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HIV risk and Pre-exposure Prophylaxis interest among female bar workers in Dar es Salaam: a cross-sectional survey

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Title: HIV risk and Pre-exposure Prophylaxis interest among female bar workers in Dar es Salaam: a cross-sectional survey

Running Head: HIV risk and PrEP interest in Dar es Salaam barmaids

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ABSTRACT

Objective: Female bar workers (FBW) in East Africa often conduct sex work to supplement their incomes, and may be vulnerable to HIV acquisition. Pre-exposure prophylaxis (PrEP) offers protection against HIV acquisition. However, there is little research on FBW's sexual health. Our objective was to determine HIV risk behaviors and interest in PrEP among FBW in the largest city in East Africa.

Design: Cross-sectional survey covering respondents' work and personal lives, including social and behavioral risk factors for HIV. Those who did not report being HIV-positive were asked about their knowledge of and interest in PrEP. All women were offered free on-site HIV testing and counselling (HTC).

Setting: Eight randomly selected workplaces, i.e. bars, in Kinondoni district, Dar es Salaam (DSM).

Participants: 66 FBW (≥18 years) selected at random from all women working in selected bars on the day of visit.

Results: Half of respondents reported having had sex for money: 20% with bar clients only, 15% with other men only and 15% with both. Almost all (98%) reported ≥1 non-commercial partners in the past 12 months; only 30% reported using condoms with these partners. 85% of respondents had ever been pregnant; 44% had had an unintended pregnancy. Only 5% of respondents had ever heard of PrEP. However, 54% were somewhat/very interested in daily-pill PrEP and 79% were somewhat/very interested in LAI PrEP. When asked to rank modalities, LAI PrEP was the most-preferred. Seven percent of the 56 respondents who completed HTC were HIV-positive.

Conclusions: FBW in DSM have elevated risk factors for HIV acquisition, and PrEP appears highly acceptable. Studies assessing PrEP initiation and adherence in FBW appear warranted.

Keywords: Female bar workers; Barmaids; Tanzania; Pre-exposure prophylaxis; HIV prevention

STRENGTHS AND LIMITATIONS OF THIS STUDY

- This study is the first to evaluate biological HIV status and interest in pre-exposure prophylaxis (PrEP) in bar workers in Dar es Salaam.
- The study population was selected at random from among all female bar workers in one of the three districts of the city.
- The sample is relatively small, potentially limiting power to see significant differences within subgroups.
- The sensitive nature of many of the HIV risk factors considered, and the self-report methods employed by the survey, may have led to underreporting of risk behaviours.
- It is unclear how far the findings of this work can be generalized geographically.

INTRODUCTION

Female sex workers (FSW), i.e. women who receive money or other goods in exchange for sexual services, are a key population for the HIV epidemic in sub-Saharan Africa (SSA). These women are at especially high risk of acquiring and transmitting HIV and other sexually transmitted infections (STI).[1] There is substantial research on how sex workers (SW) contribute to,[2] and are impacted by,[3] the HIV epidemic in SSA.

SW are sometimes divided into 'direct' SW for whom it is a primary profession, and 'indirect' SW, for whom it is a supplementary source of income.[4] Indirect SW may be particularly important for HIV epidemics if they do not self-identify as SW, and thus are not reached by or do not access HIV prevention services such as those targeting direct FSW. In East Africa, female bar workers (FBW), women who either sell or deliver drinks to customers in commercial establishments, often act as indirect FSW. FBW, or barmaids, often do not self-identify as FSW,[5 6] and, in contrast to bar-based direct FSW, are employed by bars to provide non-sexual services. However, past quantitative research has shown that a substantial minority of FBW (35-45%) have sex in return for money, often with bar clients.[7 8] FBW are often stigmatized and considered by others to be FSW.[9 10] Qualitative work suggests FBW have limited ability to protect themselves against STIs and other adverse consequences of sex work, notably when negotiating condom use.[11-13]

Pre-exposure prophylaxis (PrEP) is an important HIV prevention tool, proven to substantially prevent HIV acquisition when taken as prescribed.[14 15] There are several planned and ongoing PrEP demonstration projects in Africa.[16 17] However, previous PrEP studies have found variable adherence in both general [18] and FSW populations.[19 20] Most published PrEP studies have focused on daily pill-based PrEP, although one study showed effectiveness for on-demand pills among

men-who-have-sex-with-men (MSM).[21] However, other prevention modalities have been considered, including long-acting injectables,[22 23] vaginal gels [24] and vaginal rings.[25]

The World Health Organization recommends PrEP for populations with an annual risk of HIV acquisition greater than 3%,[26] and as such it is likely to be a key intervention for reducing HIV among FSW internationally.[27] Several countries in Africa with generalized epidemics have included FSW among the key populations eligible for PrEP, [28-30] but few if any had begun widespread implementation for FSW by mid-2017. Past research has shown high acceptability of daily-pill PrEP amongst FSW hypothetically in a range of settings,[31] and in practice in Kenya.[32]

Although many FBW also act as SW, there is limited evidence on how much risky sexual behaviour FBW engage in. To our knowledge, there is no research on the acceptability of PrEP amongst FBW. We therefore conducted a study to determine HIV prevalence, HIV-related risk factors, and initial interest in and acceptability of PrEP amongst FBW in Dar es Salaam municipality (DSM), Tanzania, the largest city in eastern Africa.

METHODS

We conducted a cross-sectional study using a two-stage sampling method in January 2017. We first randomly selected eight bars from a paper listing of all licensed premises in Kinondoni district, DSM (one of three in the municipality). We repeatedly sampled without replacement first a page number and then line number from the listing. The field team visited each bar at a time arranged by telephone with each bar's licensee. After explaining the study first to the bar manager and then to all FBW present, FBW were invited to participate in a computer-assisted personal

interview (CAPI), and then complete HIV testing and counselling (HTC). Study inclusion criteria were being 18 years or older and working as a FBW at the time of study visit. Between 6 and 12 FBW – depending on the length of each interview – were chosen at random within each bar based on a list drawn up by the bar manager at first bar entry. All interviews were conducted in a three-wheel taxi (*bajaji*) with closed sides parked close to the bar, to ensure privacy.

The CAPI covered several topics, including: women's socio-demographics; their work history; their sexual history, including past STI diagnoses and HIV testing; their knowledge of HIV prevention modalities; substance use; and psychological wellbeing (PHQ-9 depression scale, 4-item PTSD screen, generalized social support scale). Respondents were asked if they had ever heard of PrEP or a daily pill to prevent HIV infection. They were then asked how interested they were in taking PrEP as: (i) a daily pill; (ii) an injection every 3 months; (iii) a pericoital vaginal gel; (iv) a monthly vaginal ring. Finally, they were asked to rank the four modalities from most to least preferred. Questions about PrEP were not asked to those who self-reported having previously tested HIV-positive, and due to a coding error were not asked at the first bar visited. Anyone testing positive for HIV and not already linked to care was referred to their clinic of choice.

In this analysis, we provide descriptive statistics for various potential risk and protective factors for HIV acquisition. We then assess bivariate associations between these factors and interest in various modalities of PrEP, using χ^2 tests for binary variables and Kruskal-Wallis tests for continuous and ordinal variables. The study received ethical approval from Harvard T.H. Chan School of Public Health and the Tanzanian National Institute for Medical Research. Written informed consent was obtained from each participant.

Participant and Public Involvement

Neither patients nor public were directly involved in the development, design or recruitment of the study. HIV test results were provided to participants at point of testing; results will not otherwise be disseminated directly to study participants.

RESULTS

Participant characteristics

Sixty-six FBW were invited to participate in the study and all agreed (Table 1). Most of the women were in their twenties (median age 26, interquartile range [IQR]: 23-30). Almost all the women (91%) were born outside of DSM. FBW had been working as barmaids for a median of two years (IQR: 4 months to 4 years). Only 9% FBW planned to continue working as FBW, all but one of whom planned to stop within two years. FBW reported a median monthly income of $91 (IQR: $68-136). Most FBW (85%) had been pregnant in the past, 44% reported having had an unintended pregnancy and 39% a miscarriage or termination. 71% of FBW had a living child at the time of interview (median 1, IQR: 1-2). 96% of FBW had previously taken an HIV test (median 3 tests in lifetime, IQR: 2-5), with 53% having tested within the past six months and 78% within the past 12. Three women (5%) had previously tested positive for HIV. Fifty-six FBW (85%) consented to test for HIV and four of these (7%) tested positive; only one had not previously received a positive test result.

HIV acquisition risk factors

Exactly half of FBW reported ever having had sex with someone in return for money: 20% only with bar clients; 15% only with other men; and 15% with both. Of the 35% FBW reporting sex with bar clients, 74% reported asking clients to use condoms often or always. A majority (52%) reported that clients sometimes or often asked not to use condoms, but only 8% of FBW reported often or always agreeing not to use condoms in situations where they want to use a condom but their clients has asked not to. FBW also reported a median of two non-commercial partners in the past 12 months (IQR: 1-3, maximum 8). 68% of FBW reported having a primary partner, and only 18% of these women reported using a condom at last sex with this partner. Only 30% of FBW reported using male or female condoms as a family planning method, while another 24% reported using pills, injectables or implants.

PrEP interest

Questions about PrEP were asked to 56 women (3 had previously tested HIV positive, 7 were in the first bar visited). Only 5% of these FBW had ever heard of PrEP, however 54% were either somewhat or very interested in a daily pill that protected against HIV infection, and only 16% were uninterested (Figure 1A). When asked about other potential treatment modalities, 79% of FBW were interested in long-acting injectable PrEP, 38% in vaginal gel PrEP and only 11% in monthly vaginal ring PrEP. Only one women was somewhat or very uninterested in any type of PrEP. Level of interest in daily-pill PrEP was significantly correlated with interest in long-acting injectable PrEP ($\rho = 0.40$, p=0.003), but not with either vaginal modality. When asked to rank the four modalities, the most preferred method was long-acting injectable PrEP, although 82% of women ranked daily-pill PrEP as either their first or second preference (Figure 1B). Restricting

our sample to all respondents with at least 'neutral' (96%) or at least 'somewhat interested' (86%) responses for at least one PrEP modality did not change these patterns.

Predictors of PrEP interest

Associations between interest in each PrEP modality and the range of HIV risk factors are presented in Table 2. There was no significant difference in interest level (very/somewhat interested vs. neutral or somewhat/very uninterested) in daily-pill PrEP for those who did/did not report any sex for money (60% vs. 46%, p=0.30), or for those who did/did not report sex for money with bar clients (61% vs 49%, p=0.33). Interest in long-acting injectable PrEP was similarly unassociated with having had sex in return for money (any sex for money: 80% vs 77%, p=0.78; sex for money with bar clients: 86% vs. 74%, p=0.31). The only socio-demographic or behavioral factor associated with significantly higher interest in daily-pill PrEP was a history of miscarriage or termination (61% vs. 39%, p=0.04), and the only factor associated with significantly higher interest in long-acting injectable PrEP was number of non-client partners in the past 12 months (interest: median 2, IQR: 1-3; no interest: median 1, IQR: 1-1; p=0.03). Willingness to consent for an HIV test was not associated with interest in daily-pill PrEP (54% vs 50%, p=0.83).

DISCUSSION

In a random sample of 66 FBW from bars in DSM, HIV prevalence was low (similar to the 7% prevalence for 25-29 year old women nationally, and 8% for 15-49 year old women in DSM, in 2011-12, the most-recent nationally representative survey [33]). However risk factors for HIV

acquisition were substantial – including multiple partners, moderate to low condom use, and substantial levels of sex for money. The proportion of FBW reporting sex for money was similar to earlier quantitative studies.[7 8]

Awareness of PrEP for HIV prevention was very low but interest in PrEP, particularly for daily pills and long-acting injectables, was high. Both these modalities are likely to be recognizable to women in Tanzania since family planning options have similar modes of delivery, e.g. daily contraceptive pills, injectable Depo-Provera and implanted Nur-Isterate. Greater interest in long-acting injectables may also reflect the difficulties of taking daily pills for these working women, and of applying gels prior to sex when timing of sex acts is unpredictable and sometimes not chosen by them. While no PrEP is currently available to Tanzanian women, daily-pill PrEP demonstration trials will begin in key Tanzanian populations in 2018 and long-acting injectable PrEP has reached phase-III trials elsewhere through HPTN-084.[34]

Strengths and limitations

This study provides a first insight into the HIV serostatus and PrEP interest of FBW in DSM. While the sample in this study is small, it was a random sample drawn from a full enumeration of all licensed premises (n>2500) in Kinondoni district, an area with a population of over 1,750,000 inhabitants in 2012,[35] and then a full enumeration of all FBW working in each bar at the time of first visit. Nevertheless, it is possible that the sample of women drawn differs on some characteristics from other FBW in Kinondoni. Caution is needed in generalizing beyond Kinondoni to the rest of DSM, as well as to other areas of Tanzania and East Africa. However, even should the results only be applicable within Kinondoni or DSM, our results suggest that a very large number of FBWs in this region are at risk of HIV acquisition and local interventions may be warranted.

Additionally, since many of the questions asked were sensitive ones, and the responses self-reported through face-to-face interviews, FBW may have underreported some risk behaviours. The potential for social desirability bias to affect questions about PrEP was lessened by the very low baseline awareness of this HIV prevention option.

CONCLUSIONS

Based on these data, FBW appear to be a key population for HIV prevention efforts, both to protect themselves and their partners. PrEP seems acceptable to FBW in DSM, and this study also showed the feasibility of contacting FBW at their workplaces. Nevertheless, further information is needed on the feasibility of delivering PrEP and supporting HIV-related health services in this population. Studies assessing PrEP initiation and adherence among FBW appear warranted.

REFERENCES

1. 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):538-49.

2. Gouws E, Cuchi P. Focusing the HIV response through estimating the major modes of HIV transmission: a multi-country analysis. *Sex. Transm. Infect.* 2012;88(Suppl 2):i76-i85.

3. 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. *Lancet* 2015;385(9962):55-71.

4. Harcourt C, Donovan B. The many faces of sex work. *Sex. Transm. Infect.* 2005;81(3):201-06.

5. Sori AT. Poverty, sexual experience and HIV vulnerability risks: evidence from Addis Ababa, Ethiopia. *J. Biosoc. Sci.* 2012;44(6):677-701.

6. Rosenheck R, Ngilangwa D, Manongi R, Kapiga S. Treatment-seeking behavior for sexually transmitted infections in a high-risk population. *AIDS Care* 2010;22(11):1350-58.

7. Ao TT, Sam NE, Masenga EJ, Seage III GR, Kapiga SH. Human immunodeficiency virus type 1 among bar and hotel workers in northern Tanzania: the role of alcohol, sexual behavior, and herpes simplex virus type 2. *Sex. Transm. Dis.* 2006;33(3):163-69.

8. Riedner G, Rusizoka M, Hoffmann O, Nichombe F, Lyamuya E, Mmbando D, et al. Baseline survey of sexually transmitted infections in a cohort of female bar workers in Mbeya Region, Tanzania. *Sex. Transm. Infect.* 2003;79(5):382-87.

9. van Blerk L. Negotiating boundaries: the sex work identities of 'bar girls' in Nazareth, Ethiopia. *Gender, Place and Culture* 2011;18(02):217-33.

10. Kerrigan D, Mbwambo J, Likindikoki S, Beckham S, Mwampashi A, Shembilu C, et al. Project Shikamana: Baseline Findings From a Community Empowerment–Based Combination HIV

Prevention Trial Among Female Sex Workers in Iringa, Tanzania. *J. Acquir. Immune Defic. Syndr.* 2017;74(Suppl 1):S60.

11. Beckham S. " Like Any Other Woman"? Pregnancy, Motherhood, and HIV among Sex Workers in Southern Tanzania. Johns Hopkins University, 2013.

12. Talle A. Bar workers at the border. In: Klepp K-I, Biswalo PM, Talle A, editors. *Young people at risk: fighting AIDS in northern Tanzania*. Oslo, Norway: Scandinavian University Press, 1995:18-30.

13. Van Blerk L. Poverty, migration and sex work: youth transitions in Ethiopia. *Area* 2008;40(2):245-53.

14. Baeten JM, Donnell D, Ndase P, Mugo NR, Campbell JD, Wangisi J, et al. Antiretroviral prophylaxis for HIV prevention in heterosexual men and women. *N. Engl. J. Med.* 2012;367(5):399-410.

15. Thigpen MC, Kebaabetswe PM, Paxton LA, Smith DK, Rose CE, Segolodi TM, et al. Antiretroviral preexposure prophylaxis for heterosexual HIV transmission in Botswana. *N. Engl. J. Med.* 2012;367(5):423-34.

16. AVAC. *HIV Prevention Research & Development Database*.http://www.avac.org/pxrd. (accessed 22 August 2017).

17. Cowan F, Delany-Moretlwe S, Sanders EJ, Mugo NR, Guedou FA, Alary M, et al. PrEP implementation research in Africa: what is new? *J. Int. AIDS Soc.* 2016;19(Suppl 6):21101.

18. Van der Straten A, Van Damme L, Haberer JE, Bangsberg DR. Unraveling the divergent results of pre-exposure prophylaxis trials for HIV prevention. *AIDS* 2012;26(7):F13-F19.

19. Eakle R, Gomez GB, Mbogua J, Bothma R, Naicker N, Moorhouse M, et al. Treatment And Prevention for Female Sex Workers in South Africa: First-year Results for the TAPS Demonstration Project. *HIV Research for Prevention*. Chicago, IL, 2016.

20. Kyongo J, Kiragu M, Nduta S, Karuga R, Mulwa R, Mwimali P, et al. Oral PrEP for HIV Prevention: Early Lessons from a PrEP Demonstration Project in Kenya. *HIV Research for Prevention*. Chicago, IL, 2016.

21. Molina J-M, 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.

22. Landovitz RJ, Kofron R, McCauley M. The Promise and Pitfalls of Long Acting Injectable Agents for HIV Prevention. *Curr. Opin. HIV AIDS* 2016;11(1):122.

23. Margolis DA, Gonzalez-Garcia J, Stellbrink H-J, Eron JJ, Yazdanpanah Y, Podzamczer D, et al. Long-acting intramuscular cabotegravir and rilpivirine in adults with HIV-1 infection (LATTE-2): 96-week results of a randomised, open-label, phase 2b, non-inferiority trial. *Lancet* 2017.

24. Karim QA, Karim SSA, Frohlich JA, Grobler AC, Baxter C, Mansoor LE, et al. Effectiveness and safety of tenofovir gel, an antiretroviral microbicide, for the prevention of HIV infection in women. *Science* 2010;329(5996):1168-74.

25. Baeten JM, Palanee-Phillips T, Brown ER, Schwartz K, Soto-Torres LE, Govender V, et al. Use of a vaginal ring containing dapivirine for HIV-1 prevention in women. *N. Engl. J. Med.* 2016;375(22):2121-32.

26. World Health Organization. *Consolidated guidelines on the use of antiretroviral drugs for treating and preventing HIV infection: recommendations for a public health approach*. Geneva: World Health Organization, 2016.

27. Beyrer C, Crago A-L, Bekker L-G, Butler J, Shannon K, Kerrigan D, et al. An action agenda for HIV and sex workers. *Lancet* 2015;385(9964):287-301.

28. South African National AIDS Council (SANAC). The South African National Sex Worker HIV Plan 2016-2019. Pretoria, South Africa: SANAC, 2016.

29. National AIDS & STI Control Programme (NASCOP). Framework for the Implementation of Pre-exposure Prophylaxis of HIV in Kenya. Nairobi, Kenya: NASCOP, 2017.

30. Botswana Ministry of Health. Handbook of the Botswana 2016 integrated HIV clinical care guidelines. Gabarone, Bostwana: Botswana Ministry of Health, 2016.

31. Koechlin FM, Fonner VA, Dalglish SL, O'Reilly KR, Baggaley R, Grant RM, et al. Values and preferences on the use of oral pre-exposure prophylaxis (PrEP) for HIV prevention among multiple populations: a systematic review of the literature. *AIDS Behav.* 2017;21(5):1325-35.

32. Van der Elst EM, Mbogua J, Operario D, Mutua G, Kuo C, Mugo P, et al. High acceptability of HIV pre-exposure prophylaxis but challenges in adherence and use: qualitative insights from a phase I trial of intermittent and daily PrEP in at-risk populations in Kenya. *AIDS Behav.* 2013;17(6):2162-72.

33. Tanzania Commission for AIDS (TACAIDS), Zanzibar AIDS Commission (ZAC), National Bureau of Statistics (NBS), Office of the Chief Government Statistician (OCGS), ICF International. Tanzania HIV/AIDS and Malaria Indicator Survey 2011-12. Dar es Salaam, Tanzania: TACAIDS, ZAC, NBS, OCGS, and ICF International, 2013.

34. *NIH Launches First Large Trial of a Long-Acting Injectable Drug for HIV Prevention: Study to Test Efficacy, Safety of Injectable Cabotegravir Compared to Daily Oral PrEP*.https://www.niaid.nih.gov/news-events/nih-launches-first-large-trial-long-acting-injectable-drug-hiv-prevention. (accessed 4 September 2017).

35. National Bureau of Statistics, Office of Chief Government Statistician. 2012 Population and Housing Census: Population Distribution by Administrative Areas. Dar es Salaam: National Bureau of Statistics, 2013.

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Competing interests: None declared

Data sharing statement: All unpublished data related to this research project are available with the authors and can be requested by emailing to g.harling@ucl.ac.uk.

FIGURES AND TABLES

Table 1: Descriptive statistics for socio-demographic and behavioral risk factors for HIV

	All respondents		PrEP question respondents	
	N		N	
Age	66	26 [23 - 30]	56	25 [23-29]
Born in Dar es Salaam	65	9%	55	9%
Years working in bars	66	2 [0.4 - 4]	56	1.8 [0.4-3]
Plan to continue bar work	66	11%	56	9%
Monthly income (USD)	62	91 [68 - 136]	53	91 [68-136]
Ever been pregnant	66	85%	56	82%
Of whom, ever had undesired pregnancy	56	52%	46	54%
Of whom, ever had termination or miscarriage	56	46%	46	46%
Ever had sex with anyone for money	66	50%	56	54%
Ever had sex with patron for money	66	35%	56	38%
Of whom, ever had oral sex with patron	23	70%	21	30%
Of whom, Ever had vaginal sex with patron	23	48%	21	67%
Of whom, How often asks patron to use condom †	23	4 [3 - 4]	21	4 [4-4]
Of whom, How often patron asks not to use condom †	23	2 [1 - 3]	21	3 [2-3]
Ever had sex with others for money	66	30%	21	48%
Number of non-client partners in past 12m	56	2 [1 - 3]	47	1 [1-3]
Has a primary partner	66	68%	56	66%
Of whom, used condom at last sex with primary partner	44	18%	37	19%
Currently using male condoms for family planning	66	36%	56	38%
Ever taken an HIV test	66	97%	56	96%
Number of HIV tests ever taken	64	3 [2 - 5]	54	3 [2-5]
Months since last HIV test	64	6 [3.5 - 12]	54	6 [4-12]
Willing to complete HCT today	66	85%	56	86%

Values are counts (N), proportions or medians and interquartile ranges. USD: United States dollar; HCT: HIV counselling and testing. † 5-point scale; higher values indicate greater frequency.

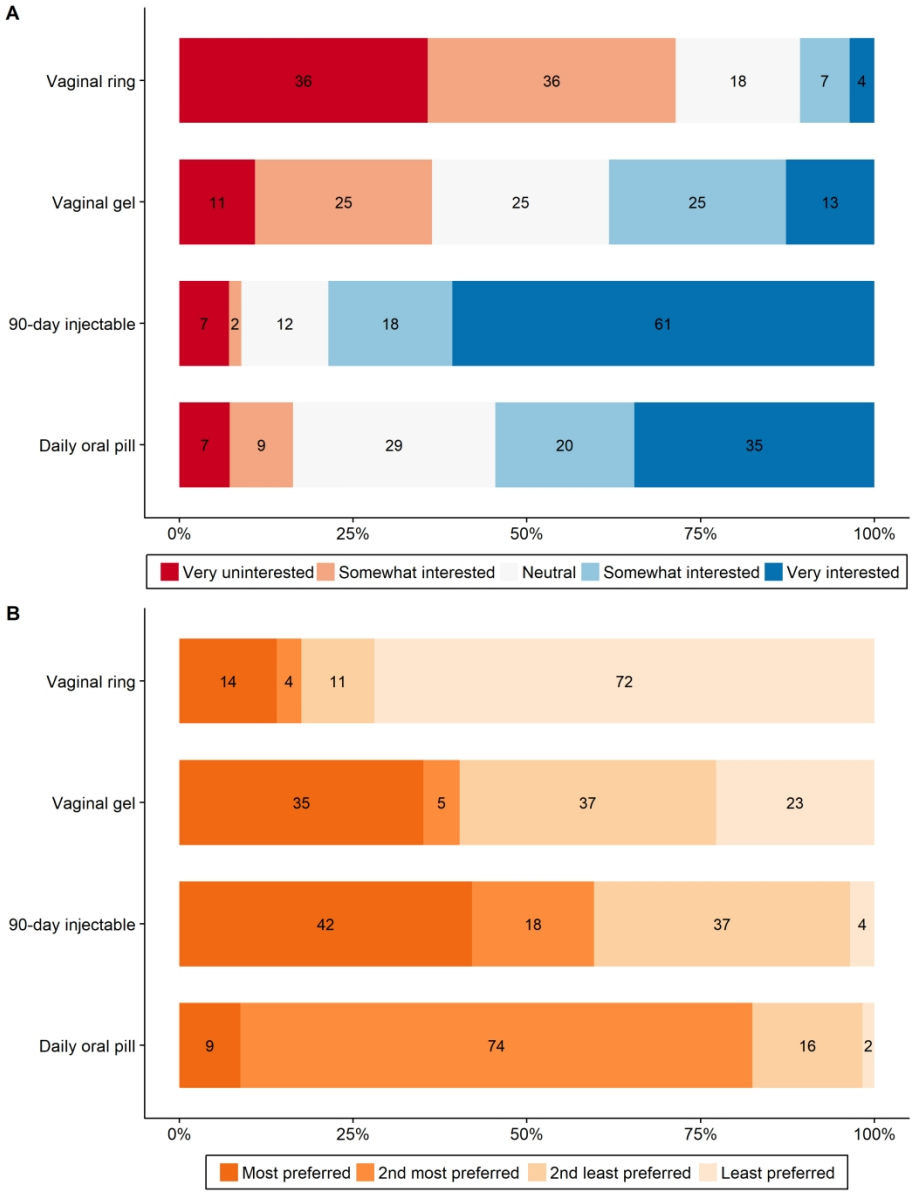
Table 2: Associations between socio-demographic and behavioral factors and interest in PrEP modalities

	Daily pill		90-day injectable		Vaginal gel		Vaginal ring	
	No	Yes	No	Yes	No	Yes	No	Yes
Very/somewhat interested in modality	30	26	12	44	35	21	50	6
Age	25 [23-30]	25 [23-28]	23 [22-28.5]	25 [23-29]	25 [22-28]	25 [23-30]	25 [22-29]	27 [24-27]
Born in Dar es Salaam	8%	10%	8%	9%	9%	10%	8%	17%
Years working in bars	1.8 [0.4-3]	1.8 [0.3-3]	1.5 [0.2-2.5]	1.8 [0.5-3]	1.5 [0.5-3]	2 [0.25-6]	1.5 [0.4-3]	2 [2-3]
Plan to continue bar work	8%	11%	8%	10%	9%	10%	11%	0%
Monthly income (USD)	91 [68-136]	91 [57-148]	91 [68-136]	91 [68-159]	102 [80-136]	91 [55-182]	91 [68-159]	91 [91-91]
Ever been pregnant	88%	77%	83%	82%	80%	86%	82%	83%
Of whom, ever had undesired pregnancy	48%	61%	50%	56%	64%	39%	56%	40%
Of whom, ever had termination or miscarriage	**30%**	**61%**	40%	47%	46%	44%	46%	40%
Ever had sex with anyone for money	46%	60%	50%	55%	54%	52%	56%	33%
Ever had sex with patron for money	31%	43%	25%	41%	40%	33%	38%	33%
Of whom, ever had oral sex with patron	27%	33%	33%	30%	31%	29%	34%	0%
Of whom, Ever had vaginal sex with patron	75%	62%	100%	61%	64%	71%	63%	100%
Of whom, How often asks patron to use condom †	4 [4-4]	4 [3-4]	4 [4-4]	4 [3-4]	4 [2-4]	4 [4-4]	4 [4-4]	3.5 [3-4]
Of whom, How often patron asks not to use condom †	1.5 [1-2.5]	2 [2-3]	2 [1-2]	2 [1-3]	2 [1-3]	2 [1-2]	2 [1-3]	2 [1-3]
Ever had sex with others for money	25%	62%	33%	50%	50%	43%	47%	50%
Number of non-client partners in past 12m	2 [1-3]	1 [1-3]	**1 [1-1]**	**2 [1-3]**	2 [1-3]	1 [1-3]	1 [1-3]	1.5 [1-3]
Has a primary partner	69%	63%	75%	64%	74%	52%	62%	100%
Of whom, used condom at last sex with primary partner	11%	26%	11%	21%	12%	36%	16%	33%
Currently using male condoms for FP	40%	53%	40%	48%	38%	60%	43%	75%
Ever taken an HIV test	100%	93%	100%	95%	97%	95%	96%	100%
Number of HIV tests ever taken	3 [2-5]	3 [2-5]	3 [1.5-5.5]	3 [2-5]	3 [2-5]	3 [2-4]	3 [2-5]	3.5 [1-5]
Months since last HIV test	5 [4-10]	7 [4-13.5]	5 [3.5-9]	7 [4-12]	6.5 [5-15]	5.5 [3.5-7]	6 [4-12]	8.5 [4-11]
Willing to complete HCT today	25 [23-30]	25 [23-28]	23 [22-28.5]	25 [23-29]	25 [22-28]	25 [23-30]	25 [22-29]	27 [24-27]

Values are counts (N column, interest in modality row), proportions or medians and interquartile ranges. USD: United States dollar; FP: Family planning; HCT: HIV counselling and testing. † 5-point scale; higher values indicate greater frequency. The two significant differences (at α=0.05) between variables based on a χ_1^2 test for binary factors and Kruskal-Wallis tests for continuous and ordinal factors are shown in bold.

Figure 1: Female bar worker interest in, and ordered preferences for, various PrEP modalities

A. Level of interest in each PrEP modality; B. Ordered preference for each PrEP modality. Numbers in figures are percentages of all respondents. PrEP: Pre-exposure prophylaxis.



Female bar worker interest in, and ordered preferences for, various PrEP modalities

A. Level of interest in each PrEP modality; B. Ordered preference for each PrEP modality. Numbers in figures are percentages of all respondents. PrEP: Pre-exposure prophylaxis.

STROBE 2007 (v4) Statement—Checklist of items that should be included in reports of *cross-sectional studies*

Section/Topic	Item #	Recommendation	Reported on page #
Title and abstract	1	(*a*) Indicate the study's design with a commonly used term in the title or the abstract	1
		(*b*) Provide in the abstract an informative and balanced summary of what was done and what was found	2
Introduction			
Background/rationale	2	Explain the scientific background and rationale for the investigation being reported	5-6
Objectives	3	State specific objectives, including any prespecified hypotheses	6
Methods			
Study design	4	Present key elements of study design early in the paper	6-7
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection	6-7
Participants	6	(*a*) Give the eligibility criteria, and the sources and methods of selection of participants	7
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable	7
Data sources/ measurement	8*	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group	7
Bias	9	Describe any efforts to address potential sources of bias	7
Study size	10	Explain how the study size was arrived at	7
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why	7
Statistical methods	12	(*a*) Describe all statistical methods, including those used to control for confounding	7
		(*b*) Describe any methods used to examine subgroups and interactions	7
		(*c*) Explain how missing data were addressed	n/a
		(*d*) If applicable, describe analytical methods taking account of sampling strategy	n/a
		(*e*) Describe any sensitivity analyses	n/a
Results			

Participants	13*	(a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed	8
		(b) Give reasons for non-participation at each stage	n/a
		(c) Consider use of a flow diagram	n/a
Descriptive data	14*	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders	8 & Table 1
		(b) Indicate number of participants with missing data for each variable of interest	Table 1
Outcome data	15*	Report numbers of outcome events or summary measures	8-9
Main results	16	(*a*) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included	9-10
		(*b*) Report category boundaries when continuous variables were categorized	n/a
		(*c*) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period	n/a
Other analyses	17	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses	n/a
Discussion			
Key results	18	Summarise key results with reference to study objectives	10-11
Limitations	19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias	11
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence	11
Generalisability	21	Discuss the generalisability (external validity) of the study results	11
Other information			
Funding	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based	16

*Give information separately for cases and controls in case-control studies and, if applicable, for exposed and unexposed groups in cohort and cross-sectional studies.

Note: An Explanation and Elaboration article discusses each checklist item and gives methodological background and published examples of transparent reporting. The STROBE checklist is best used in conjunction with this article (freely available on the Web sites of PLoS Medicine at http://www.plosmedicine.org/, Annals of Internal Medicine at http://www.annals.org/, and Epidemiology at http://www.epidem.com/). Information on the STROBE Initiative is available at www.strobe-statement.org.

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HIV risk and Pre-exposure Prophylaxis interest among female bar workers in Dar es Salaam: a cross-sectional survey

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Title: HIV risk and Pre-exposure Prophylaxis interest among female bar workers in Dar es Salaam: a cross-sectional survey

Running Head: HIV risk and PrEP interest in Dar es Salaam barmaids

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ABSTRACT

Objective: Female bar workers (FBW) in East Africa often conduct sex work to supplement their incomes, and may be vulnerable to HIV acquisition. Pre-exposure prophylaxis (PrEP) offers protection against HIV acquisition. However, there is little research on FBW's sexual health. Our objective was to determine HIV risk behaviors and interest in PrEP among FBW in the largest city in East Africa.

Design: Cross-sectional survey covering respondents' work and personal lives, including social and behavioral risk factors for HIV. Those who did not report being HIV-positive were asked about their knowledge of and interest in PrEP. All women were offered free on-site HIV testing and counselling (HTC).

Setting: Eight randomly selected workplaces, i.e. bars, in Kinondoni district, Dar es Salaam (DSM).

Participants: 66 FBW (≥18 years) selected at random from all women working in selected bars on the day of visit.

Results: Half of respondents reported having had sex for money: 20% with bar clients only, 15% with other men only and 15% with both. Almost all (98%) reported ≥1 non-commercial partners in the past 12 months; only 30% reported using condoms with these partners. 85% of respondents had ever been pregnant; 44% had had an unintended pregnancy. Only 5% of respondents had ever heard of PrEP. However, 54% were somewhat/very interested in daily-pill PrEP and 79% were somewhat/very interested in long-acting injectable PrEP. When asked to rank modalities, long-acting injectable PrEP was the most-preferred. Seven percent of the 56 respondents who completed HTC tested HIV-positive.

Conclusions: FBW in DSM have elevated risk factors for HIV acquisition, and PrEP appears highly acceptable. Studies assessing PrEP initiation and adherence in FBW appear warranted.

Keywords: Female bar workers; Barmaids; Tanzania; Pre-exposure prophylaxis; HIV prevention

STRENGTHS AND LIMITATIONS OF THIS STUDY

- The study population was selected at random from among all female bar workers in one of the three districts of the city of Dar es Salaam.
- HIV serostatus was evaluated using a rapid diagnostic test to avoid differential or non-differential misreporting.
- The sample is relatively small, potentially limiting power to see significant differences within subgroups.
- The sensitive nature of many of the HIV risk factors considered, and the self-report methods employed by the survey, may have led to underreporting of risk behaviours.
- It is unclear how far the findings of this work can be generalized geographically.

INTRODUCTION

Female sex workers (FSW), i.e. women who receive money or other goods in exchange for sexual services, are a key population for the HIV epidemic in sub-Saharan Africa (SSA). These women are at especially high risk of acquiring and transmitting HIV and other sexually transmitted infections (STI).[1] There is substantial research on how sex workers (SW) contribute to,[2] and are impacted by,[3] the HIV epidemic in SSA.

Sex workers are sometimes divided into 'direct' sex workers for whom it is a primary profession, and 'indirect' sex workers, for whom it is a supplementary source of income.[4] Indirect sex workers may be particularly important for HIV epidemics if they do not self-identify as sex workers, and thus are not reached by or do not access HIV prevention services such as those targeting direct FSW. In East Africa, female bar workers (FBW), women who either sell or deliver drinks to customers in commercial establishments, often act as indirect FSW.

FBW, or barmaids, often do not self-identify as FSW,[5 6] and, in contrast to bar-based direct FSW, are employed by bars to provide non-sexual services. However, past quantitative research has shown that a substantial minority of FBW (35-45%) have sex in return for money, often with bar clients.[7 8] FBW are often stigmatized and considered by others to be FSW.[9 10] Qualitative work suggests FBW have limited ability to protect themselves against STIs and other adverse consequences of sex work, notably when negotiating condom use.[11-13] While precise numbers are hard to obtain, FBWs likely comprise a large proportion of the 'accommodation and food service activities' employment category, which accounted for 6.5% of all employed Tanzanian women aged >15 in 2014,[14] and it has been claimed that FBWs are the largest single employment group in Tanzania.[15]

There is substantial evidence – both direct and indirect – for structural, behavioural and biomedical interventions that should be able to reduce HIV acquisition and transmission among FSW.[16] Structural approaches include community mobilization, advocacy and social and economic empowerment alongside anti-discrimination policies including legal protection. Behavioural approaches include peer and community-based behaviour change, condom provision. However, many of these interventions are highly context-specific and have proven difficult to implement consistently.[17] Biomedical interventions may be more easily implemented in a wide range of settings. Proven biomedical approaches for FSW include FSW-friendly provision of services such as voluntary testing, linkage to care and antiretroviral treatment – including prevention of mother-to-child transmission and post-exposure prophylaxis. There is no evidence at present as to how FSW-applicable interventions affect FBWs.

Pre-exposure prophylaxis (PrEP) is an important biomedical HIV prevention tool, proven to substantially prevent HIV acquisition when taken as prescribed.[18 19] There are several planned and ongoing PrEP demonstration projects in Africa.[20 21] However, previous PrEP studies have found variable adherence.[22] Few PrEP trials have explicitly included FSW in their inclusion criteria – although some included proportions of unmarried women with multiple partners who reported histories of transactional sex [16] – and to our knowledge none have targeted FBW. Evidence from FSW from South Africa,[23] Kenya [24] and Zimbabwe [25] points to variable levels of uptake but rapidly declining retention of FSW on daily pill-based PrEP. Most published PrEP studies have focused on daily pill-based PrEP, although one study showed effectiveness for on-demand pills among men-who-have-sex-with-men (MSM).[26] However, other prevention modalities have been considered, including long-acting injectables,[27 28] vaginal gels [29] and vaginal rings.[30]

The World Health Organization (WHO) recommends PrEP for populations with an annual risk of HIV acquisition greater than 3%,[31] and as such it is likely to be a key intervention for reducing HIV among FSW internationally.[32] Several countries in Africa with generalized epidemics have included FSW among the key populations eligible for PrEP,[33-35] but few if any had begun widespread implementation for FSW by mid-2017. Past research has shown high acceptability of daily-pill PrEP amongst FSW hypothetically in a range of settings,[36] and in practice in Kenya.[37] While FBW acquisition risk may be lower on average than direct sex workers, it may well be that they meet the WHO criterion for PrEP.

At the time of this study. PrEP was not available anywhere within Tanzania. Two assessments of interest and barriers to PrEP amongst adolescent girls and young women conducted in 2017 and found high interest but concerns around cost, side-effects and stigma.[38 39] As part of one of these studies, healthcare providers were largely supportive of PrEP provision, although they were concerned about behavioural disinhibition and work overload.[40] Evidence specifically on FSW is not currently available.

Although many FBW also act as FSW, there is limited evidence on how much risky sexual behaviour FBW engage in. To our knowledge, there is no research on the acceptability of PrEP amongst FBW. We therefore conducted a study to determine HIV prevalence, HIV-related risk factors, and initial interest in and acceptability of PrEP amongst FBW in Dar es Salaam municipality (DSM), Tanzania, the largest city in eastern Africa.

METHODS

We conducted a cross-sectional study using a two-stage sampling method in January 2017. We first randomly selected eight bars from a paper listing of all licensed premises in Kinondoni

district, DSM (one of three in the municipality). We repeatedly sampled without replacement first a page number and then line number from the listing. Our work was a feasibility study for a larger study, and thus no formal power calculation was used to establish sample size. However, our sample of 56 individuals with HIV tests gave us 66% power to provide 95% confidence intervals of +/- 10% around an expected HIV prevalence estimate of 20%.

The field team visited each bar at a time arranged by telephone with each bar's licensee. After explaining the study first to the bar manager and then to all FBW present, FBW were invited to participate in a computer-assisted personal interview (CAPI), and then complete HIV testing and counselling (HTC). Study inclusion criteria were being 18 years or older and working as a FBW at the time of study visit. Between 6 and 12 FBW – depending on the length of each interview – were chosen at random within each bar based on a list drawn up by the bar manager at first bar entry. All interviews were conducted in a three-wheel taxi (*bajaji*) with closed sides parked close to the bar, to ensure privacy.

The CAPI covered several topics, including: women's socio-demographics; their work history; their sexual history, including past STI diagnoses and HIV testing; their knowledge of HIV prevention modalities; substance use; and psychological wellbeing (depression, post-traumatic stress disorder (PTSD) and generalized social support). For depression we asked the PHQ-9 scale, which has previously been used with Tanzanian women living with HIV.[41] We assessed PTSD using the PTSD-IV screening tool. Generalized social support was measured using a 10-item version of the Duke-UNC Functional Social Support Questionnaire (FSSQ), adapted to include instrumental support and validated for Tanzanian women.[42] Potential responses to each FSSQ question were: "as much as I would like" (4); "less than I would like" (3); "much less than I would like" (2); and "never" (1). A mean score <3 is considered as 'low social support'.

Respondents were asked if they had ever heard of PrEP or a daily pill to prevent HIV infection. Then, following a brief description of each modality, they were asked how interested they were in taking PrEP as: (i) a daily pill; (ii) an injection every 3 months; (iii) a pericoital vaginal gel; (iv) a monthly vaginal ring. For each PrEP modality interest was gauged on a five-point scale: very interested; somewhat interested; neutral; somewhat uninterested; very uninterested. Finally, they were asked to rank the four modalities from most to least preferred. All PrEP questions are presented in Supplementary Material 1. Questions about PrEP were not asked to those who self-reported having previously tested HIV-positive, and due to a coding error were not asked at the first bar visited. Anyone testing positive for HIV and not already linked to care was referred to their clinic of choice.

In this analysis, we provide descriptive statistics for various potential risk and protective factors for HIV acquisition. We then assess bivariate associations between these factors and interest in various modalities of PrEP, using χ^2 tests for binary variables and Kruskal-Wallis tests for continuous and ordinal variables. We dichotomized PrEP interest as either positive (very interested or somewhat interested) or not (neutral, somewhat uninterested or very uninterested), in order to evaluate which factors were and were not associated with active interest in PrEP. HIV status was measured based on HIV test result.

The study received ethical approval from Harvard T.H. Chan School of Public Health and the Tanzanian National Institute for Medical Research. Written informed consent was obtained from each participant.

Participant and Public Involvement

Neither patients nor public were directly involved in the development, design or recruitment of the study. HIV test results were provided to participants at point of testing; results will not otherwise be disseminated directly to study participants.

RESULTS

Participant characteristics

Sixty-six FBW were invited to participate in the study and all agreed (Table 1). Most of the women were in their twenties (median age 26, interquartile range [IQR]: 23-30). Almost all the women (91%) were born outside of DSM. FBW had been working as barmaids for a median of two years (IQR: 4 months to 4 years). Only 9% FBW planned to continue working as FBW, all but one of whom planned to stop within two years. FBW reported a median monthly income of $91 (IQR: $68-136). Most FBW (85%) had been pregnant in the past, 44% reported having had an unintended pregnancy and 39% a miscarriage or termination. 71% of FBW had a living child at the time of interview (median 1, IQR: 1-2).

Psychometric properties for the wellbeing measures were acceptable: Cronbach's alpha was 0.71 for PHQ-9, 0.71 for the PTSD-IV and 0.85 for FSSQ. Based on standard score summation, 20% of respondents showed depressive symptoms, while 21% affirmed 3 or 4 PTSD-IV questions and thus screened positive for possible PTSD, and 58% had a mean FSSQ score <3 and thus had low social support.

Almost all (96%) of FBW had previously taken an HIV test (median 3 tests in lifetime, IQR: 2-5), with 53% having tested within the past six months and 78% within the past 12. Three women

(5%) had previously tested positive for HIV. Fifty-six FBW (85%) consented to test for HIV and four of these (7%) tested positive; only one had not previously received a positive test result.

HIV acquisition risk factors

Exactly half of FBW reported ever having had sex with someone in return for money: 20% only with bar clients; 15% only with other men; and 15% with both. Of the 35% FBW reporting sex with bar clients, 74% reported asking clients to use condoms often or always. A majority (52%) reported that clients sometimes or often asked not to use condoms, but only 8% of FBW reported often or always agreeing not to use condoms in situations where they want to use a condom but their clients has asked not to. FBW also reported a median of two non-commercial partners in the past 12 months (IQR: 1-3, maximum 8). 68% of FBW reported having a primary partner, and only 18% of these women reported using a condom at last sex with this partner. Only 30% of FBW reported using male or female condoms as a family planning method, while another 24% reported using pills, injectables or implants. Almost half (47%) of respondents believed they were either at great risk of, or certain to become infected with, HIV.

PrEP interest

Questions about PrEP were asked to 56 women (3 had previously tested HIV positive, 7 were in the first bar visited). Only 5% of these FBW had ever heard of PrEP, however 54% were either somewhat or very interested in a daily pill that protected against HIV infection, and only 16% were uninterested (Figure 1A). When asked about other potential treatment modalities, 79% of FBW were interested or very interested in long-acting injectable PrEP, 38% in vaginal gel PrEP and only 11% in monthly vaginal ring PrEP. Only one women was somewhat or very uninterested in any type of PrEP. Level of interest in daily-pill PrEP was statistically significantly correlated with interest in long-acting injectable PrEP ($\rho = 0.40$, p=0.003), but not

with either vaginal modality. When asked to rank the four modalities, the most preferred method was long-acting injectable PrEP, although 82% of women ranked daily-pill PrEP as either their first or second preference (Figure 1B). Restricting our sample to all respondents with at least 'neutral' (96%) or at least 'somewhat interested' (86%) responses for at least one PrEP modality did not change these patterns.

Correlates of PrEP interest

Associations between interest in each PrEP modality and the range of HIV risk factors are presented in Table 2. There was no significant difference in interest level (very/somewhat interested vs. neutral or somewhat/very uninterested) in daily-pill PrEP for those who did/did not report any sex for money (60% vs. 46%, p=0.30). This pattern was similar for those who did/did not report sex for money with bar clients (62% vs 49%, p=0.33) and those who did/did not report sex for money with others (59% vs 51%, p=0.60). Interest in long-acting injectable PrEP was similarly not significantly associated with having had sex in return for money (any sex for money: 80% vs 77%, p=0.78; sex for money with bar clients: 86% vs. 74%, p=0.31; sex for money with non-bar clients: 76% vs 79%, p=0.80). The only socio-demographic or behavioral factor associated with significantly higher interest in daily-pill PrEP was a history of miscarriage or termination (61% vs. 39%, p=0.04). The only factor associated with significantly higher interest in long-acting injectable PrEP was number of non-client partners in the past 12 months (interest: median 2, IQR: 1-3; no interest: median 1, IQR: 1-1; p=0.03). Willingness to consent for an HIV test was not significantly associated with interest in daily-pill PrEP (54% vs 50%, p=0.83).

DISCUSSION

In a random sample of 66 FBW from bars in DSM, HIV prevalence was low (similar to the 7% prevalence for 25-29 year old women nationally, and 8% for 15-49 year old women in DSM, in 2011-12, the most-recent nationally representative survey [43]). However risk factors for HIV acquisition were substantial – including multiple partners, moderate to low condom use, and substantial levels of sex for money. The proportion of FBW reporting sex for money was similar to earlier quantitative studies.[7 8]

Awareness of PrEP for HIV prevention was very low but interest in PrEP, particularly for daily pills and long-acting injectables, was high. Both these modalities are likely to be recognizable to women in Tanzania since family planning options have similar modes of delivery, e.g. daily contraceptive pills, injectable Depo-Provera and implanted Nur-Isterate. Greater interest in long-acting injectables may also reflect the difficulties of taking daily pills for these working women, and of applying gels prior to sex when timing of sex acts is unpredictable and sometimes not chosen by them. These findings thus resonate with those of earlier work in other sub-Saharan African settings with FSW, which found limited retention on daily pill-based PrEP.[23-25]

While many of differences in PrEP interest were not significant in this small sample (and none remain significant if we adjust for multiple testing using the Holm-Bonferroni or any other method), respondents who reported having sex for money (either with bar clients or others), those who had had a miscarriage or abortion and those with more non-client partners all reported greater interest in PrEP. This pattern of findings, if reproduced in other data, would suggest that those FBW with a higher risk profile for sexually transmitted diseases have a rationally greater interest in PrEP. It was also notable that PrEP interest was similar for those

having sex either with bar clients or with others; if efforts are made to determine which FBWs are having sex for money, inquiries should not be limited to bar patrons.

This study highlights that FBW in Dar are at substantial risk for HIV acquisition, that many are aware that they are at substantial risk and following discussion many are interested PrEP. However, this is only the first stage of the PrEP care continuum,[44] FBW will additionally need assistance in accessing PrEP and remaining in care. Both of these stages are likely to be hampered by the stigma and fluidity of life situation that working as an FBW can bring.

While no PrEP is currently available to Tanzanian women, daily-pill PrEP demonstration trials will begin in key Tanzanian populations in 2018 and long-acting injectable PrEP has reached phase-III trials elsewhere through HPTN-084.[45] Successful PrEP strategies for FBW will require tailored PrEP programming for such women, mostly likely including clinical care provided outside standard clinics. One important option here might be workplace-based service provision – since the bar location forms a multi-year basis for work for the majority of respondents.

Strengths and limitations

This study provides a first insight into the HIV serostatus and PrEP interest of FBW in DSM. While the sample in this study is small, it was a random sample drawn from a full enumeration of all licensed premises (n>2500) in Kinondoni district, an area with a population of over 1,750,000 inhabitants in 2012,[46] and then a full enumeration of all FBW working in each bar at the time of first visit. Nevertheless, it is possible that the sample of women drawn differs on some characteristics from other FBW in Kinondoni. Furthermore, our small sample size means that we cannot rule out some substantial but not significant associations in fact reflecting true associations that this study lacks the power to confirm. Further analysis with additional FBWs

would allow the separation of truly null associations from underpowered analyses. Similarly, we are not able to conduct multivariable analysis in this dataset, something that would be important in follow-up work.

Caution is needed in generalizing beyond Kinondoni to the rest of DSM, as well as to other areas of Tanzania and East Africa. However, even should the results only be applicable within Kinondoni or DSM, our results suggest that a very large number of FBWs in this region are at risk of HIV acquisition and local interventions may be warranted. Additionally, since many of the questions asked were sensitive ones, and the responses self-reported through face-to-face interviews, FBW may have underreported some risk behaviours. The potential for social desirability bias to affect questions about PrEP was lessened by the very low baseline awareness of this HIV prevention option.

CONCLUSIONS

Based on these data, FBW appear to be a key population for HIV prevention efforts, both to protect themselves and their partners. PrEP seems acceptable to FBW in DSM, and this study also showed the feasibility of contacting FBW at their workplaces. Nevertheless, further information is needed on the feasibility of delivering PrEP and supporting HIV-related health services in this population. Studies assessing PrEP initiation and adherence among FBW appear warranted.

REFERENCES

1. Baral S, Beyrer C, Muessig K, 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):538-49.

2. Gouws E, Cuchi P. Focusing the HIV response through estimating the major modes of HIV transmission: a multi-country analysis. *Sex Transm Infect* 2012;88(Suppl 2):i76-i85.

3. Shannon K, Strathdee SA, Goldenberg SM, et al. Global epidemiology of HIV among female sex workers: influence of structural determinants. *Lancet* 2015;385(9962):55-71.

4. Harcourt C, Donovan B. The many faces of sex work. *Sex Transm Infect* 2005;81(3):201-06.

5. Sori AT. Poverty, sexual experience and HIV vulnerability risks: evidence from Addis Ababa, Ethiopia. *J Biosoc Sci* 2012;44(6):677-701.

6. Rosenheck R, Ngilangwa D, Manongi R, Kapiga S. Treatment-seeking behavior for sexually transmitted infections in a high-risk population. *AIDS Care* 2010;22(11):1350-58.

7. Ao TT, Sam NE, Masenga EJ, Seage III GR, Kapiga SH. Human immunodeficiency virus type 1 among bar and hotel workers in northern Tanzania: the role of alcohol, sexual behavior, and herpes simplex virus type 2. *Sex Transm Dis* 2006;33(3):163-69.

8. Riedner G, Rusizoka M, Hoffmann O, et al. Baseline survey of sexually transmitted infections in a cohort of female bar workers in Mbeya Region, Tanzania. *Sex Transm Infect* 2003;79(5):382-87.

9. van Blerk L. Negotiating boundaries: the sex work identities of 'bar girls' in Nazareth, Ethiopia. *Gender, Place and Culture* 2011;18(02):217-33.

10. Kerrigan D, Mbwambo J, Likindikoki S, et al. Project Shikamana: Baseline Findings From a Community Empowerment–Based Combination HIV Prevention Trial Among Female Sex Workers in Iringa, Tanzania. *J Acquir Immune Defic Syndr* 2017;74(Suppl 1):S60.

11. Beckham S. " Like Any Other Woman"? Pregnancy, Motherhood, and HIV among Sex Workers in Southern Tanzania. Johns Hopkins University, 2013.

12. Talle A. Bar workers at the border. In: Klepp K-I, Biswalo PM, Talle A, eds. Young people at risk: fighting AIDS in northern Tanzania. Oslo, Norway: Scandinavian University Press, 1995:18-30.

13. Van Blerk L. Poverty, migration and sex work: youth transitions in Ethiopia. *Area* 2008;40(2):245-53.

14. National Bureau of Statistics (NBS) [Tanzania]. Tanzania Integrated Labour Force Survey 2014. Dar es Salaam: NBS,, 2014.

15. Akarro RR. Some factors associated with condom use among bar maids in Tanzania. *J Biosoc Sci* 2009;41(01):125-37.

16. Bekker L-G, Johnson L, Cowan F, et al. Combination HIV prevention for female sex workers: what is the evidence? *Lancet* 2015;385(9962):72-87.

17. Iskarpatyoti BS, Lebov J, Hart L, Thomas J, Mandal M. Evaluations of Structural Interventions for HIV Prevention: A Review of Approaches and Methods. *AIDS Behav* 2018;22(4):1253-64.

18. Baeten JM, Donnell D, Ndase P, et al. Antiretroviral prophylaxis for HIV prevention in heterosexual men and women. *N Engl J Med* 2012;367(5):399-410.

19. Thigpen MC, Kebaabetswe PM, Paxton LA, et al. Antiretroviral preexposure prophylaxis for heterosexual HIV transmission in Botswana. *N Engl J Med* 2012;367(5):423-34.

20. AVAC. HIV Prevention Research & Development Database. 10 April 2017 2016. http://www.avac.org/pxrd. (accessed 22 August 2017.

21. Cowan F, Delany-Moretlwe S, Sanders EJ, et al. PrEP implementation research in Africa: what is new? *J Int AIDS Soc* 2016;19(Suppl 6):21101.

22. Van der Straten A, Van Damme L, Haberer JE, Bangsberg DR. Unraveling the divergent results of pre-exposure prophylaxis trials for HIV prevention. *AIDS* 2012;26(7):F13-F19.

23. Eakle R, Gomez GB, Mbogua J, et al. Treatment And Prevention for Female Sex Workers in South Africa: First-year Results for the TAPS Demonstration Project. HIV Research for Prevention. Chicago, IL, 2016.

24. Kyongo J, Kiragu M, Nduta S, et al. Oral PrEP for HIV Prevention: Early Lessons from a PrEP Demonstration Project in Kenya. HIV Research for Prevention. Chicago, IL, 2016.

25. Cowan FM, Davey C, Fearon E, et al. Targeted combination prevention to support female sex workers in Zimbabwe accessing and adhering to antiretrovirals for treatment and prevention of HIV (SAPPH-IRe): a cluster-randomised trial. *The lancet HIV* 2018;5(8):e417-e26.

26. Molina J-M, Capitant C, Spire B, et al. On-demand preexposure prophylaxis in men at high risk for HIV-1 infection. *N Engl J Med* 2015;373(23):2237-46.

27. Landovitz RJ, Kofron R, McCauley M. The Promise and Pitfalls of Long Acting Injectable Agents for HIV Prevention. *Curr Opin HIV AIDS* 2016;11(1):122.

28. Margolis DA, Gonzalez-Garcia J, Stellbrink H-J, et al. Long-acting intramuscular cabotegravir and rilpivirine in adults with HIV-1 infection (LATTE-2): 96-week results of a randomised, open-label, phase 2b, non-inferiority trial. *Lancet* 2017.

29. Karim QA, Karim SSA, Frohlich JA, et al. Effectiveness and safety of tenofovir gel, an antiretroviral microbicide, for the prevention of HIV infection in women. *Science* 2010;329(5996):1168-74.

30. Baeten JM, Palanee-Phillips T, Brown ER, et al. Use of a vaginal ring containing dapivirine for HIV-1 prevention in women. *N Engl J Med* 2016;375(22):2121-32.

31. World Health Organization. *Consolidated guidelines on the use of antiretroviral drugs for treating and preventing HIV infection: recommendations for a public health approach*. Geneva: World Health Organization, 2016.

32. Beyrer C, Crago A-L, Bekker L-G, et al. An action agenda for HIV and sex workers. *Lancet* 2015;385(9964):287-301.

33. South African National AIDS Council (SANAC). The South African National Sex Worker HIV Plan 2016-2019. Pretoria, South Africa: SANAC, 2016.

34. National AIDS & STI Control Programme (NASCOP). Framework for the Implementation of Pre-exposure Prophylaxis of HIV in Kenya. Nairobi, Kenya: NASCOP, 2017.

35. Botswana Ministry of Health. Handbook of the Botswana 2016 integrated HIV clinical care guidelines. Gabarone, Bostwana: Botswana Ministry of Health, 2016.

36. Koechlin FM, Fonner VA, Dalglish SL, et al. Values and preferences on the use of oral pre-exposure prophylaxis (PrEP) for HIV prevention among multiple populations: a systematic review of the literature. *AIDS Behav* 2017;21(5):1325-35.

37. Van der Elst EM, Mbogua J, Operario D, et al. High acceptability of HIV pre-exposure prophylaxis but challenges in adherence and use: qualitative insights from a phase I trial of intermittent and daily PrEP in at-risk populations in Kenya. *AIDS Behav* 2013;17(6):2162-72.

38. Population Council. Adolescent girls and young women's perceptions of oral pre-exposure prophylaxis introduction in Tanzania: findings from implementation science research". DREAMS Tanzania Results Brief 3. Washington, DC: Population Council, 2017.

39. Lees S, Scorgie F, Khoza N, et al. Understanding motives for initiating PrEP amongst adolescent girls and young women (AGYW) in South Africa and Tanzania. AIDS 2018. Amsterdam, the Netherlands, 2018.

40. Pilgrim N, Jani N, Mathur S, et al. Provider perspectives on PrEP for adolescent girls and young women in Tanzania: The role of provider biases and quality of care. *PLoS ONE* 2018;13(4):e0196280.

41. Belenky NM, Cole SR, Pence BW, Itemba D, Maro V, Whetten K. Depressive symptoms, HIV medication adherence, and HIV clinical outcomes in Tanzania: a prospective, observational study. *PLoS ONE* 2014;9(5):e95469.

42. Antelman G, Fawzi MCS, Kaaya S, et al. Predictors of HIV-1 serostatus disclosure: a prospective study among HIV-infected pregnant women in Dar es Salaam, Tanzania. *AIDS* 2001;15(14):1865-74.

43. Tanzania Commission for AIDS (TACAIDS), Zanzibar AIDS Commission (ZAC), National Bureau of Statistics (NBS), Office of the Chief Government Statistician (OCGS), ICF International. Tanzania HIV/AIDS and Malaria Indicator Survey 2011-12. Dar es Salaam, Tanzania: TACAIDS, ZAC, NBS, OCGS, and ICF International, 2013.

44. Nunn AS, Brinkley-Rubinstein L, Oldenburg CE, et al. Defining the HIV pre-exposure prophylaxis care continuum. *AIDS (London, England)* 2017;31(5):731.

45. NIH Launches First Large Trial of a Long-Acting Injectable Drug for HIV Prevention: Study to Test Efficacy, Safety of Injectable Cabotegravir Compared to Daily Oral PrEP. 20 Dec 2016 2016. https://www.niaid.nih.gov/news-events/nih-launches-first-large-trial-long-acting-injectable-drug-hiv-prevention. (accessed 4 September 2017.

46. National Bureau of Statistics, Office of Chief Government Statistician. 2012 Population and Housing Census: Population Distribution by Administrative Areas. Dar es Salaam: National Bureau of Statistics, 2013.

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FIGURES AND TABLES

Table 1: Descriptive statistics for socio-demographic and behavioral risk factors for HIV

	All respondents		PrEP question respondents	
	N		N	
Age	66	26 [23 - 30]	56	25 [23-29]
Born in Dar es Salaam	65	9%	55	9%
Years working in bars	66	2 [0.4 - 4]	56	1.8 [0.4-3]
Plan to continue bar work	66	11%	56	9%
Monthly income (USD)	62	91 [68 - 136]	53	91 [68-136]
Ever been pregnant	66	85%	56	82%
Of whom, ever had undesired pregnancy	56	52%	46	54%
Of whom, ever had termination or miscarriage	56	46%	46	46%
Ever had sex with anyone for money	66	50%	56	54%
Ever had sex with patron for money	66	35%	56	38%
Of whom, ever had oral sex with patron	23	70%	21	30%
Of whom, Ever had vaginal sex with patron	23	48%	21	67%
Of whom, How often asks patron to use condom †	23	4 [3 - 4]	21	4 [4-4]
Of whom, How often patron asks not to use condom †	23	2 [1 - 3]	21	3 [2-3]
Ever had sex with others for money	66	30%	21	48%
Number of non-client partners in past 12 months	56	2 [1 - 3]	47	1 [1-3]
Has a primary partner	66	68%	56	66%
Of whom, used condom at last sex with primary partner	44	18%	37	19%
Currently using male condoms for family planning	66	36%	56	38%
PHQ-9 major depressive symptoms	66	20%	56	16%
PTSD-IV screen positive	66	21%	56	23%
Low social support	66	58%	56	55%
Ever taken an HIV test	66	97%	56	96%
Number of HIV tests ever taken	64	3 [2 - 5]	54	3 [2-5]
Months since last HIV test	64	6 [3.5 - 12]	54	6 [4-12]
Willing to complete HCT today	66	85%	56	86%

Values are counts (N), proportions or medians and interquartile ranges. USD: United States dollar; PHQ: Patient Health Questionnaire; PTSD: Post-traumatic stress disorder; HCT: HIV counselling and testing. † 5-point scale; higher values indicate greater frequency.

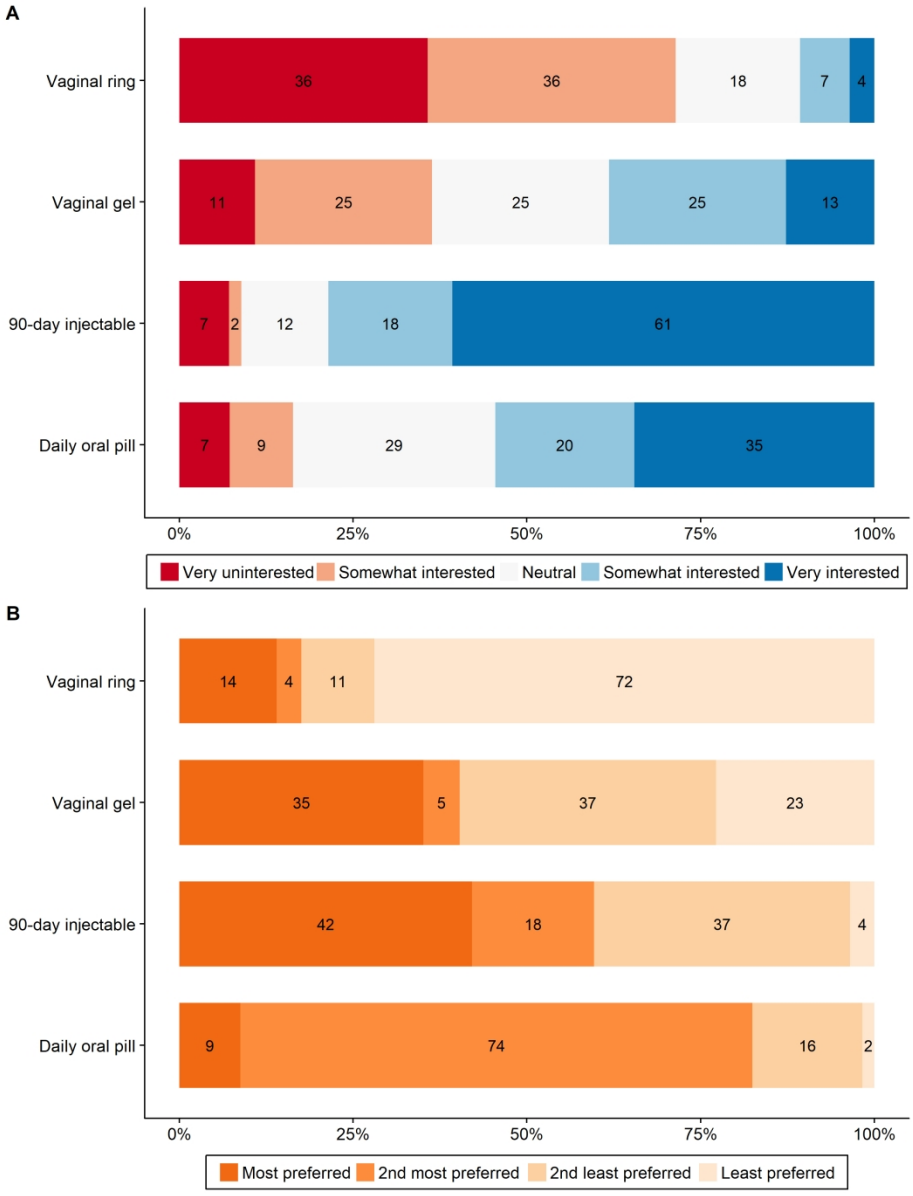
Table 2: Associations between socio-demographic and behavioral factors and interest in PrEP modalities

	Daily pill		90-day injectable		Vaginal gel		Vaginal ring	
	No	Yes	No	Yes	No	Yes	No	Yes
Very/somewhat interested in modality	30	26	12	44	35	21	50	6
Age	25 [23-30]	25 [23-28]	23 [22-28.5]	25 [23-29]	25 [22-28]	25 [23-30]	25 [22-29]	27 [24-27]
Born in Dar es Salaam	8%	10%	8%	9%	9%	10%	8%	17%
Years working in bars	1.8 [0.4-3]	1.8 [0.3-3]	1.5 [0.2-2.5]	1.8 [0.5-3]	1.5 [0.5-3]	2 [0.25-6]	1.5 [0.4-3]	2 [2-3]
Plan to continue bar work	8%	11%	8%	10%	9%	10%	11%	0%
Monthly income (USD)	91 [68-136]	91 [57-148]	91 [68-136]	91 [68-159]	102 [80-136]	91 [55-182]	91 [68-159]	91 [91-91]
Ever been pregnant	88%	77%	83%	82%	80%	86%	82%	83%
Of whom, ever had undesired pregnancy	48%	61%	50%	56%	64%	39%	56%	40%
Of whom, ever had termination or miscarriage	**30%**	**61%**	40%	47%	46%	44%	46%	40%
Ever had sex with anyone for money	46%	60%	50%	55%	54%	52%	56%	33%
Ever had sex with patron for money	31%	43%	25%	41%	40%	33%	38%	33%
Of whom, ever had oral sex with patron	27%	33%	33%	30%	31%	29%	34%	0%
Of whom, Ever had vaginal sex with patron	75%	62%	100%	61%	64%	71%	63%	100%
Of whom, How often asks patron to use condom †	4 [4-4]	4 [3-4]	4 [4-4]	4 [3-4]	4 [2-4]	4 [4-4]	4 [4-4]	3.5 [3-4]
Of whom, How often patron asks not to use condom †	1.5 [1-2.5]	2 [2-3]	2 [1-2]	2 [1-3]	2 [1-3]	2 [1-2]	2 [1-3]	2 [1-3]
Ever had sex with others for money	25%	62%	33%	50%	50%	43%	47%	50%
Number of non-client partners in past 12m	2 [1-3]	1 [1-3]	**1 [1-1]**	**2 [1-3]**	2 [1-3]	1 [1-3]	1 [1-3]	1.5 [1-3]
Has a primary partner	69%	63%	75%	64%	74%	52%	62%	100%
Of whom, used condom at last sex with primary partner	11%	26%	11%	21%	12%	36%	16%	33%
Currently using male condoms for family planning	40%	53%	40%	48%	38%	60%	43%	75%
PHQ-9 major depressive symptoms	15%	27%	8%	25%	17%	29%	24%	0%
PTSD-IV screen positive	15%	30%	8%	27%	20%	29%	24%	17%
Low social support	50%	60%	58%	55%	54%	57%	58%	33%
Ever taken an HIV test	100%	93%	100%	95%	97%	95%	96%	100%
Number of HIV tests ever taken	3 [2-5]	3 [2-5]	3 [1.5-5.5]	3 [2-5]	3 [2-5]	3 [2-4]	3 [2-5]	3.5 [1-5]
Months since last HIV test	5 [4-10]	7 [4-13.5]	5 [3.5-9]	7 [4-12]	6.5 [5-15]	5.5 [3.5-7]	6 [4-12]	8.5 [4-11]
Willing to complete HCT today	25 [23-30]	25 [23-28]	23 [22-28.5]	25 [23-29]	25 [22-28]	25 [23-30]	25 [22-29]	27 [24-27]

Values are counts (interest in modality row), proportions or medians and interquartile ranges. USD: United States dollar; FP: Family planning; HCT: HIV counselling and testing. † 5-point scale; higher values indicate greater frequency. The two significant differences (at α=0.05) between variables based on a χ^2_1 test for binary factors and Kruskal-Wallis tests for continuous and ordinal factors are shown in bold.

Figure 1: Female bar worker interest in, and ordered preferences for, various PrEP modalities

A. Level of interest in each PrEP modality; B. Ordered preference for each PrEP modality. Numbers in figures are percentages of all respondents. PrEP: Pre-exposure prophylaxis.



Female bar worker interest in, and ordered preferences for, various PrEP modalities

A. Level of interest in each PrEP modality; B. Ordered preference for each PrEP modality. Numbers in figures are percentages of all respondents. PrEP: Pre-exposure prophylaxis.

Title: HIV risk and Pre-exposure Prophylaxis interest among female bar workers in Dar es Salaam: a cross-sectional survey

Supplementary Materials

Supplementary Material 1: PrEP questionnaire section

A new method for preventing HIV is called pre-exposure prophylaxis, or PrEP. PrEP is for people who do not have HIV but who are at risk of getting it, to prevent HIV infection. Typically, PrEP is a taken as daily pill to prevent HIV infection

Prior to today, had you ever heard of pre-exposure prophylaxis (PrEP), or a daily pill to prevent HIV infection?

- Yes
- No
- Don't know/not sure
- Prefer not to answer

How interested are you in taking daily PrEP to prevent HIV infection?

- Very interested
- Somewhat interested
- Neutral
- Somewhat uninterested
- Very uninterested
- Don't know
- Prefer not to answer

One version of PrEP is a daily pill taken by mouth; PrEP is most effective when taken every single day. How difficult do you think it would be to take PrEP every single day?

- Very difficult
- Somewhat difficult
- Neither difficult nor easy
- Somewhat easy
- Very easy
- I don't know
- Prefer not to answer

What are some reasons it may be difficult to take daily oral PrEP every single day?

- Difficulty remembering
- Travel/migration
- Alcohol/drug use
- Fear that my spouse/other non-commercial partner might find out
- Fear that other sex workers might find out
- Fear that my clients might find out
- Fear that other people might find out
- Prefer not to answer

If you were to get PrEP, where would you prefer to get PrEP?

- Public facility
- Private facility
- Drug store/pharmacy
- Peer educator
- Other: _____
- Prefer not to answer

Another form of PrEP that is being tested is an injection, or a shot, every 3 months – instead of a pill by mouth every day.

If found to be effective, how interested would you be in taking injectable PrEP?

- Very interested
- Somewhat interested
- Neutral
- Somewhat uninterested
- Very uninterested
- Don't know
- Prefer not to answer

How difficult do you think it would be to return for an injection every 3 months?

- Very difficult
- Somewhat difficult
- Neither difficult nor easy
- Somewhat easy
- Very easy
- Don't know
- Prefer not to answer

A third form of PrEP that is being tested is a gel (like a lubricant) that you insert into your vagina.

If found to be effective, how interested would you be in taking PrEP as a vaginal gel?

- Very interested
- Somewhat interested
- Neutral
- Somewhat uninterested
- Very uninterested
- Don't know
- Prefer not to answer

How difficult do you think it would be to apply the gel before sex?

- Very difficult
- Somewhat difficult
- Neither difficult nor easy
- Somewhat easy
- Very easy
- Don't know
- Prefer not to answer

A fourth form of PrEP that is being tested is a vaginal ring that you insert into your vagina once per month.

If found to be effective, how interested would you be in taking PrEP as a vaginal ring?

- Very interested
- Somewhat interested
- Neutral
- Somewhat uninterested
- Very uninterested
- Don't know
- Prefer not to answer

How difficult do you think it would be to remember to replace the ring each month?

- Very difficult
- Somewhat difficult
- Neither difficult nor easy
- Somewhat easy
- Very easy
- Don't know
- Prefer not to answer

Of the four ways of taking PrEP, please tell me which you prefer the most and which the least? (Enter a 1 for the MOST preferred, and a 4 for the LEAST preferred method.

___ A daily oral pill
___ Quarterly (every 3 months) injection/shot
___ A gel (like a lubricant) that you insert into your vagina
___ A ring that you insert into your vagina

STROBE 2007 (v4) Statement—Checklist of items that should be included in reports of *cross-sectional studies*

Section/Topic	Item #	Recommendation	Reported on page #
Title and abstract	1	(*a*) Indicate the study's design with a commonly used term in the title or the abstract	1
		(*b*) Provide in the abstract an informative and balanced summary of what was done and what was found	2
Introduction			
Background/rationale	2	Explain the scientific background and rationale for the investigation being reported	5-6
Objectives	3	State specific objectives, including any prespecified hypotheses	6
Methods			
Study design	4	Present key elements of study design early in the paper	6-7
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection	6-7
Participants	6	(*a*) Give the eligibility criteria, and the sources and methods of selection of participants	7
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable	7
Data sources/ measurement	8*	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group	7
Bias	9	Describe any efforts to address potential sources of bias	7
Study size	10	Explain how the study size was arrived at	7
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why	7
Statistical methods	12	(*a*) Describe all statistical methods, including those used to control for confounding	7
		(*b*) Describe any methods used to examine subgroups and interactions	7
		(*c*) Explain how missing data were addressed	n/a
		(*d*) If applicable, describe analytical methods taking account of sampling strategy	n/a
		(*e*) Describe any sensitivity analyses	n/a
Results			

Participants	13*	(a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed	8
		(b) Give reasons for non-participation at each stage	n/a
		(c) Consider use of a flow diagram	n/a
Descriptive data	14*	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders	8 & Table 1
		(b) Indicate number of participants with missing data for each variable of interest	Table 1
Outcome data	15*	Report numbers of outcome events or summary measures	8-9
Main results	16	(*a*) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included	9-10
		(*b*) Report category boundaries when continuous variables were categorized	n/a
		(*c*) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period	n/a
Other analyses	17	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses	n/a
Discussion			
Key results	18	Summarise key results with reference to study objectives	10-11
Limitations	19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias	11
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence	11
Generalisability	21	Discuss the generalisability (external validity) of the study results	11
Other information			
Funding	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based	16

*Give information separately for cases and controls in case-control studies and, if applicable, for exposed and unexposed groups in cohort and cross-sectional studies.

Note: An Explanation and Elaboration article discusses each checklist item and gives methodological background and published examples of transparent reporting. The STROBE checklist is best used in conjunction with this article (freely available on the Web sites of PLoS Medicine at http://www.plosmedicine.org/, Annals of Internal Medicine at http://www.annals.org/, and Epidemiology at http://www.epidem.com/). Information on the STROBE Initiative is available at www.strobe-statement.org.

BMJ Open

HIV risk and Pre-exposure Prophylaxis interest among female bar workers in Dar es Salaam: a cross-sectional survey

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Title: HIV risk and Pre-exposure Prophylaxis interest among female bar workers in Dar es Salaam: a cross-sectional survey

Running Head: HIV risk and PrEP interest in Dar es Salaam barmaids

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ABSTRACT

Objective: Female bar workers (FBW) in East Africa often conduct sex work to supplement their incomes, and may be vulnerable to HIV acquisition. Pre-exposure prophylaxis (PrEP) offers protection against HIV acquisition. However, there is little research on FBW's sexual health. Our objective was to determine HIV risk behaviors and interest in PrEP among FBW in the largest city in East Africa.

Design: Cross-sectional survey covering respondents' work and personal lives, including social and behavioral risk factors for HIV. The survey aimed to determine the feasibility of working with FBW and HIV prevalence estimates. Those who did not report being HIV-positive were asked about their knowledge of and interest in PrEP. All women were offered free on-site HIV testing and counselling (HTC).

Setting: Eight randomly selected workplaces, i.e. bars, in Kinondoni district, Dar es Salaam (DSM).

Participants: 66 FBW (≥18 years) selected at random from all women working in selected bars on the day of visit.

Results: Half of respondents reported having had sex for money: 20% with bar clients only, 15% with other men only and 15% with both. Almost all (98%) reported ≥1 non-commercial partners in the past 12 months; only 30% reported using condoms with these partners. 85% of respondents had ever been pregnant; 44% had had an unintended pregnancy. Only 5% of respondents had ever heard of PrEP. However, 54% were somewhat/very interested in daily-pill PrEP and 79% were somewhat/very interested in long-acting injectable PrEP. When asked to rank modalities, long-acting injectable PrEP was the most-preferred. Seven percent of the 56 respondents who completed HTC tested HIV-positive.

Conclusions: FBW in DSM have elevated risk factors for HIV acquisition, and PrEP appears highly acceptable. Studies developing PrEP delivery models and assessing PrEP initiation and adherence in FBW appear warranted.

Keywords: Female bar workers; Barmaids; Tanzania; Pre-exposure prophylaxis; HIV prevention

STRENGTHS AND LIMITATIONS OF THIS STUDY

- The study population was selected at random from among all female bar workers in one of the three districts of the city of Dar es Salaam.
- HIV serostatus was evaluated using a rapid diagnostic test to avoid differential or non-differential misreporting.
- The sample is relatively small, potentially limiting power to see significant differences within subgroups, but can potentially motivate for studies designing and evaluating PrEP delivery models in this population.
- The sensitive nature of many of the HIV risk factors considered, and the self-report methods employed by the survey, may have led to underreporting of risk behaviours.
- It is unclear how far the findings of this work can be generalized geographically.

INTRODUCTION

Female sex workers (FSW), i.e. women who receive money or other goods in exchange for sexual services, are a key population for the HIV epidemic in sub-Saharan Africa (SSA). These women are at especially high risk of acquiring and transmitting HIV and other sexually transmitted infections (STI).[1] There is substantial research on how sex workers (SW) contribute to,[2] and are impacted by,[3] the HIV epidemic in SSA.

Sex workers are sometimes divided into 'direct' sex workers for whom it is a primary profession, and 'indirect' sex workers, for whom it is a supplementary source of income.[4] Indirect sex workers may be particularly important for HIV epidemics if they do not self-identify as sex workers, and thus are not reached by or do not access HIV prevention services such as those targeting direct FSW. In East Africa, female bar workers (FBW), women who either sell or deliver drinks to customers in commercial establishments, often act as indirect FSW.

FBW, or barmaids, often do not self-identify as FSW,[5 6] and, in contrast to bar-based direct FSW, are employed by bars to provide non-sexual services. However, past quantitative research has shown that a substantial minority of FBW (35-45%) have sex in return for money, often with bar clients.[7 8] FBW are often stigmatized and considered by others to be FSW.[9 10] Qualitative work suggests FBW have limited ability to protect themselves against STIs and other adverse consequences of sex work, notably when negotiating condom use.[11-13] While precise numbers are hard to obtain, FBWs likely comprise a large proportion of the 'accommodation and food service activities' employment category, which accounted for 6.5% of all employed Tanzanian women aged >15 in 2014,[14] and it has been claimed that FBWs are the largest single employment group in Tanzania.[15]

There is substantial evidence – both direct and indirect – for structural, behavioural and biomedical interventions that should be able to reduce HIV acquisition and transmission among FSW.[16] Structural approaches include community mobilization, advocacy and social and economic empowerment alongside anti-discrimination policies including legal protection. Behavioural approaches include peer and community-based behaviour change, condom provision. However, many of these interventions are highly context-specific and have proven difficult to implement consistently.[17] Biomedical interventions may be more easily implemented in a wide range of settings. Proven biomedical approaches for FSW include FSW-friendly provision of services such as voluntary testing, linkage to care and antiretroviral treatment – including prevention of mother-to-child transmission and post-exposure prophylaxis. There is no evidence at present as to how FSW-applicable interventions affect FBWs.

Pre-exposure prophylaxis (PrEP) is an important biomedical HIV prevention tool, proven to substantially prevent HIV acquisition when taken as prescribed.[18 19] There are several planned and ongoing PrEP demonstration projects in Africa.[20 21] However, previous PrEP studies have found variable adherence.[22] Few PrEP trials have explicitly included FSW in their inclusion criteria – although some included proportions of unmarried women with multiple partners who reported histories of transactional sex [16] – and to our knowledge none have targeted FBW. Evidence from FSW from South Africa,[23] Kenya [24] and Zimbabwe [25] points to variable levels of uptake but rapidly declining retention of FSW on daily pill-based PrEP. Most published PrEP studies have focused on daily pill-based PrEP, although one study showed effectiveness for on-demand pills among men-who-have-sex-with-men (MSM).[26] However, other prevention modalities have been considered, including long-acting injectables,[27 28] vaginal gels [29] and vaginal rings.[30]

The World Health Organization (WHO) recommends PrEP for populations with an annual risk of HIV acquisition greater than 3%,[31] and as such it is likely to be a key intervention for reducing HIV among FSW internationally.[32] Several countries in Africa with generalized epidemics have included FSW among the key populations eligible for PrEP,[33-35] but few if any had begun widespread implementation for FSW by mid-2017. Past research has shown high acceptability of daily-pill PrEP amongst FSW hypothetically in a range of settings,[36] and in practice in Kenya.[37] While FBW acquisition risk may be lower on average than direct sex workers, it may well be that they meet the WHO criterion for PrEP.

At the time of this study. PrEP was not available anywhere within Tanzania. Two assessments of interest and barriers to PrEP amongst adolescent girls and young women conducted in 2017 and found high interest but concerns around cost, side-effects and stigma.[38 39] As part of one of these studies, healthcare providers were largely supportive of PrEP provision, although they were concerned about behavioural disinhibition and work overload.[40] Evidence specifically on FSW is not currently available.

Although many FBW also act as FSW, there is limited evidence on how much risky sexual behaviour FBW engage in. To our knowledge, there is no research on the acceptability of PrEP amongst FBW. We therefore analyzed data from a feasibility study measuring HIV prevalence, HIV-related risk factors, and initial interest in and acceptability of PrEP amongst FBW in Dar es Salaam municipality (DSM), Tanzania, the largest city in eastern Africa.

METHODS

We conducted a cross-sectional study using a two-stage sampling method in January 2017. This study was a feasibility study whose primary aim was to determine the feasibility of

working with FBW in Dar es Salaam, and to provide parameter estimates for HIV prevalence and intra-cluster correlation coefficients, to inform a subsequent larger study. The larger study was ultimately judged infeasible based on the HIV prevalence measured in this study. We first randomly selected eight bars from a sampling frame listing all licensed premises in Kinondoni district, DSM (one of the three districts in the municipality). We repeatedly sampled without replacement first a page number and then line number from the listing. Our work was a feasibility study for a larger study, and thus no formal power calculation was used to establish sample size. However, our sample of 56 individuals with HIV tests gave us 66% power to provide 95% confidence intervals of +/- 10% around an expected HIV prevalence estimate of 20%.

The field team visited each bar at a time arranged by telephone with each bar's licensee. After explaining the study first to the bar manager and then to all FBW present, FBW were invited to participate in a computer-assisted personal interview (CAPI), and then complete HIV testing and counselling (HTC). Study inclusion criteria were being 18 years or older and working as a FBW at the time of study visit. Between 6 and 12 FBW – depending on the length of each interview – were chosen at random within each bar based on a list drawn up by the bar manager at first bar entry. All interviews were conducted in a three-wheel taxi (*bajaji*) with closed sides parked close to the bar, to ensure privacy.

The CAPI covered several topics, including: women's socio-demographics; their work history; their sexual history, including past STI diagnoses and HIV testing; their knowledge of HIV prevention modalities; substance use; and psychological wellbeing (depression, post-traumatic stress disorder (PTSD) and generalized social support). For depression we asked the PHQ-9 scale, which has previously been used with Tanzanian women living with HIV.[41] We assessed PTSD using the PTSD-IV screening tool. Generalized social support was measured using a 10-

item version of the Duke-UNC Functional Social Support Questionnaire (FSSQ), adapted to include instrumental support and validated for Tanzanian women.[42] Potential responses to each FSSQ question were: “as much as I would like” (4); “less than I would like” (3); “much less than I would like” (2); and “never” (1). A mean score <3 is considered as ‘low social support'.

Respondents were asked if they had ever heard of PrEP or a daily pill to prevent HIV infection. Then, following a brief description of each modality, they were asked how interested they were in taking PrEP as: (i) a daily pill; (ii) an injection every 3 months; (iii) a pericoital vaginal gel; (iv) a monthly vaginal ring. For each PrEP modality interest was gauged on a five-point scale: very interested; somewhat interested; neutral; somewhat uninterested; very uninterested. Finally, they were asked to rank the four modalities from most to least preferred. All PrEP questions are presented in Supplementary Material 1. Questions about PrEP were not asked to those who self-reported having previously tested HIV-positive, and due to a coding error were not asked at the first bar visited. Anyone testing positive for HIV and not already linked to care was referred to their clinic of choice.

In this analysis, we provide descriptive statistics for various potential risk and protective factors for HIV acquisition. We then assess bivariate associations between these factors and interest in various modalities of PrEP, using χ^2 tests for binary variables and Kruskal-Wallis tests for continuous and ordinal variables. We dichotomized PrEP interest as either positive (very interested or somewhat interested) or not (neutral, somewhat uninterested or very uninterested), in order to evaluate which factors were and were not associated with active interest in PrEP. HIV status was measured based on HIV test result.

The study received ethical approval from Harvard T.H. Chan School of Public Health and the Tanzanian National Institute for Medical Research. Written informed consent was obtained from each participant.

Participant and Public Involvement

Neither patients nor public were directly involved in the development, design or recruitment of the study. HIV test results were provided to participants at point of testing; results will not otherwise be disseminated directly to study participants.

RESULTS

Participant characteristics

Sixty-six FBW were invited to participate in the study and all agreed (Table 1). Most of the women were in their twenties (median age 26, interquartile range [IQR]: 23-30). Almost all the women (91%) were born outside of DSM. FBW had been working as barmaids for a median of two years (IQR: 4 months to 4 years). Only 9% FBW planned to continue working as FBW, all but one of whom planned to stop within two years. FBW reported a median monthly income of $91 (IQR: $68-136). Most FBW (85%) had been pregnant in the past, 44% reported having had an unintended pregnancy and 39% a miscarriage or termination. 71% of FBW had a living child at the time of interview (median 1, IQR: 1-2).

Psychometric properties for the wellbeing measures were acceptable: Cronbach's alpha was 0.71 for PHQ-9, 0.71 for the PTSD-IV and 0.85 for FSSQ. Based on standard score summation, 20% of respondents showed depressive symptoms, while 21% affirmed 3 or 4 PTSD-IV questions and thus screened positive for possible PTSD, and 58% had a mean FSSQ score <3 and thus had low social support.

Almost all (96%) of FBW had previously taken an HIV test (median 3 tests in lifetime, IQR: 2-5), with 53% having tested within the past six months and 78% within the past 12. Three women

(5%) had previously tested positive for HIV. Fifty-six FBW (85%) consented to test for HIV and four of these (7%) tested positive; only one had not previously received a positive test result.

HIV acquisition risk factors

Exactly half of FBW reported ever having had sex with someone in return for money: 20% only with bar clients; 15% only with other men; and 15% with both. Of the 35% FBW reporting sex with bar clients, 74% reported asking clients to use condoms often or always. A majority (52%) reported that clients sometimes or often asked not to use condoms, but only 8% of FBW reported often or always agreeing not to use condoms in situations where they want to use a condom but their clients has asked not to. FBW also reported a median of two non-commercial partners in the past 12 months (IQR: 1-3, maximum 8). 68% of FBW reported having a primary partner, and only 18% of these women reported using a condom at last sex with this partner. Only 30% of FBW reported using male or female condoms as a family planning method, while another 24% reported using pills, injectables or implants. Almost half (47%) of respondents believed they were either at great risk of, or certain to become infected with, HIV.

PrEP interest

Questions about PrEP were asked to 56 women (3 had previously tested HIV positive, 7 were in the first bar visited). Only 5% of these FBW had ever heard of PrEP, however 54% were either somewhat or very interested in a daily pill that protected against HIV infection, and only 16% were uninterested (Figure 1A). When asked about other potential treatment modalities, 79% of FBW were interested or very interested in long-acting injectable PrEP, 38% in vaginal gel PrEP and only 11% in monthly vaginal ring PrEP. Only one women was somewhat or very uninterested in any type of PrEP. Level of interest in daily-pill PrEP was statistically significantly correlated with interest in long-acting injectable PrEP ($\rho = 0.40$, p=0.003), but not

with either vaginal modality. When asked to rank the four modalities, the most preferred method was long-acting injectable PrEP, although 82% of women ranked daily-pill PrEP as either their first or second preference (Figure 1B). Restricting our sample to all respondents with at least 'neutral' (96%) or at least 'somewhat interested' (86%) responses for at least one PrEP modality did not change these patterns.

Correlates of PrEP interest

Associations between interest in each PrEP modality and the range of HIV risk factors are presented in Table 2. There was no significant difference in interest level (very/somewhat interested vs. neutral or somewhat/very uninterested) in daily-pill PrEP for those who did/did not report any sex for money (60% vs. 46%, p=0.30). This pattern was similar for those who did/did not report sex for money with bar clients (62% vs 49%, p=0.33) and those who did/did not report sex for money with others (59% vs 51%, p=0.60). Interest in long-acting injectable PrEP was similarly not significantly associated with having had sex in return for money (any sex for money: 80% vs 77%, p=0.78; sex for money with bar clients: 86% vs. 74%, p=0.31; sex for money with non-bar clients: 76% vs 79%, p=0.80). The only socio-demographic or behavioral factor associated with significantly higher interest in daily-pill PrEP was a history of miscarriage or termination (61% vs. 39%, p=0.04). The only factor associated with significantly higher interest in long-acting injectable PrEP was number of non-client partners in the past 12 months (interest: median 2, IQR: 1-3; no interest: median 1, IQR: 1-1; p=0.03). Willingness to consent for an HIV test was not significantly associated with interest in daily-pill PrEP (54% vs 50%, p=0.83).

DISCUSSION

In a random sample of 66 FBW from bars in DSM, HIV prevalence was low (similar to the 7% prevalence for 25-29 year old women nationally, and 8% for 15-49 year old women in DSM, in 2011-12, the most-recent nationally representative survey[43]). However, risk factors for HIV acquisition were substantial – including multiple partners, moderate to low condom use, and substantial levels of sex for money. The proportion of FBW reporting sex for money was similar to earlier quantitative studies.[7 8]

Awareness of PrEP for HIV prevention was very low but interest in PrEP, particularly for daily pills and long-acting injectables, was high. Both these modalities are likely to be recognizable to women in Tanzania since family planning options have similar modes of delivery, e.g. daily contraceptive pills, injectable Depo-Provera and implanted Nur-Isterate. Greater interest in long-acting injectables may also reflect the difficulties of taking daily pills for these working women, and of applying gels prior to sex when timing of sex acts is unpredictable and sometimes not chosen by them. These findings thus resonate with those of earlier work in other sub-Saharan African settings with FSW, which found limited retention on daily pill-based PrEP.[23-25]

While many of differences in PrEP interest were not significant in this small sample (and none remain significant if we adjust for multiple testing using the Holm-Bonferroni or any other method), respondents who reported having sex for money (either with bar clients or others), those who had had a miscarriage or abortion and those with more non-client partners all reported greater interest in PrEP. This pattern of findings, if reproduced in other data, would suggest that those FBW with a higher risk profile for sexually transmitted diseases have a rationally greater interest in PrEP. It was also notable that PrEP interest was similar for those

having sex either with bar clients or with others; if efforts are made to determine which FBWs are having sex for money, inquiries should not be limited to bar patrons.

This study highlights that FBW in Dar are at substantial risk for HIV acquisition, that many are aware that they are at substantial risk and following discussion many are interested PrEP. However, this is only the first stage of the PrEP care continuum,[44] FBW will additionally need assistance in accessing PrEP and remaining in care. Both of these stages are likely to be hampered by the stigma and fluidity of life situation that working as an FBW can bring.

While no PrEP is currently available to Tanzanian women, daily-pill PrEP demonstration trials will begin in key Tanzanian populations in 2018 and long-acting injectable PrEP has reached phase-III trials elsewhere through HPTN-084.[45] Successful PrEP strategies for FBW will require tailored PrEP programming for such women, mostly likely including clinical care provided outside standard clinics. One important option here might be workplace-based service provision – since the bar location forms a multi-year basis for work for the majority of respondents.

Strengths and limitations

This study provides a first insight into the HIV serostatus and PrEP interest of FBW in DSM. While the sample in this study is small, it was a random sample drawn from a full enumeration of all licensed premises (n>2500) in Kinondoni district, an area with a population of over 1,750,000 inhabitants in 2012,[46] and then a full enumeration of all FBW working in each bar at the time of first visit. Nevertheless, it is possible that the sample of women drawn differs on some characteristics from other FBW in Kinondoni. Furthermore, our small sample size means that we cannot rule out some substantial but not significant associations in fact reflecting true associations that this study lacks the power to confirm. Further analysis with additional FBWs

would allow the separation of truly null associations from underpowered analyses. Similarly, we are not able to conduct multivariable analysis in this dataset, something that would be important in follow-up work.

Caution is needed in generalizing beyond Kinondoni to the rest of DSM, as well as to other areas of Tanzania and East Africa. However, even should the results only be applicable within Kinondoni or DSM, our results suggest that a very large number of FBWs in this region are at risk of HIV acquisition and local interventions may be warranted. Additionally, since many of the questions asked were sensitive ones, and the responses self-reported through face-to-face interviews, FBW may have underreported some risk behaviours. The potential for social desirability bias to affect questions about PrEP was lessened by the very low baseline awareness of this HIV prevention option.

CONCLUSIONS

Based on these initial data, FBW are likely to be a key population for HIV prevention efforts, including PrEP, to protect both themselves and their partners from acquiring HIV. PrEP seems acceptable to this sample of FBW – who commonly engaged in unprotected transactional sex with clients, but planned to discontinue sex work in the near future.

This study also provided evidence of the feasibility of contacting FBW at their workplaces. Nevertheless, further information is needed on both the best design for delivering PrEP and supporting HIV-related health services to this population and the effectiveness of different PrEP models in attracting FBW to PrEP and ensuring continued PrEP utilization throughout periods of high HIV acquisition risk.

REFERENCES

1. Baral S, Beyrer C, Muessig K, 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):538-49.

2. Gouws E, Cuchi P. Focusing the HIV response through estimating the major modes of HIV transmission: a multi-country analysis. *Sex Transm Infect* 2012;88(Suppl 2):i76-i85.

3. Shannon K, Strathdee SA, Goldenberg SM, et al. Global epidemiology of HIV among female sex workers: influence of structural determinants. *Lancet* 2015;385(9962):55-71.

4. Harcourt C, Donovan B. The many faces of sex work. *Sex Transm Infect* 2005;81(3):201-06.

5. Sori AT. Poverty, sexual experience and HIV vulnerability risks: evidence from Addis Ababa, Ethiopia. *J Biosoc Sci* 2012;44(6):677-701.

6. Rosenheck R, Ngilangwa D, Manongi R, Kapiga S. Treatment-seeking behavior for sexually transmitted infections in a high-risk population. *AIDS Care* 2010;22(11):1350-58.

7. Ao TT, Sam NE, Masenga EJ, Seage III GR, Kapiga SH. Human immunodeficiency virus type 1 among bar and hotel workers in northern Tanzania: the role of alcohol, sexual behavior, and herpes simplex virus type 2. *Sex Transm Dis* 2006;33(3):163-69.

8. Riedner G, Rusizoka M, Hoffmann O, et al. Baseline survey of sexually transmitted infections in a cohort of female bar workers in Mbeya Region, Tanzania. *Sex Transm Infect* 2003;79(5):382-87.

9. van Blerk L. Negotiating boundaries: the sex work identities of 'bar girls' in Nazareth, Ethiopia. *Gender, Place and Culture* 2011;18(02):217-33.

10. Kerrigan D, Mbwambo J, Likindikoki S, et al. Project Shikamana: Baseline Findings From a Community Empowerment–Based Combination HIV Prevention Trial Among Female Sex Workers in Iringa, Tanzania. *J Acquir Immune Defic Syndr* 2017;74(Suppl 1):S60.

11. Beckham S. " Like Any Other Woman"? Pregnancy, Motherhood, and HIV among Sex Workers in Southern Tanzania. Johns Hopkins University, 2013.

12. Talle A. Bar workers at the border. In: Klepp K-I, Biswalo PM, Talle A, eds. Young people at risk: fighting AIDS in northern Tanzania. Oslo, Norway: Scandinavian University Press, 1995:18-30.

13. Van Blerk L. Poverty, migration and sex work: youth transitions in Ethiopia. *Area* 2008;40(2):245-53.

14. National Bureau of Statistics (NBS) [Tanzania]. Tanzania Integrated Labour Force Survey 2014. Dar es Salaam: NBS,, 2014.

15. Akarro RR. Some factors associated with condom use among bar maids in Tanzania. *J Biosoc Sci* 2009;41(01):125-37.

16. Bekker L-G, Johnson L, Cowan F, et al. Combination HIV prevention for female sex workers: what is the evidence? *Lancet* 2015;385(9962):72-87.

17. Iskarpatyoti BS, Lebov J, Hart L, Thomas J, Mandal M. Evaluations of Structural Interventions for HIV Prevention: A Review of Approaches and Methods. *AIDS Behav* 2018;22(4):1253-64.

18. Baeten JM, Donnell D, Ndase P, et al. Antiretroviral prophylaxis for HIV prevention in heterosexual men and women. *N Engl J Med* 2012;367(5):399-410.

19. Thigpen MC, Kebaabetswe PM, Paxton LA, et al. Antiretroviral preexposure prophylaxis for heterosexual HIV transmission in Botswana. *N Engl J Med* 2012;367(5):423-34.

20. AVAC. HIV Prevention Research & Development Database. 10 April 2017 2016. http://www.avac.org/pxrd. (accessed 22 August 2017.

21. Cowan F, Delany-Moretlwe S, Sanders EJ, et al. PrEP implementation research in Africa: what is new? *J Int AIDS Soc* 2016;19(Suppl 6):21101.

22. Van der Straten A, Van Damme L, Haberer JE, Bangsberg DR. Unraveling the divergent results of pre-exposure prophylaxis trials for HIV prevention. *AIDS* 2012;26(7):F13-F19.

23. Eakle R, Gomez GB, Mbogua J, et al. Treatment And Prevention for Female Sex Workers in South Africa: First-year Results for the TAPS Demonstration Project. HIV Research for Prevention. Chicago, IL, 2016.

24. Kyongo J, Kiragu M, Nduta S, et al. Oral PrEP for HIV Prevention: Early Lessons from a PrEP Demonstration Project in Kenya. HIV Research for Prevention. Chicago, IL, 2016.

25. Cowan FM, Davey C, Fearon E, et al. Targeted combination prevention to support female sex workers in Zimbabwe accessing and adhering to antiretrovirals for treatment and prevention of HIV (SAPPH-IRe): a cluster-randomised trial. *The lancet HIV* 2018;5(8):e417-e26.

26. Molina J-M, Capitant C, Spire B, et al. On-demand preexposure prophylaxis in men at high risk for HIV-1 infection. *N Engl J Med* 2015;373(23):2237-46.

27. Landovitz RJ, Kofron R, McCauley M. The Promise and Pitfalls of Long Acting Injectable Agents for HIV Prevention. *Curr Opin HIV AIDS* 2016;11(1):122.

28. Margolis DA, Gonzalez-Garcia J, Stellbrink H-J, et al. Long-acting intramuscular cabotegravir and rilpivirine in adults with HIV-1 infection (LATTE-2): 96-week results of a randomised, open-label, phase 2b, non-inferiority trial. *Lancet* 2017.

29. Karim QA, Karim SSA, Frohlich JA, et al. Effectiveness and safety of tenofovir gel, an antiretroviral microbicide, for the prevention of HIV infection in women. *Science* 2010;329(5996):1168-74.

30. Baeten JM, Palanee-Phillips T, Brown ER, et al. Use of a vaginal ring containing dapivirine for HIV-1 prevention in women. *N Engl J Med* 2016;375(22):2121-32.

31. World Health Organization. *Consolidated guidelines on the use of antiretroviral drugs for treating and preventing HIV infection: recommendations for a public health approach*. Geneva: World Health Organization, 2016.

32. Beyrer C, Crago A-L, Bekker L-G, et al. An action agenda for HIV and sex workers. *Lancet* 2015;385(9964):287-301.

33. South African National AIDS Council (SANAC). The South African National Sex Worker HIV Plan 2016-2019. Pretoria, South Africa: SANAC, 2016.

34. National AIDS & STI Control Programme (NASCOP). Framework for the Implementation of Pre-exposure Prophylaxis of HIV in Kenya. Nairobi, Kenya: NASCOP, 2017.

35. Botswana Ministry of Health. Handbook of the Botswana 2016 integrated HIV clinical care guidelines. Gabarone, Bostwana: Botswana Ministry of Health, 2016.

36. Koechlin FM, Fonner VA, Dalglish SL, et al. Values and preferences on the use of oral pre-exposure prophylaxis (PrEP) for HIV prevention among multiple populations: a systematic review of the literature. *AIDS Behav* 2017;21(5):1325-35.

37. Van der Elst EM, Mbogua J, Operario D, et al. High acceptability of HIV pre-exposure prophylaxis but challenges in adherence and use: qualitative insights from a phase I trial of intermittent and daily PrEP in at-risk populations in Kenya. *AIDS Behav* 2013;17(6):2162-72.

38. Population Council. Adolescent girls and young women's perceptions of oral pre-exposure prophylaxis introduction in Tanzania: findings from implementation science research". DREAMS Tanzania Results Brief 3. Washington, DC: Population Council, 2017.

39. Lees S, Scorgie F, Khoza N, et al. Understanding motives for initiating PrEP amongst adolescent girls and young women (AGYW) in South Africa and Tanzania. AIDS 2018. Amsterdam, the Netherlands, 2018.

40. Pilgrim N, Jani N, Mathur S, et al. Provider perspectives on PrEP for adolescent girls and young women in Tanzania: The role of provider biases and quality of care. *PLoS ONE* 2018;13(4):e0196280.

41. Belenky NM, Cole SR, Pence BW, Itemba D, Maro V, Whetten K. Depressive symptoms, HIV medication adherence, and HIV clinical outcomes in Tanzania: a prospective, observational study. *PLoS ONE* 2014;9(5):e95469.

42. Antelman G, Fawzi MCS, Kaaya S, et al. Predictors of HIV-1 serostatus disclosure: a prospective study among HIV-infected pregnant women in Dar es Salaam, Tanzania. *AIDS* 2001;15(14):1865-74.

43. Tanzania Commission for AIDS (TACAIDS), Zanzibar AIDS Commission (ZAC), National Bureau of Statistics (NBS), Office of the Chief Government Statistician (OCGS), ICF International. Tanzania HIV/AIDS and Malaria Indicator Survey 2011-12. Dar es Salaam, Tanzania: TACAIDS, ZAC, NBS, OCGS, and ICF International, 2013.

44. Nunn AS, Brinkley-Rubinstein L, Oldenburg CE, et al. Defining the HIV pre-exposure prophylaxis care continuum. *AIDS (London, England)* 2017;31(5):731.

45. NIH Launches First Large Trial of a Long-Acting Injectable Drug for HIV Prevention: Study to Test Efficacy, Safety of Injectable Cabotegravir Compared to Daily Oral PrEP. 20 Dec 2016 2016. https://www.niaid.nih.gov/news-events/nih-launches-first-large-trial-long-acting-injectable-drug-hiv-prevention. (accessed 4 September 2017.

46. National Bureau of Statistics, Office of Chief Government Statistician. 2012 Population and Housing Census: Population Distribution by Administrative Areas. Dar es Salaam: National Bureau of Statistics, 2013.

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FIGURES AND TABLES

Table 1: Descriptive statistics for socio-demographic and behavioral risk factors for HIV

	All respondents		PrEP question respondents	
	N		N	
Age	66	26 [23 - 30]	56	25 [23-29]
Born in Dar es Salaam	65	9%	55	9%
Years working in bars	66	2 [0.4 - 4]	56	1.8 [0.4-3]
Plan to continue bar work	66	11%	56	9%
Monthly income (USD)	62	91 [68 - 136]	53	91 [68-136]
Ever been pregnant	66	85%	56	82%
Of whom, ever had undesired pregnancy	56	52%	46	54%
Of whom, ever had termination or miscarriage	56	46%	46	46%
Ever had sex with anyone for money	66	50%	56	54%
Ever had sex with patron for money	66	35%	56	38%
Of whom, ever had oral sex with patron	23	70%	21	30%
Of whom, Ever had vaginal sex with patron	23	48%	21	67%
Of whom, How often asks patron to use condom †	23	4 [3 - 4]	21	4 [4-4]
Of whom, How often patron asks not to use condom †	23	2 [1 - 3]	21	3 [2-3]
Ever had sex with others for money	66	30%	21	48%
Number of non-client partners in past 12 months	56	2 [1 - 3]	47	1 [1-3]
Has a primary partner	66	68%	56	66%
Of whom, used condom at last sex with primary partner	44	18%	37	19%
Currently using male condoms for family planning	66	36%	56	38%
PHQ-9 major depressive symptoms	66	20%	56	16%
PTSD-IV screen positive	66	21%	56	23%
Low social support	66	58%	56	55%
Ever taken an HIV test	66	97%	56	96%
Number of HIV tests ever taken	64	3 [2 - 5]	54	3 [2-5]
Months since last HIV test	64	6 [3.5 - 12]	54	6 [4-12]
Willing to complete HCT today	66	85%	56	86%

Values are counts (N), proportions or medians and interquartile ranges. USD: United States dollar; PHQ: Patient Health Questionnaire; PTSD: Post-traumatic stress disorder; HCT: HIV counselling and testing. † 5-point scale; higher values indicate greater frequency.

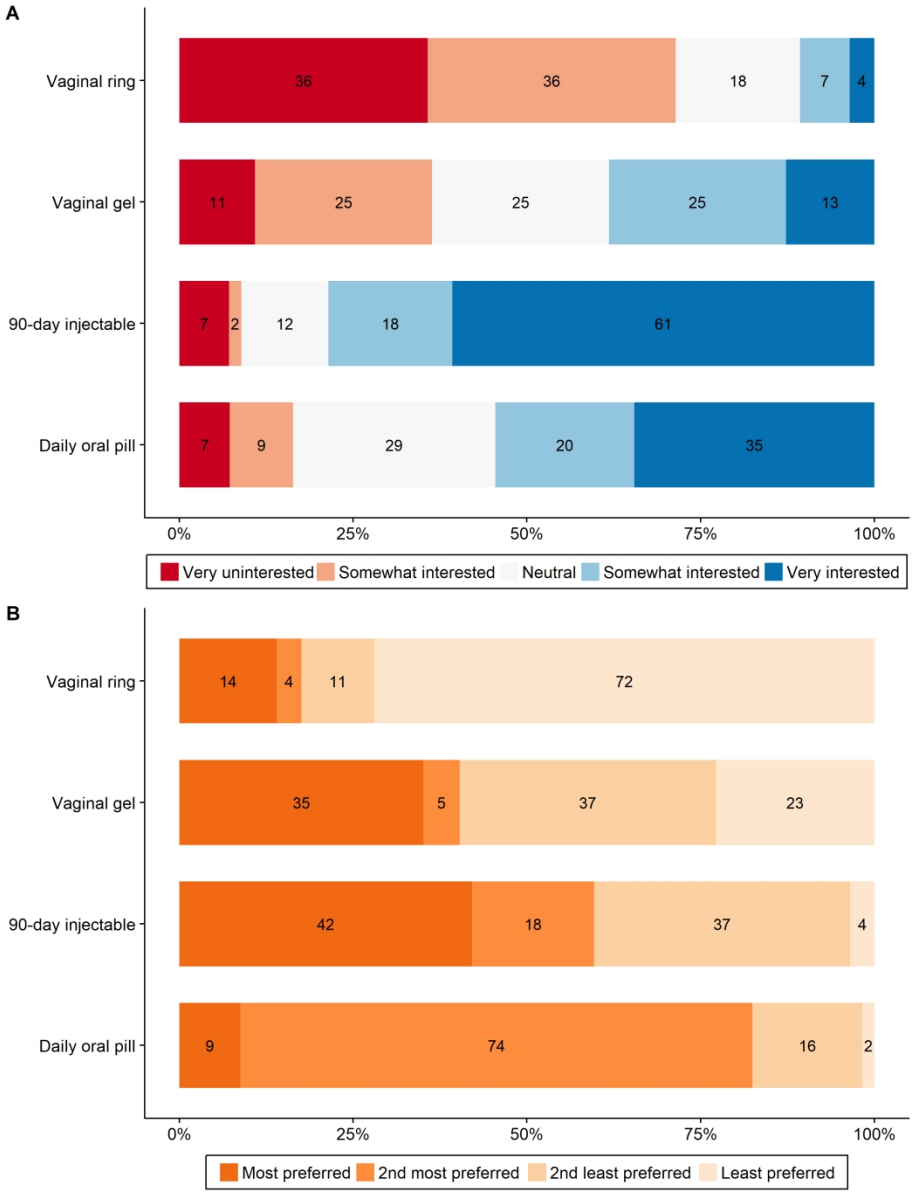
Table 2: Associations between socio-demographic and behavioral factors and interest in PrEP modalities

	Daily pill		90-day injectable		Vaginal gel		Vaginal ring	
	No	Yes	No	Yes	No	Yes	No	Yes
Very/somewhat interested in modality	30	26	12	44	35	21	50	6
Age	25 [23-30]	25 [23-28]	23 [22-28.5]	25 [23-29]	25 [22-28]	25 [23-30]	25 [22-29]	27 [24-27]
Born in Dar es Salaam	8%	10%	8%	9%	9%	10%	8%	17%
Years working in bars	1.8 [0.4-3]	1.8 [0.3-3]	1.5 [0.2-2.5]	1.8 [0.5-3]	1.5 [0.5-3]	2 [0.25-6]	1.5 [0.4-3]	2 [2-3]
Plan to continue bar work	8%	11%	8%	10%	9%	10%	11%	0%
Monthly income (USD)	91 [68-136]	91 [57-148]	91 [68-136]	91 [68-159]	102 [80-136]	91 [55-182]	91 [68-159]	91 [91-91]
Ever been pregnant	88%	77%	83%	82%	80%	86%	82%	83%
Of whom, ever had undesired pregnancy	48%	61%	50%	56%	64%	39%	56%	40%
Of whom, ever had termination or miscarriage	**30%**	**61%**	40%	47%	46%	44%	46%	40%
Ever had sex with anyone for money	46%	60%	50%	55%	54%	52%	56%	33%
Ever had sex with patron for money	31%	43%	25%	41%	40%	33%	38%	33%
Of whom, ever had oral sex with patron	27%	33%	33%	30%	31%	29%	34%	0%
Of whom, Ever had vaginal sex with patron	75%	62%	100%	61%	64%	71%	63%	100%
Of whom, How often asks patron to use condom †	4 [4-4]	4 [3-4]	4 [4-4]	4 [3-4]	4 [2-4]	4 [4-4]	4 [4-4]	3.5 [3-4]
Of whom, How often patron asks not to use condom †	1.5 [1-2.5]	2 [2-3]	2 [1-2]	2 [1-3]	2 [1-3]	2 [1-2]	2 [1-3]	2 [1-3]
Ever had sex with others for money	25%	62%	33%	50%	50%	43%	47%	50%
Number of non-client partners in past 12m	2 [1-3]	1 [1-3]	**1 [1-1]**	**2 [1-3]**	2 [1-3]	1 [1-3]	1 [1-3]	1.5 [1-3]
Has a primary partner	69%	63%	75%	64%	74%	52%	62%	100%
Of whom, used condom at last sex with primary partner	11%	26%	11%	21%	12%	36%	16%	33%
Currently using male condoms for family planning	40%	53%	40%	48%	38%	60%	43%	75%
PHQ-9 major depressive symptoms	15%	27%	8%	25%	17%	29%	24%	0%
PTSD-IV screen positive	15%	30%	8%	27%	20%	29%	24%	17%
Low social support	50%	60%	58%	55%	54%	57%	58%	33%
Ever taken an HIV test	100%	93%	100%	95%	97%	95%	96%	100%
Number of HIV tests ever taken	3 [2-5]	3 [2-5]	3 [1.5-5.5]	3 [2-5]	3 [2-5]	3 [2-4]	3 [2-5]	3.5 [1-5]
Months since last HIV test	5 [4-10]	7 [4-13.5]	5 [3.5-9]	7 [4-12]	6.5 [5-15]	5.5 [3.5-7]	6 [4-12]	8.5 [4-11]
Willing to complete HCT today	25 [23-30]	25 [23-28]	23 [22-28.5]	25 [23-29]	25 [22-28]	25 [23-30]	25 [22-29]	27 [24-27]

Values are counts (interest in modality row), proportions or medians and interquartile ranges. USD: United States dollar; FP: Family planning; HCT: HIV counselling and testing. † 5-point scale; higher values indicate greater frequency. The two significant differences (at α=0.05) between variables based on a χ^2_1 test for binary factors and Kruskal-Wallis tests for continuous and ordinal factors are shown in bold.

Figure 1: Female bar worker interest in, and ordered preferences for, various PrEP modalities

A. Level of interest in each PrEP modality; B. Ordered preference for each PrEP modality. Numbers in figures are percentages of all respondents. PrEP: Pre-exposure prophylaxis.



Female bar worker interest in, and ordered preferences for, various PrEP modalities

A. Level of interest in each PrEP modality; B. Ordered preference for each PrEP modality. Numbers in figures are percentages of all respondents. PrEP: Pre-exposure prophylaxis.

Title: HIV risk and Pre-exposure Prophylaxis interest among female bar workers in Dar es Salaam: a cross-sectional survey

Supplementary Materials

Supplementary Material 1: PrEP questionnaire section

A new method for preventing HIV is called pre-exposure prophylaxis, or PrEP. PrEP is for people who do not have HIV but who are at risk of getting it, to prevent HIV infection. Typically, PrEP is a taken as daily pill to prevent HIV infection

Prior to today, had you ever heard of pre-exposure prophylaxis (PrEP), or a daily pill to prevent HIV infection?

- Yes
- No
- Don't know/not sure
- Prefer not to answer

How interested are you in taking daily PrEP to prevent HIV infection?

- Very interested
- Somewhat interested
- Neutral
- Somewhat uninterested
- Very uninterested
- Don't know
- Prefer not to answer

One version of PrEP is a daily pill taken by mouth; PrEP is most effective when taken every single day. How difficult do you think it would be to take PrEP every single day?

- Very difficult
- Somewhat difficult
- Neither difficult nor easy
- Somewhat easy
- Very easy
- I don't know
- Prefer not to answer

What are some reasons it may be difficult to take daily oral PrEP every single day?

- Difficulty remembering
- Travel/migration
- Alcohol/drug use
- Fear that my spouse/other non-commercial partner might find out
- Fear that other sex workers might find out
- Fear that my clients might find out
- Fear that other people might find out
- Prefer not to answer

If you were to get PrEP, where would you prefer to get PrEP?

- Public facility
- Private facility
- Drug store/pharmacy
- Peer educator
- Other: _____
- Prefer not to answer

Another form of PrEP that is being tested is an injection, or a shot, every 3 months – instead of a pill by mouth every day.

If found to be effective, how interested would you be in taking injectable PrEP?

- Very interested
- Somewhat interested
- Neutral
- Somewhat uninterested
- Very uninterested
- Don't know
- Prefer not to answer

How difficult do you think it would be to return for an injection every 3 months?

- Very difficult
- Somewhat difficult
- Neither difficult nor easy
- Somewhat easy
- Very easy
- Don't know
- Prefer not to answer

A third form of PrEP that is being tested is a gel (like a lubricant) that you insert into your vagina.

If found to be effective, how interested would you be in taking PrEP as a vaginal gel?

- Very interested
- Somewhat interested
- Neutral
- Somewhat uninterested
- Very uninterested
- Don't know
- Prefer not to answer

How difficult do you think it would be to apply the gel before sex?

- Very difficult
- Somewhat difficult
- Neither difficult nor easy
- Somewhat easy
- Very easy
- Don't know
- Prefer not to answer

A fourth form of PrEP that is being tested is a vaginal ring that you insert into your vagina once per month.

If found to be effective, how interested would you be in taking PrEP as a vaginal ring?

- Very interested
- Somewhat interested
- Neutral
- Somewhat uninterested
- Very uninterested
- Don't know
- Prefer not to answer

How difficult do you think it would be to remember to replace the ring each month?

- Very difficult
- Somewhat difficult
- Neither difficult nor easy
- Somewhat easy
- Very easy
- Don't know
- Prefer not to answer

Of the four ways of taking PrEP, please tell me which you prefer the most and which the least? (Enter a 1 for the MOST preferred, and a 4 for the LEAST preferred method.

___ A daily oral pill
___ Quarterly (every 3 months) injection/shot
___ A gel (like a lubricant) that you insert into your vagina
___ A ring that you insert into your vagina

STROBE 2007 (v4) Statement—Checklist of items that should be included in reports of *cross-sectional studies*

Section/Topic	Item #	Recommendation	Reported on page #
Title and abstract	1	(*a*) Indicate the study's design with a commonly used term in the title or the abstract	1
		(*b*) Provide in the abstract an informative and balanced summary of what was done and what was found	2
Introduction			
Background/rationale	2	Explain the scientific background and rationale for the investigation being reported	5-6
Objectives	3	State specific objectives, including any prespecified hypotheses	6
Methods			
Study design	4	Present key elements of study design early in the paper	6-7
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection	6-7
Participants	6	(*a*) Give the eligibility criteria, and the sources and methods of selection of participants	7
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable	7
Data sources/ measurement	8*	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group	7
Bias	9	Describe any efforts to address potential sources of bias	7
Study size	10	Explain how the study size was arrived at	7
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why	7
Statistical methods	12	(*a*) Describe all statistical methods, including those used to control for confounding	7
		(*b*) Describe any methods used to examine subgroups and interactions	7
		(*c*) Explain how missing data were addressed	n/a
		(*d*) If applicable, describe analytical methods taking account of sampling strategy	n/a
		(*e*) Describe any sensitivity analyses	n/a
Results			

Participants	13*	(a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed	8
		(b) Give reasons for non-participation at each stage	n/a
		(c) Consider use of a flow diagram	n/a
Descriptive data	14*	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders	8 & Table 1
		(b) Indicate number of participants with missing data for each variable of interest	Table 1
Outcome data	15*	Report numbers of outcome events or summary measures	8-9
Main results	16	(*a*) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included	9-10
		(*b*) Report category boundaries when continuous variables were categorized	n/a
		(*c*) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period	n/a
Other analyses	17	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses	n/a
Discussion			
Key results	18	Summarise key results with reference to study objectives	10-11
Limitations	19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias	11
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence	11
Generalisability	21	Discuss the generalisability (external validity) of the study results	11
Other information			
Funding	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based	16

*Give information separately for cases and controls in case-control studies and, if applicable, for exposed and unexposed groups in cohort and cross-sectional studies.

Note: An Explanation and Elaboration article discusses each checklist item and gives methodological background and published examples of transparent reporting. The STROBE checklist is best used in conjunction with this article (freely available on the Web sites of PLoS Medicine at http://www.plosmedicine.org/, Annals of Internal Medicine at http://www.annals.org/, and Epidemiology at http://www.epidem.com/). Information on the STROBE Initiative is available at www.strobe-statement.org.