



BMJ Open Willingness, preferred ways and potential barriers to use pre-exposure prophylaxis for HIV prevention among men who have sex with men in China

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ABSTRACT

Objective To explore willingness and preferred ways to use HIV pre-exposure prophylaxis (PrEP), factors associated with willingness, and potential barriers to PrEP use among men who have sex with men (MSM) in Changsha, China.

Design A cross-sectional survey was conducted from 25 June to 31 August 2019. Two hundred and fifty-five MSM were recruited from three community-based organisations (CBOs) in Changsha City. Willingness and potential barriers to use PrEP were examined using researcher-created scales. Univariate and multivariate logistic regression was used to analyse the factors associated with willingness to use PrEP. P values <0.05 were considered significant.

Setting Three MSM inclusive CBOs in Changsha, Hunan Province, China.

Participants 255 HIV-negative MSM were recruited through their CBOs with snowball sampling.

Results Less than half of the participants (43.1%) had heard of PrEP and 15.3% were willing to use PrEP. The participants reported higher willingness to use event-driven PrEP (3.70±0.07) than daily PrEP (2.65±0.07). Higher self-rated risk and fear of contracting HIV (OR: 14.47, 95% CI 2.19 to 95.53), awareness of PrEP (OR: 4.20, 95% CI 1.64 to 10.73), sharing one's own sexual orientation with parents or siblings (OR: 2.52, 95% CI 1.54 to 7.20) and having a university education or above (OR: 0.29, 95% CI 0.12 to 0.72) were associated with willingness to use PrEP. Only 12.2% of the sample was concerned about potential barriers to PrEP use.

Conclusion Efforts to improve awareness and knowledge of PrEP, teach self-evaluation of HIV infection risk and provide social and emotional support for MSM are needed to scale up PrEP implementation in China.

INTRODUCTION

HIV/AIDS is a major infectious disease that seriously endangers people's health. Data from the Joint United Nations Program on HIV/AIDS showed that 38.0 million people were living with HIV and 1.7 million people were newly infected with HIV globally in 2019.¹ In China, at the end of October 2019, over 958 000 people were living with HIV and

Strengths and limitations of this study

- The pre-exposure prophylaxis (PrEP) willingness scale and potential barriers to use PrEP scale were adapted after the qualitative outcome analysis component of this mixed methods study, making the scale more appropriate for the Chinese men who have sex with men (MSM) population.
- This study investigated the preferred ways of taking and potential barriers to using PrEP, providing guidance for PrEP implementation among MSM in China.
- This study was conducted at three MSM-friendly community-based organisations in nine districts in Changsha City, ensuring accessibility for MSM, a hard-to-reach population.
- The relatively small sample size of this study may potentially limit the generalisability of the results to other regions.

over 131 000 new cases were reported from January to October 2019. Among the new cases, heterosexual transmission accounted for 73.7%, while male homosexual transmission accounted for 23.0%.² The prevalence of HIV infection among Chinese men who have sex with men (MSM) has steadily increased from 5.5% in 2009 to 7.8% in 2017.³ Although many strategies (eg, safe sex education, issuing condoms, free HIV testing and medical male circumcision) have had a positive impact on reducing new HIV infection, the epidemic of HIV infection among MSM has not been adequately controlled. Multiple interventions must be integrated to control this epidemic, including the addition of biomedical interventions to traditional behavioural interventions.⁴ Additional safe and effective approaches to HIV prevention are urgently needed.

Pre-exposure prophylaxis (PrEP) is a widely recognised and promising strategy for HIV prevention. PrEP is the use of oral tenofovir

disoproxil fumarate (TDF), coformulated TDF/emtricitabine (TDF/FTC) or coformulated TDF/lamivudine (TDF/3TC) by HIV-negative people to prevent HIV acquisition.⁵ This prevention method has been recommended by the WHO, which has emphasised the daily use of antiretrovirals in HIV-uninfected people to prevent HIV infection (including MSM) since 2012.⁵ In 2015, the WHO launched evidence-based guidelines recommending that anyone at substantial risk of contracting HIV should be offered PrEP.⁶ Moreover, in 2019, WHO broadened its recommendations on 2+1+1 event-driven oral PrEP use for MSM (two pills, which serve as the loading dose, between 2 and 24 hours in advance of sex; a third pill 24 hours after the first two pills are taken and a fourth pill 48 hours after the first two pills are taken).⁷ Over 50 countries have incorporated PrEP into their health and service systems⁸; of these countries, 10 have implemented nationwide programmes and others are conducting limited demonstration small sample projects, exploring the acceptability and costs of PrEP, for example.⁹

In 2019, the Chinese Center for Disease Control and Prevention (CDC) issued a document titled 'Implementation of the program to stop the spread of AIDS (2019–2022),' which recommended pilot work on PrEP for populations such as MSM, the formulation of improved policies to promote and manage PrEP use and the gradual expansion of such policies.¹⁰ On 11 August 2020, the Chinese National Medical Products Administration approved TDF/FTC tablets for PrEP.¹¹ To prepare for a rollout of PrEP, it is crucial to understand willingness to use PrEP and associated factors among Chinese MSM.

Previous studies in China (including mainland China, Hong Kong and Taiwan) have revealed wide variation in willingness to use oral PrEP (ranging from 7.7% to 84.9%).^{12–23} Variations in willingness to use PrEP were affected by the way it was measured, with some researchers using single items and others using multiple items/scales.^{12–23} The availability and knowledge of PrEP have changed over time, and different circumstances in different countries could impact the measurement of willingness to use PrEP. A new comprehensive tool with content pertaining to the Chinese context is needed to measure the willingness of Chinese MSM to use PrEP.

This study aimed to investigate willingness and preferred ways of using PrEP with a researcher-designed 19-item scale as well as other associated factors from several contexts. This study also investigated concerns about potential barriers to PrEP use with a researcher-designed nine-item scale. The findings of this study could provide evidence for recommendation-making and national decision-making with respect to PrEP implementation among MSM in China.

METHODS

Study design and participants

A cross-sectional study was carried out between 25 June and 31 August 2019, in Changsha City, the capital city of Hunan Province. Potential participants were recruited

through three gay-friendly community-based organisations (CBOs) for MSM services. These three organisations were health consulting service centres, and the participants were service users. These CBOs were located in three districts in well-concealed positions and supervised by the CDC of Hunan Province. These organisations were respectively founded in 2008, 2011 and 2013 and have extensive experience in consulting, peer education and testing for HIV. In previous years, they have undertaken approximately 80% of all HIV testing of MSM in Hunan Province.

Participants were eligible if they were at least 16 years old; assigned male sex at birth; self-defined their sexual orientation as gay, bisexual or other MSM; sexually active with other men in the past year; and self-reported being HIV-negative. The sample size was calculated using the

formula $n = \frac{\mu_{\alpha}^2 \pi (1-\pi)}{\delta^2}$, where $\alpha=0.05$, and π was willingness to accept PrEP (considered to be 0.6).^{12 13 17 24} In this calculation, δ was determined to be 6% (usually 0.1π); therefore, the intended sample size was 256 ($1.96 \times 19.6 \times 0.6 \times 0.4 / 0.06 / 0.06 = 256$).

Measurements

General information

A comprehensive battery of demographic questions was asked, including questions regarding age, ethnicity (Han or other), educational background (high school or below, or university/college or above), occupational status (full-time student or employed), monthly average income and household registration type (rural or urban). Current relationship status (single, married or living with a female, or in an intimate relationship with a male), sexual orientation (homosexual, bisexual or not sure) and sexual preference (men only or both men and women) were reported as well. Participants were also asked about when their last HIV tests occurred (never tested, <6 months, 6–12 months or >12 months ago), sexually transmitted infection (STI) diagnoses in the past year, self-rated risk and fear of contracting HIV (0, <25.0%, 25.0%–49.0%, 50.0%–75.0%, or >75.0%) and perception of HIV infection risk among friends who are MSM (0, <25.0%, 25.0%–49.0%, 50.0%–75.0%, or >75.0%). Another measured risk factor was illicit substance use in the past 6 months (ie, rush/poppers, ketamine, crystal, heroin, cocaine/crack and ecstasy/methylenedioxy-methylamphetamine (MDMA)/molly).

Sexual behaviours

Questions regarding sexual behaviours in the past 6 months included the participant's number of regular male partners (count), number of casual male partners (count), female sexual partners (yes or no), instances of receptive and/or insertive condomless anal sex (CAS; yes or no), number of casual partners when having CAS (count), HIV-positive male partners (yes, no or not sure) and exchange of sex for money (yes or no).

Table 1 Willingness to use PrEP among MSM

Items	Mean± SD
1. Considering my current situation, I am willing to take PrEP pills to avoid HIV infection.	3.60±0.07
2. If PrEP reduced my risk of HIV infection, I would prefer to take it before and after sex.	3.70±0.07
3. If PrEP reduced my risk of HIV infection, I would prefer to take one pill per day.	2.65±0.07
4. I am willing to use PrEP pills as soon as they are available.	3.18±0.07
5. I find it inconvenient to go to a designated hospital to get a prescription for PrEP pills. (reversed score)	2.72±0.06
6. I do not think that I need to take PrEP pills. (reversed score)	3.31±0.07
7. I am willing to take PrEP pills because they reduce my anxiety or fear of unsafe sex.	3.61±0.06
8. Even if I insist on using condoms, I am still willing to take PrEP pills because they reduce my fear of AIDS/HIV.	3.34±0.06
9. I am willing to pay for PrEP pills.	3.20±0.06
10. I only use PrEP pills when they are free or covered by Medicare.	3.00±0.07
11. I am willing to take PrEP pills even if they are not 100% effective in preventing HIV.	3.55±0.06
12. I am willing to take PrEP pills even if there are mild side effects.	3.40±0.06
13. I am willing to take PrEP pills even if I need regular tests for HIV and STDs after taking them.	3.53±0.06
14. I am willing to take PrEP pills even if they require regular hospital check-ups.	3.41±0.06
15. I would be more willing to take PrEP pills if I knew how they work.	3.90±0.05
16. I will wait until someone else has taken PrEP pills before I take PrEP. (reversed score)	2.78±0.06
17. If PrEP pills were tested and found to be effective in Chinese gay people, I would be more willing to use them.	4.09±0.05
18. I would be more willing to take PrEP pills if my partner/friend told me he was taking them.	3.83±0.05
19. If my doctor recommends PrEP pills, I will take them.	3.94±0.05

MSM, men who have sex with men; PrEP, pre-exposure prophylaxis; STD, sexually transmitted diseases.

Awareness of PrEP

Participants were asked whether they had heard about PrEP and, if so, where they had heard about it (eg, online/internet, non-governmental organisation (NGO)/CBO, sex partner, doctor, friend, family member, television/radio or other). They were also asked whether they had ever taken PrEP and, if so, how they took it (2+1+1/event-based dosing, one pill everyday or irregularly). Participants were also asked about additional sources of PrEP awareness, such as knowing someone who had taken PrEP. Those who had heard about PrEP were also asked whether they were initially consulted about PrEP by a doctor or staff from CBOs or ever professionally informed of PrEP; if they had been, they were asked about their basic knowledge of PrEP (eight related questions). Finally, all participants were asked how effective they thought PrEP was in preventing HIV infection (very effective, having some preventive effect, ineffective or not sure).

Willingness and preferred ways of using PrEP

Participants were asked to rate how likely they were to take PrEP on a 19-item scale with each five-point Likert item ranging scored from 'extremely unlikely' to 'extremely likely'. This comprised the quantitative step of the present mixed methods study. The 19-item scale was based on a seven-item scale developed by Holt *et al.*²⁵, taking PrEP availability in Changsha, China into consideration and combined with the thematic analysis from the qualitative portion of the present study (table 1).

Of the 19 items, two concerned preferred ways of using PrEP: 'If PrEP reduced my risk of HIV infection, I would prefer to take it before and after sex' and 'If PrEP reduced my risk of HIV infection, I would prefer to take one pill per day'. Combining the scores of three experts, the scale's item-level content validity index (I-CVI) was 1.00 for 17 items and 0.67 for two items. The scale-level content validity index (S-CVI) scores were 0.985 for S-CVI/universal agreement (S-CVI/UA) and 0.965 for S-CVI/average (SCVI/Ave).²⁶ After analysis with SPSS, the Cronbach's α was found to be 0.905. Each item was scored from 1 to 5. The mean of the scores on all the items formed the scale score. Participants who scored equal to or higher than four points were considered willing to use PrEP.

Potential barriers to PrEP use

Participants were asked to rate their concern about potential barriers to PrEP use on a nine-item scale scored from 1 'extremely unlikely' to 5 'extremely likely'. Combining the scores of three experts, the I-CVI of this scale was 1.00 for all items, the S-CVI/UA was 1.00 and the SCVI/Ave was 1.00.²⁶ After analysis with SPSS, the Cronbach's α was found to be 0.894. The mean of the scores on all the items formed the scale score. Participants who scored equal to or higher than four points were considered to be concerned about the potential barriers to PrEP use (table 2).

Table 2 Concerns about potential barriers to using PrEP

Items	Mean± SD
1. I worry that people will think I am HIV positive or being treated for AIDS.	3.07±0.07
2. I worry that people will find out I am gay.	2.97±0.07
3. I worry that people will think I am sexually promiscuous.	3.09±0.08
4. I worry that people will think I am a sex worker.	2.78±0.08
5. I do not want anyone to know I am on PrEP.	3.54±0.07
6. Taking PrEP pills will make my partner think I do not trust him.	2.98±0.07
7. Using PrEP pills makes me feel embarrassed.	2.65±0.07
8. Asking my doctor for a prescription for PrEP pills would make me feel embarrassed.	2.77±0.07
9. Compared with hospitals/designated pharmacies, I prefer to obtain PrEP drugs from ordinary pharmacies/ gay working groups or purchase them myself abroad.	3.37±0.07

PrEP, pre-exposure prophylaxis.

Data collection

Recruitment for the study took place at three CBOs. If MSM came to the CBO, the staff would mention to them that there was a PrEP research project underway, and whether they were willing to meet the researchers for further information. If MSM were willing to meet the researchers, the CBO staff would lead them to an office, where the researchers were. The CBO staff would leave the room, allowing for private conversation between the participant and the researcher. Potential participants were informed about the background, aim and method of the study and could decide to participate in the research or not.

The online survey was designed with 'Wenjuanxing' software that helps with online survey collection. Anonymous survey data were collected through several steps. A quick response code (QR code, a type of matrix barcode/two-dimensional barcode) generated by Wenjuanxing was provided by the researchers; when potential participants scanned the QR code on their smartphone, they were taken to a homepage that detailed the background and aims of the present study. Each potential participant completed an online informed consent form if they agreed to participate. Completion of a demographic screener in the online survey helped to determine eligibility. The participants were provided with a brief introduction to PrEP in the online survey, including the principles of prevention, evidence concerning the effectiveness of PrEP, two recommended ways of using PrEP (daily use and event-driven use) and the side effects of using PrEP. PrEP is available in Changsha City with a doctor's prescription from a HIV/AIDS-specific hospital and costs 1980 RMB (approximately US\$291) for one bottle with 30 tablets. The participants who provided informed consent clicked through to an online survey that took approximately 30 min to complete. A process of checking conflicting answers was embedded into the online survey system to control the quality of the participants' responses. Participants filled in the surveys on their own. On completion of the survey, the participants were

given a 50 RMB (approximately US\$7.5) allowance for their time and transportation. The researchers were in the same room as the participants throughout the questionnaire completion process, offering help if the participants felt confused about scanning the QR code or the way the questions were phrased.

Statistical analysis

Descriptive analyses were carried out for all variables. Bivariate analyses were used to assess bivariate relationships between independent variables. Factors that were significantly associated with willingness to use PrEP in the univariate regression analysis ($p < 0.05$) were purposely selected and further explored using multivariate logistic regression analysis to determine which of these variables were independently associated with willingness to use PrEP. Statistical significance was set at $p < 0.05$. All statistical analyses were conducted using SPSS V.25.0. Incomplete questionnaires were deleted and excluded from the analysis.

Patients and public involvement

No patients were involved in the design of this study. Three CBOs helped with recruitment.

RESULTS

Sociodemographic characteristics of participants

A total of 287 MSM were informed about the study and 256 MSM agreed to participate. The response rate was 89.2%. The survey was conducted with 256 men who met the inclusion criteria and consented to participate. After the removal of one uncompleted questionnaire, the data of 255 participants were included in the final analysis. The ages of these participants ranged from 18 to 45 years (mean=24.51 years, SD=0.38 years). The majority of the participants were of Han ethnicity (94.5%) and from a rural household (56.9%). Out of the 255 participants, 169 men (66.3%) were employed and 33.7% were full-time students. Most of the participants were educated

at the college level (70.2%), and 48.2% indicated a monthly income <4000 RMB (approximately US\$587). Over half of the participants were single (54.9%), identified themselves as homosexual (72.9%) and had sex with men exclusively (72.9%). In addition, 40.4% of the participants were in an intimate relationship with a man (40.4%) and 4.7% were married or living with a woman. Smaller percentages identified as bisexual (25.1%) or were not sure of their sexuality (2.0%) (table 3).

Over three-fifths of the sample (65.1%) had been tested for HIV at least once, and over half of the sample (55.3%) reported having had an HIV test within the last 6 months. In terms of STI screening, 141 participants (55.3%) had never been tested and eight participants (3.1%) had been diagnosed with an STI. The participants' self-rated risk and fear of contracting HIV were low: 20.8% believed they were at no risk, and 58.0% believed their risk was below 25.0%. Only 11.7% of the sample thought their gay friends had a risk of HIV infection greater than 75.0%. The most commonly used substance among participants was Rush (poppers; 23.1%), and 72.5% of the participants declared no substance use.

Sexual behaviours

In terms of sexual behaviours, 132 participants reported only one regular partner and 74 participants reported two or more casual partners. Four participants reported having had commercial sex and 30 participants had female sex partners. Furthermore, 36.5% of the sample reported having had CAS, and 41.9% (n=93) of these participants reported having had CAS with casual partners. Eight participants reported HIV-positive partners, and 105 participants were unaware of their partners' serostatuses.

Awareness of PrEP

Nearly half of the participants (n=145, 43.1%) reported that they had never heard of PrEP prior to this study. Only one participant reported having ever taken PrEP pills, and he took them irregularly. Those who had heard about PrEP cited the internet (66.2%), CBOs (37.2%) and friends (17.9%) as their main sources of information about PrEP. Seventy-one participants reported that they had been initially consulted about or informed of PrEP by the staff of a CBO (42.1%) or by a doctor or nurse (6.9%).

In general, the participants had insufficient knowledge of PrEP. The two questions with the highest correct response rates concerned the effectiveness of PrEP, and the key to PrEP's effectiveness is adherence. Of the participants, 41.2% viewed PrEP as a very effective strategy and 53.3% thought that PrEP may have some effect on HIV prevention. Three participants thought that PrEP was totally useless (table 4).

Willingness and preferred ways to use PrEP

The mean scores on the individual scale items regarding willingness and preferred ways to use PrEP ranged from

Table 3 Demographic characteristics of the study sample

Character	Frequency	Percentage
Age		
18–22	127	49.8
23–27	61	23.9
≥28	67	26.3
Ethnicity		
Han	241	94.5
Others	14	5.5
Educational background		
Junior high school or below	14	5.5
Senior high school	49	19.2
University/college	179	70.2
Master degree or above	13	5.1
Occupational status		
Full-time student	86	33.7
Employed	169	66.3
Average monthly income		
1–1999 RMB	59	23.1
2000–3999 RMB	64	25.1
4000–5999 RMB	83	32.5
6000–7999 RMB	19	7.5
8000 RMB or above	30	11.8
Current living conditions		
Very stable (living in a place purchased by oneself or by parents)	75	29.4
Relatively stable (renting a room or dormitory)	178	69.8
Unstable (no permanent residence)	2	0.8
Household registration type		
Rural	145	56.9
Urban	110	43.1
Current relationship status		
Single	140	54.9
Married or living with a female	12	4.7
In an intimate relationship with a male	103	40.4
Sexual orientation		
Homosexual	186	72.9
Bisexual	64	25.1
Not sure	5	2.0
With whom have you talked about your sexual orientation? (multiple choice)		
No one	38	14.9
Parents or siblings	47	18.4
Wife or girlfriend	8	3.1

Continued

**Table 3** Continued

Character	Frequency	Percentage
Friends	193	75.7
Colleagues or classmates	69	27.1
Sexual preference		
Men only	186	72.9
Both men and women	69	27.7

1.37 to 4.68. The mean score on the overall 19-item scale was 3.41 ± 0.61 ; this indicated that, on average, the MSM in this study fell slightly above neutral in their endorsement of willingness to use PrEP, as each item was scored from 1 ('extremely unlikely') to 5 ('extremely likely'). A score of four points or higher indicated willingness to use PrEP. Overall, 39 participants (15.3%) had mean scores of four points or higher (were willing to use PrEP). The majority of the participants (84.7%) were unwilling to use or neutral about PrEP (table 1).

The participants' scores on each item indicated that Chinese MSM would be more willing to use PrEP if it was tested in Chinese MSM and recommended by their doctors. They were also more willing to take PrEP if they knew how it worked or knew that their friends were taking PrEP. The participants' mean scores on two items concerning preferred ways to use PrEP indicated that daily PrEP use (2.65 ± 0.07) was less preferable than event-driven use (3.70 ± 0.07).

Concerns regarding potential barriers to PrEP use

The mean scores on the individual scale items regarding potential barriers to PrEP use ranged from 1.00 to 5.00 with a mean score of 3.03 ± 0.51 ; this indicated that, on average, the MSM in this study fell slightly above neutral in their endorsement of concerns regarding the potential barriers to PrEP use. Overall, 31 participants had a mean score of ≥ 4 . Only 12.2% of the participants were concerned about potential barriers to PrEP use, while the remaining 87.8% were not (table 2).

Of the nine items on this scale, the mean scores on four items were above three points. The lowest mean score was 2.77 ± 0.07 for 'asking my doctor for a prescription for PrEP pills would make me feel embarrassed'. The highest mean score was 3.54 ± 0.07 for 'I do not want anyone to know I am on PrEP'.

Factors associated with willingness to use PrEP

According to the univariate logistic regression, participants who had university/college or higher education were less willing to use PrEP (OR: 0.46, 95% CI 0.22 to 0.94). Participants were more willing to use PrEP if they had told their parents or siblings about their sexual orientation (OR: 2.68, 95% CI 1.25 to 5.72), reported a high level of risk and fear of contracting HIV (>75.0%; OR: 16.00, 95% CI 2.92 to 87.77), had ever heard of PrEP (OR: 2.30, 95% CI 1.33 to 6.46). In the univariable model, participants who were not sure about the effectiveness of

Table 4 Awareness and knowledge of PrEP

Character	Frequency	Percentage
Awareness of PrEP (n=255)		
No	110	43.1
Yes	145	56.9
Information resources (multiple choice, n=145)		
The internet	96	66.2
CBOs	54	37.2
Sexual partners	6	4.1
VCT clinic doctors	6	4.1
Friends	26	17.9
TV	4	2.8
Initially consulted about or informed of PrEP (n=145)		
No	74	51.0
Yes, by the staff of a CBO	61	42.1
Yes, by a doctor or a nurse	10	6.9
(Knowledge of PrEP n=71)		
To what extent does PrEP prevent HIV infection if it is used strictly according to medical advice?		
Approximately 30%	3	4.2
Approximately 50%	3	4.2
Approximately 80%	9	12.7
Over 90%	50	70.4
I do not know	6	8.5
How many people worldwide are currently using PrEP?		
Less than or equal to 50 000	7	9.8
50 001–1 00 000	2	2.8
1 00 001–1 50 000	1	1.4
1 50 001–2 00 000	1	1.4
More than 200 000	18	25.4
I do not know	42	59.2
What is the approximate percentage of every 100 PrEP users that experience common drug side effects, such as headaches, nausea, and weight loss?		
10%	23	32.4
20%	4	5.6
30%	1	1.4
40%	2	2.8
50%	3	4.2
Over 50%	3	4.2
I do not know	35	49.3
How often do PrEP users typically need to be followed up to monitor medication side effects, blood test results, and STDs?		
Every month	10	14.1
Every 3 months	28	39.4
Every 6 months	3	4.2
I do not know	30	42.3

Continued

Table 4 Continued

Character	Frequency	Percentage
For PrEP users, which of the following body parts need to be regularly tested for gonorrhoea and chlamydia?		
Rectum only	3	4.2
Urethra only	4	5.6
Pharynx only	1	1.4
All of the above	25	35.2
I do not know	38	53.6
What is the key factor affecting the effectiveness of PrEP?		
Gender	1	0.1
Age	0	0
Adherence	60	84.5
I do not know	10	1.4
'Alcohol should not be consumed while using PrEP'. Please indicate whether this statement is correct or not.		
True	42	59.2
False	7	9.9
I do not know	22	30.9
Has the Chinese Drug Administration approved tenofovir/emtricitabine as a PrEP drug?		
Yes	23	32.4
No	13	18.3
I do not know	35	49.3
Have you ever taken PrEP pills? n=145		
No	144	99.3
Yes	1	0.7
View of PrEP (n=255)		
Not sure	11	4.3
Not effective in HIV prevention	3	1.2
May have some preventive effect	136	53.3
Very effective	105	41.2

CBO, community-based organisation; PrEP, pre-exposure prophylaxis; VCT, voluntary counseling and testing.

PrEP (OR: 0.25, 95% CI 0.12 to 0.54) would be less likely to use PrEP, compared with those who thought PrEP was very effective. But this association did not remain significant in the multivariable model when adjusted for other characteristics (table 5).

According to the multivariate logistic regression, having a higher education level (OR:0.29, 95% CI 0.12 to 0.72), having told parents or siblings about one's sexual orientation (OR: 2.29, 95% CI 0.97 to 5.39), being aware of PrEP (OR: 4.20, 95% CI 1.64 to 10.73) and self-rating a high level of risk and fear of getting HIV (OR: 14.47, 95% CI 2.19 to 95.53) were independently associated with willingness to use PrEP.

DISCUSSION

This is the first study to assess willingness to use PrEP and other associated factors among MSM in Hunan Province, China. The results of the present study suggest that the majority of MSM in Changsha City lack knowledge of PrEP. Participants had uncertainty about PrEP, including willingness to use PrEP and possible barriers they might face if they use PrEP. Only 15.3% of MSM were interested in using PrEP.

Willingness to use PrEP was relatively low among the MSM in this study. A global estimate of the acceptability of PrEP among MSM showed that acceptance ranged from 19.1% to 96.2% with a pooled estimate of 57.8%.²⁷ The rate of willingness to use PrEP in the present study was lower than rates reported in Shanghai City (19.1%)²⁵; Guangzhou City (36.2%)¹⁴; Chengdu City (84.9% if PrEP was effective and free)¹⁵; Brazil, Mexico and Peru (64.2%)²⁸ and Kenya (44.9%).²⁹ There are several potential reasons for the low rate of willingness to use PrEP in the present sample. First, a lack of sufficient information and knowledge of PrEP could inhibit willingness to use PrEP. The present results showed that only 43.1% of the participants had ever heard of PrEP, and these participants had poor knowledge of PrEP. TDF/FTC was approved as PrEP for HIV prevention on 11 August 2020,¹¹ while the present study was carried out in 2019. At the time of this study, there were no policies to support PrEP; even now, China has not yet issued any medical guidance for the use of PrEP. The inclusion of PrEP in standard strategies for HIV prevention still has a long way to go. Second, Changsha City is in the South-Central part of the Chinese mainland, and MSM in Changsha may receive less new and reliable information about PrEP and may be less open to new approaches to HIV prevention compared with MSM in some cities with more developed economies or more frequent international communications. Third, the measurement tool used in this study was a 19-item scale that asked participants to consider multiple circumstances related to taking PrEP. Unlike previous studies in China, which have typically asked participants to consider PrEP under ideal circumstances (eg, where PrEP is 100% effective and free), the 19-item scale in this study asked participants to consider a broader set of issues. This may have resulted in lower level of but could be more trustworthy than those of previous studies by considering a range of issues that may affect willingness to use PrEP.

Cost may be a particular barrier to PrEP use. In this study, 33.7% of the participants were full-time students, without stable income and 48.2% indicated a monthly income of less than 4000 RMB (approximately US\$587). In Changsha, a bottle of TDF/FTC costs 1980 RMB (approximately US\$291). To access PrEP, they need to pay out-of-pocket costs for a medical examination before they receive a prescription and additional costs for routine check-ups. Thus, using PrEP would create a significant financial burden for low-income earners. Unfortunately, there is no sign that PrEP will be free or covered by health insurance in the next few years in China.

Table 5 Logistic regression of willingness to use PrEP (n=255)

Variable	Category	Univariate logistic regression		Multivariate logistic regression	
		OR (95% CI)	P	OR (95% CI)	P
Educational background	High school or below	Ref.			
	University/college or above	0.46 (0.22 to 0.94)	0.033	0.29 (0.12 to 0.72)	0.007
Told parents or siblings about sexual orientation	No	Ref.			
	Yes	2.68 (1.25 to 5.72)	0.011	2.29 (0.97 to 5.39)	0.058
Self-perception of risk of HIV infection	No risk	Ref.			
	Low risk (<25.0%)	NS			
	Median risk (49.0~25.0%)	NS			
	High risk (25.0~50.0%)	NS			
	Very dangerous (>75.0%)	16.00 (2.92 to 87.77)	0.001	14.47 (2.19 to 95.53)	0.006
Awareness of PrEP	No	Ref.			
	Yes	2.30 (1.33 to 6.46)	0.008	4.20 (1.64 to 10.73)	0.003
Participants' view of PrEP	Very effective	Ref.			
	May have some preventive effect	NS			
	May have no preventive effects	NS			
	Not sure	0.25 (0.12 to 0.54)	<0.001	NS	

NS, not significant in the analysis; PrEP, pre-exposure prophylaxis; Ref., reference.

According to our analysis, awareness of PrEP was 43.1% and positively associated with willingness to use PrEP. This result was consistent with those of previous studies, which have indicated that increasing awareness of PrEP can be helpful in increasing the acceptance and use of PrEP.^{21 30 31} One study revealed that higher levels of PrEP comprehension encouraged MSM in China to use PrEP under various conditions.¹⁴ Similarly, a Latin American study showed that PrEP use was directly related to PrEP awareness and that increasing awareness and knowledge of PrEP (including its safety and efficacy) were key to increasing the demand for PrEP.²⁸ To promote PrEP programmes effectively, reliable information, targeted education and PrEP counselling should be delivered to key populations. A social network intervention in the USA indicated that after the provision of information to increase knowledge about PrEP's benefits, address concerns about PrEP and endorse PrEP use as a symbol of pride and health, the percentage of participants who reported using PrEP increased from 3% to 11%.³² A study in North Brazil showed that participants who learnt about PrEP online were more willing to use PrEP.³³ Educational strategies to raise awareness must be targeted to address specific barriers contributing to low levels of PrEP acceptability, such as doubts about its efficacy, side effects, perceived risk and access to PrEP services.³³ To spread the use of PrEP in China, more correct information about PrEP should be provided to MSM.

Consistent with several previous studies,^{25 30 34–38} MSM in the present study who perceived themselves as being at a higher risk of HIV infection (vs no risk) were more willing

to use PrEP. A study in California showed that those with medium and high levels of concern about contracting HIV were almost two times as likely to be willing to take PrEP.³⁹ As such, self-evaluation of HIV infection risk with professional guidance may potentially improve the uptake of PrEP and should be encouraged.

The present study showed that having told parents/siblings about one's sexual orientation was associated with willingness to use PrEP. MSM who were comfortable about their sexual identities and willing to disclose them to their families were more likely to access social and emotional support. Previous studies have indicated that 'outing' is associated with higher access to HIV prevention services and sexual risk reduction.^{40–42}

Some studies have found that PrEP willingness was positively associated with higher educational level.^{43–45} Conversely, a higher education level was associated with lower willingness to use PrEP in this study. A possible explanation could be that participants with more education were more concerned about PrEP's effectiveness, safety and side effects, so they were more cautious about PrEP use.^{46–49}

Further interventions should be designed to provide information regarding PrEP to MSM. As internet access is now convenient, interventions to increase knowledge of PrEP could be achieved through web-based advertisements, online courses, digital counselling, peer education and community-based education. As primary hubs of disseminating healthcare information for MSM, CBOs should take responsibility for the delivery of information about PrEP and PrEP-related health services.

Limitations

Several limitations of this study should be acknowledged. First, the participants in this study comprised a convenience sample of MSM connected to local HIV/AIDS-focused CBOs; thus, they were not representative of all MSM in China. As MSM visiting CBOs have more chance to learn about PrEP, their awareness of PrEP might have been higher than other MSM in China. Second, the self-reported nature of the questionnaire could have led to recall and social desirability biases, especially with regards to the data concerning risky sexual behaviours and drug use. To minimise recall bias, most questions were limited to behaviours and experiences occurring in the past 6 months. Third, this study did not meet the target sample size as one uncompleted questionnaire was removed. Finally, this cross-sectional study cannot be used to infer causality. Despite these limitations, the present study contributes to a growing body of literature on willingness to use PrEP and other associated factors, providing practical recommendations for the implementation of PrEP programmes in China.

CONCLUSIONS

The present study revealed relatively low awareness of and willingness to use PrEP among MSM in Changsha City, China. This study also investigated concerns about potential barriers to PrEP use. Awareness of PrEP, higher self-rated risk and fear of contracting HIV and sharing one's sexual orientation with parents or siblings were facilitators of willingness to use PrEP. Therefore, MSM should be educated on PrEP knowledge and how to self-evaluate their risk of HIV infection. Helping MSM to accept their sexual identities and providing them with more emotional and social support might improve PrEP acceptance. Interventions are required to increase awareness and knowledge of PrEP among both MSM and infectious disease specialists. Internet-based advertisements and programmes should be implemented to encourage MSM communities and MSM-friendly CBOs.

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Ethics approval Ethical approval was obtained from the Institutional Review Board of Xiangya Nursing School, Central South University, Changsha, China (number E201912). The essential information of the study, including its purpose and procedures, the benefits and risks for participants, and their right to decline participation in the study were clearly explained to the participants.

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Data availability statement Data are available upon reasonable request. The datasets used and/or analysed in the present study are available from the corresponding author upon reasonable request.

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