016/S1473-3099\(12\)70066-X](https://doi: 10.1016/S1473-3099(12)70066-X).

31. 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 Behav.* 2015; 19(5):794–801. [https://doi: 10.1007/s10461-014-0958-x](https://doi.org/10.1007/s10461-014-0958-x).
32. Kirby T, Thornber-Dunwell M. Uptake of PrEP for HIV slow among MSM. *Lancet.* 2014; 383(9915):399–400. [https://doi: 10.1016/s0140-6736\(14\)60137-9](https://doi.org/10.1016/s0140-6736(14)60137-9).
33. Farmer KC. Methods for measuring and monitoring medication regimen adherence in clinical trials and clinical practice. *Clin Therap.* 1999; 21:1074 – 1090. [https://doi: 10.1016/S0149-2918\(99\)80026-5](https://doi.org/10.1016/S0149-2918(99)80026-5).
34. Isabelle Y; Jennifer B; Susan D, Linda McCarty, Allison M. Representation in Clinical Trials: A Review on Reaching Underrepresented Populations in Research. *Clin Researcher.* 2020; 34(7).
35. Selinger C, Kirtane A, Abouzid O, Langer R, Traverso CG, Bershteyn A. Anticipated adherence, efficacy, and impact of weekly oral preexposure prophylaxis [Abstract 1035]; Conference on Retroviruses and Opportunistic Infections; February 13–16, 2017; p. 2017, Seattle, WA.
36. Eakle R, Bothma R, Bourne A, Gumede S, Motsosi K, Rees H. “I am still negative”: Female sex workers’ perspectives on uptake and use of daily pre-exposure prophylaxis for HIV prevention in South Africa. *PLoS One.* 2019;14(4):e0212271. [https://doi: 10.1371/journal.pone.0212271](https://doi.org/10.1371/journal.pone.0212271).
37. Chu M, Cotler K, Yingling C. Understanding patient motivations for HIV pre-exposure prophylaxis initiation and adherence. *J Am Assoc Nurse Pract.* 2020; 32(6):423–8. [https://journals.lww.com/ pmid:31453828](https://journals.lww.com/pmid:31453828).
38. Eakle R, Manthata G, Stadler J, Mbogua J, Sibanyoni M, Venter WDF, et al. Preparing for PrEP & immediate treatment: focus group discussions in advance of a demonstration project in South Africa. *AIDS Res Hum Retroviruses.* 2014; 30(S1): A269–A270. <https://doi.org/10.1089/aid.2014.5606.abstract>.
39. Krakower D, Mayer KH. Engaging healthcare providers to implement HIV pre-exposure prophylaxis. *Curr Opin HIV AIDS.* 2012; 7(6):593–599. [https://doi: 10.1097/COH.0b013e3283590446](https://doi.org/10.1097/COH.0b013e3283590446).

40. Silapaswan A, Krakower D, Mayer KH. Pre-exposure prophylaxis: a narrative review of provider behaviour and interventions to increase PrEP implementation in primary care. *J Gen Intern Med.* 2017; 32(2):192–198. [https://doi: 10.1007/s11606-016-3899-4](https://doi.org/10.1007/s11606-016-3899-4).
41. Syvertsen JL, Robertson Bazzi AM, Scheibe A, Adebajo S, Strathdee SA, Wechsberg WM. The promise and peril of pre-exposure prophylaxis (PrEP): using social science to inform prep interventions among female sex workers. *Afr J Reprod Health.* 2014;18(3):74–83.
42. Eakle R, Gomez GB, Naicker N, Bothma R, Mbogua J, Cabrera Escobar MA, et al. HIV pre-exposure prophylaxis and early antiretroviral treatment among female sex workers in South Africa: results from a prospective observational demonstration project. 2017. *Plos Medicine*; 10.1371/journal.pmed.1002444. <https://doi.org/10.1371/journal.pmed.1002444>.
43. Hughey A, Hetteema A, Oldenburg C, Kohler S, McMahon S, Lejeune C. Predictors of 1-month retention on PrEP for the general population in the public sector: a longitudinal study in routine care in Swaziland. In: Poster presented at the International AIDS Conference. Amsterdam. 2018.
44. Kyongo JK, Kiragu M, Karuga R, Ochieng C, Ngunjiri A, Wachihi C, et al. How long will they take it? Oral pre-exposure prophylaxis (PrEP) retention for female sex workers, men who have sex with men and young women in a demonstration project in Kenya. In: *Journal of the International AIDS Society.* 2018; 21:54-55.
45. McKinnon L, Izulla P, Nagelkerke N, Munyao J, Wanjiru T, Shaw SY, et al. Risk factors for HIV acquisition in a prospective Nairobi-based female sex worker cohort. *AIDS Behav.* 2015; 19(12):2204-2213. [https://doi: 10.1007/s10461-015-1118-7](https://doi.org/10.1007/s10461-015-1118-7).
46. Chabata ST, Hensen B, Chiyaka T, Mushati P, Mtetwa S, Hanisch D, et al. Changes over time in HIV prevalence and sexual behaviour among young female sex-workers in 14 sites in Zimbabwe, 2013–2016. *AIDS Behav.* 2019; 23(6):1494-1507. [https://doi: 10.1007/s10461-019-024101](https://doi.org/10.1007/s10461-019-024101).
47. Reza-Paul S, Lazarus L, Doshi M, Rahman SHU, Ramaiah M, Maiya R, et al. Prioritizing risk in preparation for a demonstration project: a mixed methods feasibility study of oral Pre-Exposure Prophylaxis (PrEP) among female sex workers in South India. *PLoS One.* 2016;11(11): e0166889. [https://doi: 10.1371/journal.pone.0166889](https://doi.org/10.1371/journal.pone.0166889).