

# BMJ Open Acceptability of multiple modalities of pre-exposure prophylaxis (PrEP) among female sex workers in Tanzania: a mixed-methods study

S Wilson Beckham ,<sup>1</sup> Andrea Mantsios,<sup>2</sup> Noya Galai,<sup>3</sup> Samuel Likindikoki,<sup>4</sup> Jessie Mbwambo,<sup>4</sup> Wendy Davis,<sup>5</sup> Deanna Kerrigan<sup>5</sup>

**To cite:** Beckham SW, Mantsios A, Galai N, *et al.* Acceptability of multiple modalities of pre-exposure prophylaxis (PrEP) among female sex workers in Tanzania: a mixed-methods study. *BMJ Open* 2022;**12**:e058611. doi:10.1136/bmjopen-2021-058611

► Prepublication history for this paper is available online. To view these files, please visit the journal online (<http://dx.doi.org/10.1136/bmjopen-2021-058611>).

Received 26 October 2021  
Accepted 29 July 2022



© Author(s) (or their employer(s)) 2022. Re-use permitted under CC BY-NC. No commercial re-use. See rights and permissions. Published by BMJ.

For numbered affiliations see end of article.

## Correspondence to

Dr S Wilson Beckham;  
s.wilson.beckham@ju.edu

## ABSTRACT

**Objectives** Modalities of pre-exposure prophylaxis (PrEP) for HIV prevention offer options to women at high risk including female sex workers (FSW). This study aimed to explore FSW's acceptability and preferences for oral pills, long-acting (LA) injectable and vaginal ring PrEP.

**Design** Sequential, explanatory, mixed methods.

**Setting** Iringa, Tanzania.

**Participants** FSW aged above 18 were recruited from sex work venues using time-location sampling (n=496); HIV-uninfected (n=293) were included in this analysis. Subsequently, survey participants were recruited for in-depth interviews (n=10) and two focus group discussions (n=20).

**Primary outcome measures** (1) Acceptability of PrEP (Do you personally think it would be worth it to you to take ART if it could prevent HIV?: yes/no) and (2) preference for LA injectable versus oral pills (If you personally were going to take ART to prevent HIV infection, would you prefer to take it in the form of a daily pill or an injection once every 3 months? Injection/pill).

**Results** Participants were (92%) unaware of PrEP but 58% thought it would be worth it to personally take PrEP. Acceptability of PrEP was significantly associated with higher social cohesion (aOR 2.12; 95% CI 1.29 to 3.50) and STI symptoms in the past 6 months (aOR 2.52; 95% CI 1.38 to 4.62). Most (88%) preferred LA vs oral PrEP.

Qualitative findings revealed generally positive reactions to all types of PrEP, and they were viewed as a welcome backup to condoms. Participants had concerns about pills (burden of daily use, stigma from clients), and the vaginal ring (fear of client noticing and becoming suspicious, fear of infertility) and overall preferred LA-PrEP (less frequent use, easy to hide, belief in higher efficacy).

**Conclusions** Offering multiple formulations of PrEP within the context of community-driven HIV prevention interventions among FSW may facilitate increased uptake and adherence. LA injectable PrEP may be a particularly preferred formulation among FSW.

**Trial registration number** NCT02281578.

## INTRODUCTION

The global prevalence of HIV among female sex workers (FSW) is estimated to be 10.4% and FSW have a significantly heightened

## STRENGTHS AND LIMITATIONS OF THIS STUDY

- ⇒ This analysis used a sequential, explanatory mixed-methods design, triangulating survey and interview data.
- ⇒ This study was embedded in a parent project, a community-randomised controlled trial with years of developing relationships with community members, including a community advisory board made up of female sex workers.
- ⇒ Participants did not have the opportunity to actually try pre-exposure prophylaxis products, but were shown pictures, given explanation and given opportunity to ask questions.

risk of being infected with HIV compared with women overall.<sup>1</sup> Sub-Saharan Africa (SSA) has the highest regional HIV prevalence among FSW (36.9%), and accounts for 98 000 HIV-related deaths per year.<sup>2</sup> While condoms are an important prevention tool for FSW, many FSW are unable to demand or negotiate consistent condom use with their clients and other partners, given gendered power dynamics, financial insecurity, stigma, discrimination, and violence.<sup>3-5</sup> Given the high burden of HIV among FSW, especially in SSA, and these sociostructural barriers, identifying alternative HIV prevention options is an urgent priority.

Pre-exposure prophylaxis (PrEP) is an efficacious biomedical intervention,<sup>6</sup> and is a promising though neglected tool for HIV prevention for cisgender women, and in particular, for FSW.<sup>7,8</sup> PrEP formulations include oral tablets, long-acting (LA) injectables, and cervical rings have all been shown to reduce HIV incidence among women,<sup>6,9,10</sup> potentially creating multiple PrEP options akin to contraceptive choices.<sup>11</sup> The various attributes of these different PrEP modalities may influence FSW's preferences as they differentially assist to overcome issues with

access, stigma, and adherence.<sup>12–14</sup> For example, women may prefer LA formulations because of less frequent dosing, privacy, or ease of use,<sup>15 16</sup> or multipurpose products that also prevent pregnancy.<sup>17</sup>

While different modalities of PrEP administration may assist in overcoming challenges with behavioural HIV prevention methods such as male condoms, PrEP overall has been called a ‘biobehavioural’ prevention strategy, since it still requires good adherence to be effective.<sup>18 19</sup> Adherence to PrEP in trial settings in Africa has been relatively low.<sup>12 13</sup> Thus, it is essential that rigorous formative research<sup>20</sup> be conducted to identify optimal FSW-focused PrEP delivery strategies, drug formulations, and approaches<sup>21–25</sup> that address the needs and preferences of FSW and that reaffirm FSW’s dignity, rights, and choices.<sup>23 26 27</sup> Community-driven responses to HIV where sex worker communities take the lead in addressing social and structural factors have shown to be effective in reducing HIV risk and improving care continuum outcomes<sup>28–31</sup> and provide potential opportunities to implement PrEP in tailored programmes responsive to FSW’s needs and preferences. This formative research employed quantitative and qualitative methods to explore FSW’s needs and preferences in relation to three distinct forms of PrEP to help inform community-driven strategies among sex worker communities.

## METHODS

This is a sequential, explanatory, mixed-methods study<sup>32</sup> embedded in a longitudinal cohort of FSW participating in Project Shikamana, a community-randomised trial of a community empowerment-based combination HIV prevention intervention in Iringa, Tanzania.<sup>33</sup> The quantitative phase involved a secondary analysis of baseline survey data from the Project Shikamana cohort, collected in October 2015–April 2016. The qualitative phase involved explanatory follow-up in-depth interviews (IDI) and focus group discussions (FGD) with select cohort participants, collected in August–November 2017. Before participation, oral informed consent was obtained from all participants separately for quantitative and qualitative data collection.

### Patient and public involvement

A community advisory board consisting of 10 FSW from the community was convened to provide feedback and advice on conduct of the parent study.

### Quantitative methods

The methods, cohort demographic characteristics, and baseline survey results of Project Shikamana are published elsewhere.<sup>33</sup> In brief, 496 FSW were recruited from sex work venues using time-location sampling, tested for HIV, and surveyed in two communities. This analysis uses survey data from the 293 women in the sample who were HIV seronegative. The survey measured demographic, behavioural, and sociostructural factors related to sex work and HIV prevention and treatment.

### Quantitative outcomes and correlates

The primary outcome of this substudy was overall acceptability of PrEP. The parent study survey included five questions designed to assess awareness and acceptability of PrEP as well as preferences for oral versus injectable formulations: (1) Have you heard about the use of ART to reduce the risk of HIV infection in HI-negative people? (2) What do you think about the idea of someone using ART to prevent becoming infected with HIV? (3) If a friend or family member told you they were interested in taking ART to prevent HIV, would you support that decision? (4) Do you personally think it would be worth it to you to take ART if it could prevent HIV? (5) If you personally were going to take ART to prevent HIV infection, would you prefer to take it in the form of a daily pill or an injection once every 3 months? The first three were asked of all participants regardless of HIV status, while all five questions were asked of participants who were HIV-negative by self-report. This analysis uses question 4 (personally worth it to take PrEP: yes/no) and question 5 (preference for LA injectable vs pill form of PrEP) as the primary outcomes.

Sociodemographic variables include participants’ age (dichotomised at the median age of 30 years); education level (primary school or less vs some secondary or more); marital/cohabitation status (not currently married/living with partner vs married/lives with partner); study recruitment community; ethnicity (from local ethnic groups vs ethnicities from other regions); and number of children (0–1 vs ≥2); economic status (overall income and average amount per client, both dichotomised at the median). Health-related factors that were theorised to be associated with acceptability of PrEP included contraception use (injectable modern method vs non-injectable modern methods) and history of sexually transmitted infections (STI) (symptoms or diagnosis within past 6 months).

Sex work-related and sociostructural variables included venue type (modern bar vs local brew pub/hotel/guest-house); number of clients per week (<3 vs ≥3); mobility (travelled away from home for work in the past 6 months); years in sex work (dichotomised at the median, <7 vs ≥7); substance use in the venue (never vs any use); substance use during sex exchange (within the past 30 days); consistent condom use (always use with all client/partner types in past 30 days); a sex work stigma scale (dichotomised at the median score of 38); experience of gender-based violence (GBV) (physical or sexual, ever); and a social cohesion scale (dichotomised at the median score of 21). The social cohesion measure is a 10-item scale developed by Kerrigan *et al*.<sup>34</sup> from a study among FSW in Brazil which includes questions with a five-point Likert-scale response (1=strongly disagree; 2=disagree; 3=agree; 4=strongly agree; 0=do not know) assessing agreement with statements related to trust, solidarity, and reciprocity among FSW. This composite measure was included in the parent study to assess social cohesion within the FSW community and detect differences related to exposure to the intervention and was used in this study to examine

the role of social cohesion in PrEP decision making. Aggregate measures (sex work stigma, social cohesion) used previously validated scales, while the GBV measures were adapted from previous work (see Project Shikamana baseline publication).<sup>33</sup>

### Quantitative data analysis

The frequencies and proportions of the yes/no responses to PrEP awareness and acceptability questions were calculated, and bivariate associations tested by using  $\chi^2$  tests. Variables that were significant at a  $p < 0.10$  in bivariate analysis were retained in multivariate models with outcomes questions 4 ('worth it to take PrEP') and 5 ('injectable vs pill form'). Covariates were eliminated using backwards stepwise regression until only covariates significant at the  $p < 0.05$  level remained in the final model.

### Qualitative methods

Following analysis of quantitative data, a sampling frame of cohort members was identified. The sampling frame listed cohort members with their responses on variables that were significant correlates of PrEP acceptability in multivariate analysis, along with their answers to question four about acceptability (worth it to take PrEP) and question five about preference (injectable or pill form). This sampling frame was used to invite participation from cohort members who would represent a range of answers across the outcomes (PrEP acceptability and injectable vs pill form), their significant correlates, and study recruitment community. These women were contacted and asked if they would be interested in hearing more about the qualitative substudy. If they were, they came to the study office where they were given more information, and if willing to participate, provided informed consent and were interviewed or enrolled for FGD participation. The sampling frame was used throughout recruitment to achieve a purposive sample of 10 women for IDI and 20 women to participate in two FGD (consisting of 10 women each). Based on guidelines for qualitative sample sizes,<sup>35</sup> we considered 10 IDI participants and 20 FGD participants to be sufficient to elicit perspectives on PrEP preferences given the more structured nature of the questions asked in this substudy.

To be eligible for the qualitative phase, participants had to be a cohort member, be in or near the study communities at the time of recruitment for the qualitative substudy, and give informed consent specifically for participating in qualitative research. For IDI, the sample was further limited to women who had HIV-negative serostatus at baseline (and had not since seroconverted, by self-report). For FGD, both HIV-uninfected and HIV-infected women were recruited to elicit the opinions of women who would not be eligible to take PrEP but nevertheless may have strong feelings about the concept; HIV status was not asked nor revealed during FGD.

The interviews were conducted by an experienced research assistant who had already established rapport with the participants; she was given additional topical

training on PrEP before conducting the interviews. The IDI and FGD were conducted with an interviewer/facilitator guide, which covered certain themes and included probes but also allowed for flexibility to follow topics that were of interest to participants. The guide began with interviewer/facilitator explaining the concept of PrEP, and stressing that it requires good adherence, necessitates HIV screening to establish the user is and stays negative, and that PrEP was not yet available in Tanzania. The participants were then invited to ask any questions about PrEP, and these questions and subsequent discussion were considered data for analysis.

For each of three formulations of PrEP in turn (oral pill, injectable, cervical ring), the interviewer asked for general impressions; advantages and disadvantages; and potential challenges for sex workers, including stigma and adherence. Next, she showed pictures of the different PrEP formulations and asked for additional impressions and thoughts, especially if they had changed after seeing the pictures. Participants were then asked about willingness to use (for themselves and other sex workers); suggested changes in appearance, size or packaging; potential impact on condom use; and what location they would prefer to access PrEP (e.g., government facility, drop-in-centre).

### Qualitative data analysis

IDI and FGD were audiorecorded with permission of the participants. The first author and the interviewer debriefed after each interview and focus group, and discussed themes that arose. The interviewer wrote memos after each session to highlight key themes, record any technical issues, and suggest changes to probes for future interviews and focus groups. All recordings were transcribed verbatim, translated to English, checked for accuracy, and thematically coded using Atlas.ti. Analytical memos were produced from the code output to synthesise findings across transcripts and aide in the identification of most salient themes. Relevant codes were organised under themes and illustrative quotes were extracted for each theme.

Oral informed consent was obtained from all participants prior to their participation. Oral consent was used given that documenting signatures when working with marginalised population groups, such as sex workers, may be off-putting to participants and create additional possible risk. All participants were compensated the local equivalent of US\$5 in accordance with community standards of practice in the respective settings for their participation in this study.

## RESULTS

### Quantitative phase

Of all survey participants, 92% reported being unaware of PrEP (Question 1:  $n=269/293$ ), just under half of the participants thought PrEP was a good idea (Question 2:  $n=144/293$ , 49.15%) and slightly more would support a

friend taking PrEP (Question 3:  $n=215/281$ , 55.87%). Data on the primary outcome (interest in taking PrEP) and the bivariate associations with demographic, health, and structural factors are shown in [table 1](#). For the acceptability question about PrEP being personally worth it to take, 58% of sample agreed ( $n=167/289$ ) ([table 1](#)). These women were significantly more likely to have had STI symptoms or diagnosis in the past 6 months (OR 2.50; 95% CI 1.38 to 4.54); use alcohol or other substances during the sex exchange in the past 30 days (OR 1.88; 95% CI 1.20 to 2.96) and have higher social cohesion scores (OR 3.33; 95% CI 2.46 to 3.61). The multivariate model of acceptability of taking PrEP, controlling for covariates that were significant at  $p<0.10$  in bivariate analysis, is shown in [table 2](#). In multivariate analysis, acceptability of PrEP was significantly associated with having had symptoms or diagnosis of an STI in the past 6 months (aOR 2.52; 95% CI 1.38 to 4.62,  $p=0.003$ ) and with higher social cohesion scores (aOR 2.12; 95% CI 1.29 to 3.50,  $p=0.003$ ). For LA injectable PrEP (LA-PrEP) versus oral daily PrEP, 87.63% of the sample preferred LA-PrEP ( $n=248/283$ ). In bivariate analysis, preferring LA-PrEP was marginally associated with longer time in sex work ( $\chi^2 p=0.099$ ), but no other factors.

### Qualitative phase

Participants were purposively sampled to achieve a mix of the characteristics identified in the quantitative phase for IDI. Half of the IDI participants had indicated in their survey responses that PrEP would be acceptable, and half had indicated it unacceptable. Age ranged from 21 to 41 years (median 29.5). Seven of 10 were in the intervention vs comparison arm of the trial. Likewise, seven were of local ethnicities (e.g., Hehe) while the others were of other ethnicities not from the region. Only two did not use alcohol during encounters with clients, and eight did consume alcohol. Three had STI symptoms or diagnosis in the past 6 months, while seven had no STI symptoms or diagnosis.

Participants in IDIs and FGDs reacted mostly positively to the idea of an HIV prevention medicine. Recognising their personal HIV risk levels as sex workers who cannot always rely on clients to use condoms, participants were eager to have PrEP available to them. As one participant said about making PrEP available to FSW, ‘they should come tomorrow even, today even!’ followed by ‘It means we will be safe’ (IDI 9). Even when individual participants may have been reluctant to use PrEP, all women felt that PrEP in any form would be ‘good’ and ‘helpful’ as an HIV prevention tool, as exemplified in this quote, ‘I would just like that all of them be available, because each person chooses for herself...the injection, the pills, or the ring’ (IDI 2).

Participants articulated the pros and cons of the various PrEP formulation types ([table 3](#)). For all types, women emphasised the HIV prevention benefit, but also worried about potential side effects. While the injectable was

highly preferred for various reasons shown in [table 3](#), most were willing to use other types as well.

Three key themes unique to FSW’s hypothetical PrEP use that emerged from the data were around sex workers’ spontaneity and mobility, HIV and sex work-related stigma, and the relationship of PrEP with condom use.

A common characteristic of participants’ sex work was spontaneous short-term and long-term trips away from home with clients, often with no time to pack a bag. FSW felt that injectable PrEP was the type most likely to fit seamlessly into this reality. With pills, they may not have a chance to grab and bring them along.

As a working woman [term used for sex worker], I am very mobile. Today I’m in Iringa, tomorrow I’m in Tunduma [hundreds of kilometers west], the day after I’m in rural Ifakara [hundreds of kilometers southeast]. So I know if I get my injection, I have my two months to go there. I know it’s not until the next month that I go get the injection and then return again out there (IDI 3).

Participants feared that if clients (or partners) found their PrEP pills, they would mistake them for treatment and assume they are living with HIV. In such cases, women feared a client might accuse them of giving him HIV and become violent, or at least spread rumours about them.

You’re carrying those pills...If he sees them, right there he can already say bad things about you, right? He leaves, outing you, [saying], ‘That lady, I saw that woman, I saw her with pills, that woman...she’s sick [with HIV]!’ So already, this is stigma...Or he can beat you (IDI 3).

Participants saw PrEP as a welcome backup to condom use, in case the client refused to use one, used force, became violent at the suggestion of use, offered more money for condomless sex, or if the condom broke. Others emphasised that they would not reduce their condom use, because PrEP prevents HIV, but not other STI nor pregnancy.

There will still be condom use just the same, because condoms prevent many things. Condoms prevent pregnancy, STI, different from this [PrEP]. I believe this prevents only AIDS, but you will still get other diseases. So, I would use this [PrEP injection], but I would still definitely use condoms also (IDI 6).

### DISCUSSION

Findings from this research provide insight into tailoring PrEP roll out for FSW to best address the needs and preferences of this population. At baseline, HIV prevalence in this cohort was 41%, condom use was low, and GBV and alcohol use were common,<sup>33</sup> which highlights the urgent priority for prevention services such as PrEP to be integrated into a comprehensive approach to addressing HIV in this population. However, FSW in this study were

**Table 1** Bivariate associations: demographic, behaviour, and sociostructural factors and PrEP acceptability among FSW

Variable	Total	Interest in taking PrEP (n=289)		p-value*
	n (%)	Yes n (%)	No n (%)	
Total HIV-negative sample	293 (100)	167 (57.7)	122 (42.41)	–
Demographics				
Age				0.207
≤30	250 (85.32)	139 (83.23)	108 (88.52)	
>30	43 (14.68)	28 (16.77)	4 (11.48)	
Education				0.510
Primary or less	190 (64.85)	106 (63.47)	82 (67.21)	
Some secondary or more	103 (35.15)	61 (36.53)	40 (32.79)	
Currently married/partnered				0.226
No	230 (78.50)	127 (76.05)	100 (81.97)	
Yes	64 (21.5)	40 (23.95)	22 (18.03)	
Community				0.753
Ilula	150 (51.19)	88 (52.69)	62 (50.82)	
Mafinga	143 (48.81)	121 (48.79)	16 (45.71)	
Ethnicity				0.824
Non-local	122 (41.64)	69 (41.32)	52 (42.62)	
Local ethnicities	171 (58.36)	98 (58.68)	70 (57.38)	
Children				0.416
0–1	139 (47.44)	82 (49.10)	54 (44.26)	
2 or more	154 (52.56)	85 (50.90)	68 (55.74)	
Overall income				0.111
≤Tsh120 000/month	140 (47.78)	87 (52.10)	52 (42.62)	
>Tsh120 000/month	153 (52.22)	80 (47.90)	70 (57.38)	
Average amount per client				0.924
<Tsh15 000/exchange	119 (40.61)	68 (40.72)	49 (40.16)	
≥Tsh15 000/exchange	174 (59.39)	99 (59.28)	73 (59.84)	
Health related				
Modern contraception use (ever)				0.280
Non-injectable method	156 (65.82)	81 (62.79)	73 (69.52)	
Injectable method	81 (34.18)	48 (37.21)	32 (30.48)	
STI, past 6 months				<b>0.002</b>
No	217 (74.06)	112 (67.07)	102 (83.61)	
Yes	76 (25.94)	55 (32.93)	20 (16.39)	
Socio-structural				
Venue type				0.909
Local pub, hotel, guesthouse	150 (51.19)	86 (51.50)	62 (50.82)	
Modern bar	143 (48.81)	81 (48.50)	60 (49.18)	
No clients/ week				<b>0.105</b>
<3	185 (63.14)	98 (58.68)	83 (68.03)	
≥3	108 (36.86)	69 (41.32)	39 (31.97)	
Work mobility, past 6 months				0.815
No	160 (56.54)	91 (57.23)	67 (55.83)	
Yes	123 (43.46)	68 (42.77)	53 (44.17)	
Years in sex work				0.185

Continued

**Table 1** Continued

Variable	Total	Interest in taking PrEP (n=289)		p-value*
	n (%)	Yes n (%)	No n (%)	
<7	209 (71.33)	114 (68.26)	92 (75.41)	
≥7	84 (28.67)	53 (31.74)	30 (24.59)	
Substance use in venue, ever				0.316
Never	96 (32.99)	51 (30.72)	44 (36.36)	
Any	195 (67.01)	115 (69.28)	77 (63.64)	
Substance use during sex exchange, past 30 days				<b>0.009</b>
Never	133 (45.70)	65 (38.92)	66 (54.55)	
Any	158 (54.30)	102 (61.08)	55 (45.45)	
Consistent condom use				0.136
Inconsistent	246 (83.96)	145 (96.83)	98 (80.33)	
Consistent	47 (16.04)	22 (13.17)	24 (18.67)	
SW stigma score				0.522
Low stigma (≤38)	154 (53.29)	92 (55.09)	61 (51.26)	
High stigma (>38)	135 (46.71)	75 (44.91)	58 (48.74)	
Physical/sexual violence, ever				0.506
No	148 (50.51)	81 (48.50)	64 (52.46)	
Yes	145 (49.49)	86 (51.50)	58 (47.54)	
Social Cohesion Score				<b>0.001</b>
Low cohesion (≤21)	166 (58.04)	82 (50.31)	83 (69.17)	
High cohesion (>21)	120 (41.96)	81 (49.69)	37 (30.83)	

**Bold**=statistically significant at p<0.10 level and included in full multivariate model.

\* $\chi^2$  p values.

FSW, female sex workers; PrEP, pre-exposure prophylaxis; STI, sexually transmitted infection.

overwhelmingly unaware of PrEP, echoing findings from other settings in which awareness of PrEP among FSW was low,<sup>36 37</sup> and highlighting the critical first step of ensuring sex workers are informed and empowered to make decisions around PrEP and whether it may be a good option for them. The Global Network of Sex Work Projects has called for strengthening the capacity of sex worker organisations in educating their communities on PrEP in order to ensure that sex workers have access to accurate knowledge and information and these findings only further underscore this point.<sup>26</sup>

An important finding of this research is that PrEP acceptability among survey participants was associated with having a higher social cohesion score, highlighting the appropriateness of a community-empowerment based approach to PrEP roll-out among FSW. The link between PrEP acceptability and a sense of social cohesion among this sample suggests a greater comfort level with a new HIV prevention technology among women who feel a sense of collectivism with their fellow sex workers. Community-empowerment approaches among FSW are based on promoting solidarity, social cohesion, and mutual trust, all of which serve as mechanisms through which individual and collective empowerment are achieved.<sup>38–42</sup> An empowered FSW community with a

sense of social cohesion and trust is the optimal dynamic in which PrEP can be implemented ensuring that sex workers are educated and empowered to make decisions, and inform the process of roll-out. PrEP demonstration projects with FSW, including those from lower-income settings, have already shown the critical role community engagement plays in educating, generating demand, dispelling rumours, and supporting PrEP adherence among this key population.<sup>43</sup>

It is important to consider the influence of the larger intervention trial in shaping the relationship we detected between social cohesion and PrEP acceptability. At the time of qualitative interviews, participants reported having never heard of PrEP before. However, because this sample was enrolled in a community-empowerment-based HIV prevention trial, participants were exposed to a framework in which sex workers cultivate a sense of social cohesion and solidarity as they work together to address soci0structural barriers to their health and well-being. This framework and the social cohesion created as part of the intervention may have provided participants with an ideal view of what using PrEP might look and feel like that is not translatable to sex workers in other contexts where there is no knowledge of or exposure to social cohesion and community empowerment among sex workers.

**Table 2** Multivariate regression model of PrEP acceptability among FSW

Variable	Interest in taking PrEP			
	cOR (95% CI)	p-value*	aOR (95% CI)	p-value
STI, past 6 months		<b>0.002</b>		<b>0.003</b>
No	Ref.		Ref.	
Yes	<b>2.50 (1.38 to 4.54)</b>		<b>2.52 (1.38 to 4.62)</b>	
No clients per week		0.106		–
<3	Ref.		–	
>3	1.50 (0.92 to 2.45)		–	
Years in sex work				–
<7	–	–	–	
>7	–	–	–	
Substance use during sex exchange, past 30 days		<b>0.006</b>		–
Never	Ref.		–	
Any	<b>1.88 (1.20 to 2.96)</b>		–	
Social cohesion		<b>0.001</b>		<b>0.003</b>
Low cohesion ( $\leq 21$ )	Ref.		Ref.	
High cohesion ( $>21$ )	<b>3.33 (2.46 to 3.61)</b>		<b>2.12 (1.29 to 3.50)</b>	

**Bold**=statistically significant at  $p < 0.05$  level.  
 \*Logistic regression, accounting for clustering by venue.  
 aOR, adjusted odds ratio; cOR, crude odds ratio; FSW, female sex workers; PrEP, pre-exposure prophylaxis; STI, sexually transmitted infection.

It is also worth noting that there was a substantial proportion of participants who were not personally interested in PrEP and this too warrants further discussion. As mentioned, our findings highlight the appropriateness of a community empowerment approach which

is based in the principle that sex workers should have options and make their own decisions about their health and well-being as opposed to interventions which direct behaviour. Thus, the introduction and roll-out of PrEP among sex worker communities should not be focused

**Table 3** Comparative acceptability of distinct PrEP formulations among FSW

	Oral pill	Vaginal ring	Injectable
Pros	Familiarity with pills	Less frequent use (Monthly)	Less frequent use (Quarterly or bimonthly) Easy to hide from partners and clients Familiarity with injections, especially for family planning Belief in power and efficacy of injections over ingested medicines Fits with spontaneity and mobility of work; nothing to bring or forget on trips
Cons	Daily use Dislike of swallowing pills Easy to forget to take, especially if drinking at work Clients may see it, assume she is HIV+ and become violent Fear of interactions with alcohol	Placement in vagina She may feel or notice it Clients may feel or notice it and be suspicious Displacements during sex ('Pushed into' or fall out of body) Fear of infertility, changes to menstruation	Inability to clear it quickly from the body if there are side effects Discomfort with needles

FSW, female sex workers; PrEP, pre-exposure prophylaxis.



on persuading everyone to want to take PrEP but rather ensuring everyone has information about PrEP as an HIV prevention option so they can make an empowered decision around if PrEP is right for them. The goal would then be to ensure that those reporting they were not interested in PrEP were engaged in peer education and provided adequate information to make informed decisions around PrEP.

The role of social cohesion in community empowerment approaches among FSW has historically focused on creating an enabling environment for behavioural HIV prevention interventions such as the promotion of consistent condom use.<sup>44</sup> More recently, these strategies have begun to incorporate biomedical intervention components.<sup>45</sup> However, to date, there has been little research on integrating PrEP for FSW into a comprehensive, community-driven approach to HIV prevention.<sup>20</sup> Findings from this study support leveraging the strengths of a rights-based, community empowerment approach<sup>44</sup> focused on stimulating social cohesion and collective action to challenge structural constraints, such as sex work stigma that inhibit PrEP access and adherence.

PrEP acceptability among survey respondents was also associated with recent STI symptoms or diagnosis, suggesting women who may be more conscious of their HIV risk were particularly interested in this prevention option. Interview and focus group participants articulated recognition of their personal HIV risk levels as sex workers who cannot always rely on clients to use condoms and were eager to have PrEP available to them. As has been acknowledged in the literature, for HIV-negative FSW who are unable to use condoms consistently and are motivated to take PrEP and adhere to clinical monitoring, PrEP is likely to be both empowering and protective.<sup>23</sup>

Many FSW in this study emphasised they would not reduce condom use if on PrEP, and available data in the literature supports this, showing no evidence of risk compensation among FSW on PrEP. PrEP demonstration studies with FSW in Africa have documented no increase in unprotected sex<sup>46</sup> and significant decreases in STI over time, suggesting reductions in unprotected sex.<sup>46 47</sup> Participants in our study were attune to the importance of continued condom use to prevent STI and unintended pregnancy. Indeed, growing attention is being given to LA-PrEP integration with family planning services<sup>48</sup> and prior research indicates women's interest in new HIV prevention technologies that would be highly effective in both preventing HIV and pregnancy.<sup>17</sup> Women in multiple studies have shown strong interest in and willingness to use a vaginal ring that prevents both HIV and pregnancy,<sup>44 45 49</sup> which is currently in clinical trials.<sup>50</sup> Given the expressed interest in such multipurpose products, the prospect of integrated HIV and pregnancy prevention options is also an important area for future research.

More than three-quarters (88%) of surveyed participants in this study preferred the idea of an LA-PrEP formulation to the idea of taking daily pills. LA-PrEP was

seen by interview and focus group participants as fitting into the reality of spontaneous trips away from home with clients. Prior research examining mobility among this cohort revealed 33% of participants reported recently exchanging sex for money outside of their district or region, and 12% were both intraregionally and inter-regionally mobile for sex work.<sup>51</sup> Given high levels of mobility, often including spontaneous travel with clients as part of their work, LA-PrEP could have an important role for FSW in Tanzania, as well as other countries with similar dynamics, as part of comprehensive HIV prevention services that fit into the occupational demands of sex work.

Findings from HIV Prevention Trial Network 084 indicate that LA-PrEP is more effective than daily oral PrEP (emtricitabine/tenofovir) for preventing HIV among cisgender women.<sup>52 53</sup> Given indicated preference by some FSW and now compelling data on superior efficacy among women, LA-PrEP warrants significant attention as an HIV prevention option for FSW. Many of the questions and concerns that have been raised by the global FSW community around PrEP in general including safety and accessibility<sup>54</sup> must be taken into account to ensure thoughtful planning for LA-PrEP roll out that is responsive to the rights, dignity, and choices of FSW.

This study has several limitations including the cross-sectional nature of the study design and the fact that questions pertaining to PrEP were secondary to the primary purpose of data collection. Additionally, since there was overwhelmingly no knowledge of PrEP among this population, participants' perspectives were based on having PrEP described to them for the first time just moments before being asked their thoughts on it. Thus, they may not have had a chance to fully consider all factors of importance to them which could have elicited more depth in their responses. Another limitation is the potential for social desirability bias among this sample given that the women were part of a larger cohort enrolled in a community-empowerment based combination HIV prevention intervention trial which was designed to promote social cohesion and included exposure to HIV prevention messaging that could have influenced perspectives on PrEP. Another limitation was not including women who might not be interested in PrEP or who might be most interested in the vaginal ring to provide these additional perspectives. Finally, the participants of this study were from a particular setting of rural/small urban, agricultural areas and results may not be generalisable to sex workers in other settings.

## CONCLUSION

PrEP for HIV prevention holds significant promise as part of a comprehensive package of HIV services for FSW in SSA and globally. Educating and empowering FSW with knowledge of PrEP and the advantages and disadvantages of the distinct forms will be an important step in supporting FSW to identify appropriateness of fit within



the specific circumstances of their work and lives. Offering multiple formulations of PrEP within the context of community-driven efforts to support social cohesion and reduce stigma may facilitate PrEP uptake and adherence and ultimately reduce HIV incidence. Given the particular acceptability of LA-PrEP among FSW in this study, implementation research to ensure equitable access to LA-PrEP will also be a critical next step.

#### Author affiliations

<sup>1</sup>Health, Behavior and Society, Johns Hopkins Bloomberg School of Public Health, Baltimore, Maryland, USA

<sup>2</sup>Phia Consulting, New York, New York, USA

<sup>3</sup>Department of Epidemiology, Johns Hopkins University Bloomberg School of Public Health, Baltimore, Maryland, USA

<sup>4</sup>Psychiatry and Mental Health, Muhimbili University of Health and Allied Sciences, Dar es Salaam, Tanzania, United Republic of

<sup>5</sup>Department of Prevention and Community Health, George Washington University Milken Institute School of Public Health, Washington, DC, USA

**Acknowledgements** The study authors thank the Community Advisory Board, the Study Advisory Board, all the participants and study staff. Special thanks to Catherine Shembilu who conducted the qualitative interviews for this study.

**Contributors** SWB and AM drafted the manuscript. JM and SL oversaw quantitative data collection. SWB oversaw qualitative data collection, conducted analysis, and is responsible for the overall content. All authors approved of the completed manuscript. DK and JM were principal investigators of the parent project. NG provided statistical support. DK, WD and SWB conceived of the manuscript.

**Funding** Beckham received support from the National Institute of Mental Health (K01MH114715). This research was also funded in part by a 2016 developmental grant from the Johns Hopkins University Center for AIDS Research, an NIH funded program (P30AI094189), which is supported by the following NIH Co-Funding and Participating Institutes and Centers: NIAID, NCI, NICHD, NHLBI, NIDA, NIA, NIGMS, NIDDK, NIMHD. Kerrigan received support for the parent study from the NIMH (R01MH104044).

**Disclaimer** The content is solely the responsibility of the authors and does not necessarily represent the official views of the NIH.

**Competing interests** Several authors (SWB, DK, AM, WD) receive funding from Viiv Healthcare. The other authors report no other conflicts of interest.

**Patient and public involvement** Patients and/or the public were involved in the design, or conduct, or reporting, or dissemination plans of this research. Refer to the Methods section for further details.

**Patient consent for publication** Not applicable.

**Ethics approval** This study was approved by the ethical review boards of the Johns Hopkins Bloomberg School of Public Health in the USA (FWA0000287; Approval #5717), and the Muhimbili University of Health and Allied Sciences (2017-03-30/AEC/Vol.XII/76) and the National Institute for Medical Research (NIMR/HQ/R.8c/Vol. II/676) in Tanzania. Participants gave informed consent to participate in the study before taking part.

**Provenance and peer review** Not commissioned; externally peer reviewed.

**Data availability statement** Data are available on reasonable request.

**Open access** This is an open access article distributed in accordance with the Creative Commons Attribution Non Commercial (CC BY-NC 4.0) license, which permits others to distribute, remix, adapt, build upon this work non-commercially, and license their derivative works on different terms, provided the original work is properly cited, appropriate credit is given, any changes made indicated, and the use is non-commercial. See: <http://creativecommons.org/licenses/by-nc/4.0/>.

#### ORCID iD

S Wilson Beckham <http://orcid.org/0000-0002-9694-3091>

## REFERENCES

- Shannon K, Crago A-L, Baral SD, *et al*. The global response and unmet actions for HIV and sex workers. *Lancet* 2018;392:698–710.
- Prüss-Ustün A, Wolf J, Driscoll T, *et al*. HIV due to female sex work: regional and global estimates. *PLoS One* 2013;8:e63476.
- Chersich MF, Luchters S, Ntaganira I, *et al*. Priority interventions to reduce HIV transmission in sex work settings in sub-Saharan Africa and delivery of these services. *J Int AIDS Soc* 2013;16:17980.
- Beckham SW, Shembilu CR, Brahmabhatt H, *et al*. Female sex workers' experiences with intended pregnancy and antenatal care services in southern Tanzania. *Stud Fam Plann* 2015;46:55–71.
- Layer EH, Brahmabhatt H, Beckham SW, *et al*. "I pray that they accept me without scolding:" experiences with disengagement and re-engagement in HIV care and treatment services in Tanzania. *AIDS Patient Care STDS* 2014;28:483–8.
- Fonner VA, Dalgligh SL, Kennedy CE, *et al*. Effectiveness and safety of oral HIV preexposure prophylaxis for all populations. *AIDS* 2016;30:1973–83.
- McGillen JB, Anderson S-J, Hallett TB. Prep as a feature in the optimal landscape of combination HIV prevention in sub-Saharan Africa. *J Int AIDS Soc* 2016;19:21104.
- Mitchell KM, Prudden HJ, Washington R, *et al*. Potential impact of pre-exposure prophylaxis for female sex workers and men who have sex with men in Bangalore, India: a mathematical modelling study. *J Int AIDS Soc* 2016;19:2–10.
- 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;375:2121–32.
- Murray MI, Markowitz M, Frank I. *Tolerability and acceptability of Cabotegravir La injection: results from ECLAIR study*. Seattle: CROI, 2016.
- Delany-Moretwe S, Mullick S, Eakle R, *et al*. Planning for HIV preexposure prophylaxis introduction: lessons learned from contraception. *Curr Opin HIV AIDS* 2016;11:87–93.
- Marrazzo JM, Ramjee G, Richardson BA, *et al*. Tenofovir-based preexposure prophylaxis for HIV infection among African women. *N Engl J Med* 2015;372:509–18.
- Van Damme L, Corneli A, Ahmed K, *et al*. Preexposure prophylaxis for HIV infection among African women. *N Engl J Med* 2012;367:411–22.
- Haire BG. Preexposure prophylaxis-related stigma: strategies to improve uptake and adherence - a narrative review. *Hiv Aids* 2015;7:241–9.
- Luecke EH, Cheng H, Woeber K, *et al*. Stated product formulation preferences for HIV pre-exposure prophylaxis among women in the VOICE-D (MTN-003D) study. *J Int AIDS Soc* 2016;19:1–9.
- Eisingerich AB, Wheelock A, Gomez GB, *et al*. Attitudes and acceptance of oral and parenteral HIV preexposure prophylaxis among potential user groups: a multinational study. *PLoS One* 2012;7:e28238.
- Terris-Prestholt F, Hanson K, MacPhail C, *et al*. How much demand for new HIV prevention technologies can we really expect? results from a discrete choice experiment in South Africa. *PLoS One* 2013;8:e83193.
- Amico KR, Stirratt MJ. Adherence to preexposure prophylaxis: current, emerging, and anticipated bases of evidence. *Clin Infect Dis* 2014;59 Suppl 1:S55–60.
- Young I, McDaid L. How acceptable are antiretrovirals for the prevention of sexually transmitted HIV?: a review of research on the acceptability of oral pre-exposure prophylaxis and treatment as prevention. *AIDS Behav* 2014;18:195–216.
- Glasgow RE, Vinson C, Chambers D, *et al*. National Institutes of health approaches to dissemination and implementation science: current and future directions. *Am J Public Health* 2012;102:1274–81.
- Bekker L-G, Johnson L, Cowan F, *et al*. Combination HIV prevention for female sex workers: what is the evidence? *Lancet* 2015;385:72–87.
- Cáceres CF, O'Reilly KR, Mayer KH, *et al*. Prep implementation: moving from trials to policy and practice. *J Int AIDS Soc* 2015;18:20222.
- Cowan FM, Delany-Moretwe S. Promise and pitfalls of pre-exposure prophylaxis for female sex workers. *Curr Opin HIV AIDS* 2016;11:27–34.
- Cowan FM, Delany-Moretwe S, Sanders EJ, *et al*. Prep implementation research in Africa: what is new? *J Int AIDS Soc* 2016;19:21101.
- Venter WDF, Cowan F, Black V, *et al*. Pre-exposure prophylaxis in southern Africa: feasible or not? *J Int AIDS Soc* 2015;18:19979.
- Global Network of Sex Work Projects. *Global consultation: PreP and early treatment as HIV prevention strategies*, 2014.



- 27 Quaife M, Eakle R, Cabrera M, *et al.* Preferences for ARV-based HIV prevention methods among men and women, adolescent girls and female sex workers in gauteng province, South Africa: a protocol for a discrete choice experiment. *BMJ Open* 2016;6:e010682.
- 28 Kerrigan D, Donastorg Y, Barrington C, *et al.* Assessing and addressing social determinants of HIV among female sex workers in the dominican republic and Tanzania through community empowerment-based responses. *Curr HIV/AIDS Rep* 2020;17:88–96.
- 29 Kerrigan D, Kennedy CE, Morgan-Thomas R, *et al.* A community empowerment approach to the HIV response among sex workers: effectiveness, challenges, and considerations for implementation and scale-up. *Lancet* 2015;385:172–85.
- 30 Wirtz AL, Pretorius C, Beyrer C, *et al.* Epidemic impacts of a community empowerment intervention for HIV prevention among female sex workers in generalized and concentrated epidemics. *PLoS One* 2014;9:e88047-e.
- 31 Cowan FM, Reza-Paul S, Ramaiah M, *et al.* Strategies to promote the meaningful involvement of sex workers in HIV prevention and care. *Curr Opin HIV AIDS* 2019;14:401–8.
- 32 Creswell JW, Clark VLP. *Designing and conducting mixed methods research*. 2nd. Los Angeles: Sage Publications, Inc, 2011.
- 33 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:S60–8.
- 34 Kerrigan D, Telles P, Torres H, *et al.* Community development and HIV/STI-related vulnerability among female sex workers in rio de Janeiro, Brazil. *Health Educ Res* 2008;23:137–45.
- 35 Guest G, Namey E, Chen M. A simple method to assess and report thematic saturation in qualitative research. *PLoS One* 2020;15:e0232076.
- 36 Poon AN, Han L, Li Z, *et al.* Acceptability and willingness of HIV pre-exposure prophylaxis amongst female sex workers in China. *AIDS Care* 2019;31:1555–64.
- 37 Footer KHA, Lim S, Rael CT, *et al.* Exploring new and existing PrEP modalities among female sex workers and women who inject drugs in a U.S. City. *AIDS Care* 2019;31:1207–13.
- 38 Swendeman D, Basu I, Das S, *et al.* Empowering sex workers in India to reduce vulnerability to HIV and sexually transmitted diseases. *Soc Sci Med* 2009;69:1157–66.
- 39 Blankenship KM, West BS, Kershaw TS, *et al.* Power, community mobilization, and condom use practices among female sex workers in Andhra Pradesh, India. *AIDS* 2008;22 Suppl 5:S109–16.
- 40 Blanchard AK, Mohan HL, Shahmanesh M, *et al.* Community mobilization, empowerment and HIV prevention among female sex workers in South India. *BMC Public Health* 2013;13:234.
- 41 Reza-Paul S, Beattie T, Syed HUR, *et al.* Declines in risk behaviour and sexually transmitted infection prevalence following a community-led HIV preventive intervention among female sex workers in Mysore, India. *AIDS* 2008;22 Suppl 5:S91–100.
- 42 Cornish F, Shukla A, Banerji R, Persuading BR. Persuading, protesting and exchanging favours: strategies used by Indian sex workers to WIN local support for their HIV prevention programmes. *AIDS Care* 2010;22 Suppl 2:1670–8.
- 43 Reza-Paul S, Lazarus L, Jana S, *et al.* Community inclusion in PrEP demonstration projects: lessons for scaling up. *Gates Open Res* 2019;3:1504.
- 44 Griffin JB, Ridgeway K, Montgomery E, *et al.* Vaginal ring acceptability and related preferences among women in low- and middle-income countries: a systematic review and narrative synthesis. *PLoS One* 2019;14:e0224898.
- 45 Woodsong C, Holt JDS. Acceptability and preferences for vaginal dosage forms intended for prevention of HIV or HIV and pregnancy. *Adv Drug Deliv Rev* 2015;92:146–54.
- 46 Giguère K, Béhanzin L, Guédou FA, *et al.* PrEP use among female sex workers: no evidence for risk compensation. *J Acquir Immune Defic Syndr* 2019;82:257–64.
- 47 Eakle R, Gomez GB, Naicker N, *et al.* HIV pre-exposure prophylaxis and early antiretroviral treatment among female sex workers in South Africa: results from a prospective observational demonstration project. *PLoS Med* 2017;14:e1002444.
- 48 Bowring AL, Ampt FH, Schwartz S, *et al.* HIV pre-exposure prophylaxis for female sex workers: ensuring women's family planning needs are not left behind. *J Int AIDS Soc* 2020;23:e25442.
- 49 Woodsong C, Musara P, Chandipwisa A, *et al.* Interest in multipurpose prevention of HIV and pregnancy: perspectives of women, men, health professionals and community stakeholders in two vaginal gel studies in southern Africa. *BJOG* 2014;121 Suppl 5:45–52.
- 50 International Partnership for Microbicides. Dapivirine-Contraceptive ring. Available: <https://www.ipmglobal.org/our-work/our-products/dapivirine-contraceptive-ring>
- 51 Hendrickson ZM, Leddy AM, Galai N, *et al.* Work-related mobility and experiences of gender-based violence among female sex workers in Iringa, Tanzania: a cross-sectional analysis of baseline data from project Shikamana. *BMJ Open* 2018;8:e022621.
- 52 HPTN 084 study demonstrates superiority of cab La to oral TDF/FTC for the prevention of HIV, 2020 [Accessed 09 Nov 2020].
- 53 ViiV healthcare announces investigational injectable cabotegravir is superior to oral standard of care for HIV prevention in women, 2020 [Accessed 09 Nov 2020].
- 54 Global Network of Sex Work Projects. Prep Briefing paper; 2016.