Mapping Potential Pre-Exposure Prophylaxis Users onto a Motivational Cascade: Identifying Targets to Prepare for Implementation in China

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Abstract

Purpose: China recently commenced several pre-exposure prophylaxis (PrEP) projects, but little work has characterized potential users. This study describes awareness of, intention to use, and uptake of PrEP in a sample of men who have sex with men (MSM), a key population experiencing high rates of HIV in China.

Methods: Through a cross-sectional survey administered to 708 MSM in four cities, we mapped respondents onto a Motivational PrEP Cascade. We conducted bivariable and multivariable analysis to examine factors associated with progression through the Cascade.

Results: Among 45.6% of MSM who were PrEP eligible, 36% were in Contemplation, 9% were in PrEPparation, 2% were in PrEP Action and Initiation, and none reached Maintenance and Adherence. We found no association between individual risk factors and progression through the Cascade. In multivariable analysis, friends' positive attitudes toward PrEP, more frequent sexually transmitted infection testing, and higher scores on the perceived PrEP benefits scale were positively associated with entering PrEP Contemplation. Having higher condom use self-efficacy was associated with decreased odds of entering PrEP Contemplation. Having sex with men and women in the past 6 months, having heard of PrEP from medical providers, and knowing a PrEP user were positively associated with entering PrEPparation.

Conclusion: We found a high proportion of MSM who were PrEP eligible and identified several intervention targets to prepare for PrEP introduction in China: community education to increase accurate knowledge, gain-framed messaging for PrEP and sexual health, and provider trainings to build MSM-competent services that can support shared decision-making for PrEP initiation.

Keywords: China, HIV prevention, men who have sex with men, pre-exposure prophylaxis, PrEP cascade

Introduction

SINCE THE U.S. FOOD AND DRUG ADMINISTRATION approved emtricitabine/tenofovir disoproxil fumarate (FTC/TDF) as pre-exposure prophylaxis (PrEP) in 2012,¹ more than 40 countries have followed suit.² In places where PrEP is reaching key populations, it is having notable epidemiological impacts in controlling the HIV epidemic.^{3–8} However, scale-up of this highly effective intervention has lagged in many low- and middle-income countries. More than 80,000 people become newly infected with HIV in China each

year,⁹ more than the estimated number of new HIV infections in Western and Central Europe and North America.¹⁰

Despite the overall low population-level HIV prevalence of 0.09% and substantial progress in reducing HIV transmission from mother to child, through blood transfusion and injection drug use,⁹ the HIV epidemic continues to affect men who have sex with men (MSM) disproportionately in China. Recent studies have estimated very high HIV incidence (ranging from 5.6 to 11.8 per 100 person-years) among MSM in China^{11,12} and an increasing trend in incidence among young MSM.¹³ In China, oral FTC/TDF is

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available for HIV treatment in designated HIV treatment clinics for \$350 per bottle; the cost is not covered by insurance. The China Food and Drug Administration has not approved its indication for HIV prevention and there is no official guideline or national policy for PrEP. However, a government-funded PrEP study has recently been launched,¹⁴ and pilot implementation studies supported by the Chinese Centers for Disease Control and Prevention (China CDC) are underway, suggesting that China is investigating the role that PrEP could play in stemming the burgeoning epidemic. Early PrEP implementation programs in the United States and in sub-Saharan Africa have highlighted the importance of understanding intention to use and patterns of uptake to effectively develop, scale up, and sustain PrEP programs.^{15–18}

While existing literature on the willingness to use daily oral PrEP has begun to offer some insights into PrEP acceptability among Chinese MSM, it is limited by its exclusive focus on the hypothetical willingness to use PrEP. A previous study with gay and bisexual men in the United States highlighted the distinction between hypothetical willingness and behavioral intention to initiate PrEP, and emphasized the importance of assessing both constructs at the same time to better understand barriers to PrEP uptake.¹⁹ This finding is in line with results from one of the few PrEP demonstration projects conducted in China: in a study of 197 community-recruited MSM who expressed hypothetical willingness to use PrEP, only 13% (26/197) actually started using TDF as PrEP when it was provided to them for free.²⁰ This stands in sharp contrast to the high hypothetical willingness to use PrEP among MSM in China reported in multiple studies (64%–85%),^{20–25} underscoring the need for a more in-depth understanding of the gap between willingness to use and actual use of PrEP in this population.

The Motivational PrEP Cascade,²⁶ based on the Trans-theoretical Model of Health Behavior Change,²⁷ is a conceptual tool that helps identify discrepancies between hypothetical willingness and behavioral intention. The Cascade outlines five stages through which individuals move: from being eligible for PrEP by objective criteria but not self-identifying as a PrEP candidate or being unwilling to pursue PrEP (Stage 1—Precontemplation), to contemplation about initiation (Stage 2—PrEP Contemplation), to behavioral intention to initiate (Stage 3—PrEP Action and Initiation), to discussion with medical providers (Stage 4—PrEP Maintenance and Adherence), to the final stage of PrEP maintenance and adherence (Stage 5—PrEP Maintenance and Adherence). The Cascade allows us to track progress in PrEP uptake among individuals who were eligible for PrEP and to identify steps in the Cascade at which to target implementation efforts. The primary objective of this study was to examine PrEP awareness, intention to use PrEP, and uptake of PrEP through a modified version of the Motivational PrEP Cascade²⁶ in a setting where PrEP has yet to be formally approved, yet informal use has begun. Our secondary objective was to describe this informal PrEP use among PrEP-eligible MSM in China.

Methods

Participants and procedures

A cross-sectional convenience sample of 708 MSM was recruited in Beijing, Shanghai, Changsha, and Guangzhou,

China, from March to May 2018. To reach a diverse sample of MSM, multiple recruitment methods were utilized, including through HIV voluntary counseling and testing (VCT) sites, community-based organizations (CBOs), peer referrals, online recruitment, bathhouse venues, and respondent-driven sampling.²⁸ Participants were aged 18 years or older, assigned male at birth, had sex with at least one man in the past 12 months, and were willing and able to provide informed consent. People who self-reported as living with HIV/AIDS were excluded from the study.

The survey was developed in English, translated into Chinese, and back-translated into English by bilingual research staff; five bilingual research team members reviewed the translation and conducted pilot testing of the survey to ensure translation quality. Once participants were recruited into the study, designated research staff at each site scheduled an in-person visit at a local collaborating research institution. All study procedures were conducted in private rooms to protect privacy and confidentiality. Eligible participants completed the online survey after giving e-consent. Participants were compensated 5–8 U.S. dollars (compensation varied by site due to differences in average income level across cities and was set in accordance with local standards). The study was approved by the Institutional Review Board of Fudan University (Shanghai, China).

Outcomes

We created two coprimary outcomes: (1) being in Stage 1: Precontemplation (unwilling to take or believing they were inappropriate candidates for PrEP²⁶) versus Stage 2: Contemplation (willing to take PrEP and self-identified as appropriate candidates²⁶); (2) being in Stage 2: Contemplation versus Stage 3: PrEP Action and Initiation (seeing PrEP as accessible and planning to initiate PrEP²⁶).

Measures

PrEP awareness and knowledge. Participants were asked whether they had heard of PrEP, about the source of PrEP information, and their estimate of PrEP efficacy. Participants who chose “more than 90% effective” were categorized as “having correct knowledge about PrEP efficacy.” Participants were also asked whether they knew any PrEP user, and about their perception of friends’ attitudes toward PrEP. The following description of PrEP was shown to participants at the end of this section:

The HIV prevention pill (known as “PrEP”) is a pill taken to prevent HIV. It is safe and more than 90% effective when taken every day. People who decide to use the oral HIV prevention pill need to return to their doctor every 3 months for HIV/STI testing, bloodwork, and a new prescription for the next 3 months.

Intention to use PrEP and uptake of PrEP. We adapted the Motivational PrEP Cascade²⁶ to measure intention to use PrEP and uptake of PrEP. Four changes were made to the Cascade. First, we created modified PrEP eligibility criteria by combining Parsons et al.’s PrEP eligibility criteria²⁶ with three factors (commercial sex, recreational drug use, and group sex) derived from an HIV risk assessment tool developed for Chinese MSM (Table 1).²⁹ Parsons et al.’s

TABLE 1. SAMPLE CHARACTERISTICS

	n (%)
Demographics	
Age (<i>n</i> = 323)	
<30	144 (44.6)
≥30	179 (55.4)
City of residence (<i>n</i> = 323)	
Beijing	112 (34.7)
Changsha	35 (10.8)
Guangzhou	85 (26.3)
Shanghai	91 (28.2)
Sexual orientation (<i>n</i> = 323)	
Gay	206 (63.8)
Bisexual	111 (34.4)
Other	6 (1.9)
Education level (<i>n</i> = 323)	
Below college	114 (35.3)
College or above	209 (64.7)
Employment status (<i>n</i> = 323)	
Full-time	227 (70.3)
Not full-time	96 (29.7)
Monthly income (<i>n</i> = 323)	
<5000 RMB	150 (46.4)
5000–9999 RMB	102 (31.6)
≥10,000 RMB	71 (22.0)
Living situation (<i>n</i> = 323)	
Living alone	110 (34.1)
Not living alone	213 (65.9)
Marital status (<i>n</i> = 323)	
Single	237 (73.4)
Married	65 (20.1)
Divorced	20 (6.2)
Widowed	1 (0.3)
Sex of partners in the past 6 months (<i>n</i> = 323)	
Only men	225 (69.7)
Not only men	98 (30.3)
Relationship with steady partner in the past 6 months (<i>n</i> = 323)	
Monogamous	34 (10.5)
Nonmonogamous or other	114 (35.3)
No steady partner	175 (54.2)
PrEP awareness and knowledge	
Correct PrEP efficacy knowledge (<i>n</i> = 323)	
Yes	103 (31.9)
No	87 (26.9)
Never heard of PrEP before the survey	133 (41.2)
Know a PrEP user (<i>n</i> = 190)	
Yes	78 (41.1)
No	112 (58.9)
Friends' attitudes toward PrEP (<i>n</i> = 323)	
Do not know/oppose	162 (50.2)
No strong opinion	74 (22.9)
In favor of PrEP	87 (26.9)
PrEP eligible ^a	
No	385 (54.4)
Yes	323 (45.6)
Individual risk factors	
In a relationship with a partner not known to be HIV negative (<i>n</i> = 323)	
No	233 (72.1)
Yes	90 (27.9)
In a nonmonogamous relationship (<i>n</i> = 323)	
No	195 (60.4)
Yes	128 (39.6)

(continued)

TABLE 1. (CONTINUED)

	n (%)
Had sex with a casual male partner not known to be HIV negative, in the past 3 months (<i>n</i> = 323)	
No	253 (78.3)
Yes	70 (21.7)
Had condomless anal sex with a casual male partner in the past 3 months (<i>n</i> = 323)	
No	175 (54.2)
Yes	148 (45.8)
STI symptoms or diagnosis in the past 6 months (<i>n</i> = 323)	
No	300 (92.9)
Yes	23 (7.1)
Recreational drug use in the past 6 months (<i>n</i> = 323)	
No	313 (96.9)
Yes	10 (3.1)
Group sex with male partners in the past 6 months (<i>n</i> = 321)	
No	245 (76.3)
Yes	76 (23.7)
Commercial sex with male partners in the past 6 months (<i>n</i> = 321)	
No	278 (86.6)
Yes	43 (13.4)
Sexual health strategies	
HIV testing behavior (<i>n</i> = 323)	
Less than two times per year	67 (20.7)
Two or more times per year	256 (79.3)
STI testing behavior (<i>n</i> = 305)	
Less than two times per year	137 (44.9)
Two or more times per year	168 (55.1)
PEP use (<i>n</i> = 323)	
No	298 (92.3)
Yes	25 (7.7)
HIV risk perceptions	
Likelihood of getting HIV in 5 years (<i>n</i> = 323)	
Unlikely	207 (64.1)
Likely	116 (35.9)
Know someone who seroconverted in the past 2 years (<i>n</i> = 323)	
No	121 (37.5)
Yes	135 (41.8)
I don't know	67 (20.7)
I am afraid of becoming HIV infected (<i>n</i> = 323)	
No	71 (22.0)
Yes	252 (78.0)

^aPrEP eligibility was comprised of the individual risk factors included in the table.

PEP, postexposure prophylaxis; PrEP, pre-exposure prophylaxis; RMB, Ren Min Bi, official currency in China; STI, sexually transmitted infection.

criteria included sexual activity with men in the past 3 months rather than the 6 months recommended in the U.S. CDC PrEP guideline.³⁰ Participants were considered to have met objective criteria for PrEP if they met any one of Parsons et al.'s criteria or met one of the three China-specific risk factors in the past 6 months. Each of these factors was also entered into our analysis as individual risk factors.

Second, given that China has not officially approved oral FTC/TDF for PrEP and there is no official guideline for medical providers to prescribe PrEP, we asked "Suppose you

were interested in getting PrEP—do you know where to get it?” instead of asking whether the respondent had a medical provider willing to prescribe PrEP. Third, we modified the question used for assessing intention to initiate PrEP to fit the Chinese context. The original item was “PrEP is currently available with a prescription from your doctor and research has shown that a majority of insurance companies cover most costs or all of the costs of PrEP. Do you plan to begin PrEP?”²⁶ The item was adapted to “If PrEP were available for free, would you plan to begin PrEP?” with five options ranging from “I will definitely begin taking PrEP” to “I will definitely not begin taking PrEP”; participants were coded as intending to start PrEP if they indicated that they would probably or definitely begin taking PrEP. Fourth, we replaced “have you ever been prescribed HIV medications (e.g., Truvada) for use as PrEP?”²⁶ with the question “have you ever used PrEP?” (Yes or No) to ensure that we captured informal use. We defined “informal use” as procurement of FTC/TDF through informal channels and/or PrEP use without supervision of a health care professional in a context in which oral FTC/TDF has not been licensed for HIV prevention.³¹

Sexual health strategies. We collected information on HIV and sexually transmitted infection (STI) testing frequencies, and postexposure prophylaxis (PEP) use to measure participants' sexual health strategies.

HIV risk perception. To measure perception of HIV risk, we included three statements (previously used in studies of Chinese MSM) on 4-point scales (1–4).²² The items were “In five years, how likely do you think you would become infected with HIV?” (from “very unlikely” to “very likely”), “In the past two years have any of your friends or people you know become infected with HIV?” (No; Yes, only one; Yes, more than one; and I don't know), and

“Are you afraid of becoming infected with HIV?” (from “not afraid at all” to “very afraid”).

Psychosocial factors. We developed psychosocial measures hypothesized to influence progression across the modified Motivational Cascade among men who were PrEP-eligible. Fifteen statements on a 5-point scale (1 = “strongly agree” and 5 = “strongly disagree”) were included (Table 2).

Demographic characteristics. We collected demographic information, including city of residence, age, sexual orientation by self-report, highest level of education, employment status, monthly income, living situation, marital status, sex of partners in the past 6 months, and relationship with a steady partner in the last 6 months.

Statistical analysis

We generated descriptive statistics for the basic characteristics of the sample, the modified Motivational PrEP Cascade, and informal PrEP use. We performed exploratory factor analysis (EFA) using principal component factor extraction methods on 15 hypothesized psychosocial measures.³² Three factors were identified through EFA: (1) perceived concerns, (2) perceived benefits, and (3) stigma and disclosure. Table 2 summarizes 14 of the statements grouped into 3 factors and 1 individual item (condom use self-efficacy), and the Cronbach's alpha scores for internal consistency for each factor. Each factor was treated as a scale in the regression analysis.

We performed bivariable analysis on two primary outcomes (i.e., Stage 1 vs. Stage 2 of the Motivational PrEP Cascade and Stage 2 vs. Stage 3) and hypothesized associated factors, and entered variables that were significant in the bivariable analysis ($p < 0.05$) into multivariable logistic regression models. We controlled for seven demographic variables (age, city of residence, education level, employment status, monthly

TABLE 2. HYPOTHEZED PSYCHOSOCIAL FACTORS THAT MAY DIFFERENTIATE PRE-EXPOSURE PROPHYLAXIS-ELIGIBLE MEN AT DIFFERENT STAGES OF THE MODIFIED MOTIVATIONAL PRE-EXPOSURE PROPHYLAXIS CASCADE

Domain	Measures
Factor 1: perceived concerns (alpha = 0.78)	I worry that PrEP would be very expensive and I could not afford it. I worry about the short-term effects such as nausea, headache, and diarrhea. I don't like the idea of taking medication to prevent illness. I worry taking PrEP every day would be bad for my body. I worry that PrEP does not work and I will get HIV. I worry it would be hard for me to remember to take the pill every day. I worry if I become HIV+, certain medicines won't work because I was taking PrEP. I worry that using PrEP would increase my chance of getting an STI.
Factor 2: perceived benefits (alpha = 0.76)	PrEP can decrease new HIV infections in my community. Taking PrEP every day will protect me against HIV. Taking PrEP every day will decrease my anxiety about AIDS. I will have more agency over my sex life if I am on PrEP. Using PrEP will increase intimacy in my sex life.
Factor 3: stigma and disclosure (alpha = 0.84)	I worry that people would see me taking PrEP and think I have HIV. I worry that people would see me taking PrEP and think I am promiscuous.
Condom use self-efficacy	I am doing well with using condoms and I do not think I need PrEP to prevent HIV.

5-Point Likert scale (1 = “strongly disagree,” 5 = “strongly agree”).
AIDS, acquired immune deficiency syndrome.

FIG. 1. Source of PrEP information. PrEP, pre-exposure prophylaxis.

income, sexual orientation, and living situation) in the final multivariable regression models. All analyses were conducted in IBM SPSS Version 25.0.³³

Results

Sample characteristics

A total of 708 sexually active HIV-negative men responded to the survey. We restricted analysis to 323 (45.6%) men who met the modified PrEP eligibility criteria. Mean age of the sample ($n = 323$) was 33 years (range: 19–61, standard deviation = 9). The demographic characteristics, PrEP awareness and knowledge, individual risk factors, sexual health strategies, and HIV risk perceptions of the sample are shown in Table 1. Sources of PrEP information are shown in Figure 1.

Intention to use PrEP and uptake of PrEP: modified Motivational PrEP Cascade

Table 3 and Figure 2 present overall progression through each stage of the modified Motivational PrEP Cascade. Among the full sample of 708 sexually active MSM, 45.6% (323/708) met the modified PrEP eligibility criteria.^{26,29} However, only 36% (115/323) of these men were at the PrEP Contemplation stage (Stage 2), which is measured by self-identification as an appropriate PrEP candidate (42%, 136/323) and willingness to take PrEP (66%, 212/323). Nine percent (29/323) entered PrEP Preparation stage (Stage 3), a stage characterized by men who both intended to start taking PrEP (77%, 88/115) and knew where to access it (28%, 32/115). Among MSM at the PrEP Preparation stage, 55% (16/29) had spoken to a medical provider about PrEP and 17% (5/29) reported ever using PrEP. However, no one reached the final stage of the PrEP Cascade, Maintenance and Adherence: none had taken four or more doses a week consistently or returned for HIV and STI testing every 3 months (Stage 5).

We found no differences by individual risk factors nor risk perceptions between men in Precontemplation versus Contemplation Stage (variables that were not significantly associated with outcomes in bivariable analyses are not shown). Perceptions of positive attitudes toward PrEP among friends (adjusted odds ratio [aOR] = 2.59, $p < 0.01$), getting tested for an STI at least twice a year (aOR = 2.08, $p < 0.05$), and scoring higher on the perceived PrEP benefits scale (aOR = 1.95, $p < 0.01$) were associated with entering the PrEP Contempla-

tion Stage. Conversely, men with higher condom use self-efficacy had lower odds (aOR = 0.61, $p < 0.001$) of entering the PrEP Contemplation Stage (Table 4).

Similar analysis was performed to compare participants in PrEP Contemplation versus PrEP Preparation Stages (Table 5). Having sex with both men and women in the past 6 months (aOR = 10.04, $p < 0.05$), having heard of PrEP from medical providers (aOR = 8.31, $p < 0.05$), and knowing at least one PrEP user (aOR = 10.68, $p < 0.01$) were positively associated with being in PrEP Preparation Stage.

TABLE 3. OVERALL PROGRESSION THROUGH EACH STAGE OF THE MODIFIED MOTIVATIONAL PRE-EXPOSURE PROPHYLAXIS CASCADE

	n (%)
Objective identification	323 (45.6)
HIV negative and sexually active with men	708 (100.0)
PrEP-eligible men ^a	323 (45.6)
Stage 1: PrEP precontemplation	208 (64.4)
Stage 2: PrEP contemplation ^b	115 (35.6)
Stage 2a: willing to take PrEP	212 (65.6)
Stage 2b: self-identified as PrEP candidate	136 (42.1)
Stage 3: PrEP Preparation	29 (25.2) ^c
Stage 3a: has potential access ^a	32 (27.8)
Stage 3b: intending to take PrEP ^a	88 (76.5)
Stage 4: PrEP action and initiation	5 (17.2)
Stage 4a: spoken to a medical provider about PrEP	16 (55.2)
Stage 4b: ever used PrEP ^a	5 (17.2)
Stage 5: PrEP maintenance and adherence	0 (0)
Stage 5a: maintaining 4+ doses per week	0 (0)
Stage 5b: returning for quarterly testing	0 (0)

^aIndicates that this question was modified for use in China.

^bWe restricted our analysis of the Cascade to men who were at the Objective Identification stage. Stage 1 PrEP Precontemplation contained all men who were objectively identified and did not reach Stage 2.

^cStarting from Stage 3, each stage contained only men who met the criteria for the prior stage. Therefore, the denominator of this percentage (25.2% = 29/115) is the number of participants who reached the previous stage (i.e., Stage 2). Participants must have met criteria for both substages to reach the next stage.

Adapted from Parsons et al.²⁶

FIG. 2. The proportion of men who were PrEP eligible ($n=323$) who reached each stage of the Cascade. Adapted from Parsons et al.²⁶

Informal PrEP use

Among 323 men who were PrEP eligible, 3.1% (10/323) reported current or prior informal PrEP use, including three men at Stage 1 who had stopped PrEP before the survey and did not identify as an appropriate PrEP candidate; two men at Stage 3 who reported previous PrEP use but were not sure where to access PrEP at the time of the survey; and five people who reached Stage 4 but used PrEP without proper medical supervision. Forty percent (4/10) reported obtaining PrEP through a doctor's prescription, 20% (2/10) bought PrEP from other countries and used it in China, 20% (2/10) obtained PrEP from CBOs, and 20% (2/10) reported using HIV treatment antiretrovirals or PEP pills for PrEP. Three informal PrEP users initiated PrEP without consultation with a medical provider. Three did not take PrEP in the last 30 days, five used PrEP before and after sex (sex driven), and three reported using PrEP as a daily pill but reported taking it less than four times a week.

Discussion

To our knowledge, this is the first study to assess intention to use PrEP and uptake of PrEP among MSM in China through a theoretically derived "PrEP Cascade." Our finding that significant losses of potential PrEP users happened in the early stages of the Cascade is consistent with data collected among U.S. MSM in 2016.²⁶ Compared with the Cascade in a sample of U.S. MSM,²⁶ we observed a lower proportion of MSM who were PrEP eligible (63.9% in the United States vs. 45.6% in China) and in Stage 2 PrEP Contemplation (47.3% vs. 35.6%). Unlike in the U.S. sample, in which more than 80% of men who were contemplating PrEP use reported having a potential PrEP provider, a much lower proportion of men in our sample had access to a PrEP prescription (28%). Conversely, among those in Contemplation, intention to take PrEP was higher in our sample (77%) compared with the U.S. sample (58%). This underscores the need to develop interventions to address barriers in the PrEP Contemplation and PrEP Preparation stages, even when PrEP becomes available.

Our finding that less than a third of respondents had accurate knowledge about PrEP points to the need for community education. As media and social networks were cited as primary sources of information, peer-to-peer educational approaches and social media channels associated with CBOs could be useful resources to support community education. Perceptions of positive attitudes toward PrEP and PrEP use within social networks were found to be associated with progression across the Cascade. Particularly at a time when PrEP is not yet formally available, men in social networks that included PrEP users appeared to have greater access to information about how to obtain PrEP. These results echo prior findings that social networks play a central role in PrEP contemplation and adoption among transgender women and MSM³⁴ and among gay and bisexual men³⁵ and suggest the potential of utilizing social networks to increase PrEP contemplation and uptake in China.³⁶

In our sample, we found that medical providers were cited as the least common source of PrEP information. However, among men who were in PrEP Contemplation, those who heard of PrEP information from a medical provider had higher odds of entering PrEP Preparation, which points to the critical role of medical providers in communicating to patients about PrEP at this early stage of PrEP implementation. A U.S. study has shown that the experience of having a sexual history taken improved understanding about PrEP among young cisgender men, transgender women, and genderqueer individuals who reported condomless sex with a male partner.³⁷ Although sexual history taking is not performed routinely in health care settings in China, and may be particularly challenging to perform given the high stigma around anal sex,^{38,39} taking a sexual history is a critical component of PrEP-related services. Providing training to provide MSM-competent nonstigmatizing care is needed urgently. This should include communicating accurate information about PrEP, taking a sexual history, and going through a shared decision-making process to identify whether PrEP is appropriate for an individual client.

A large proportion of MSM who were PrEP-eligible did not self-identify as appropriate PrEP candidates, suggesting that strategies to help MSM evaluate whether PrEP is the right choice for them will be beneficial. The mismatch

TABLE 4. FACTORS ASSOCIATED WITH PRE-EXPOSURE PROPHYLAXIS CONTEMPLATION

	Bivariable analysis				
	Stage 1: precontemplation, n (%)	Stage 2: contemplation, n (%)	p	Multivariable regression	
				aOR	95% CI
Overall	208 (64.4)	115 (35.6)			
Demographics					
Relationship with steady partner					
Monogamous	28 (82.4)	6 (17.6)	0.01	Ref.	Ref.
Other	180 (62.3)	109 (37.7)		2.85	0.98–8.30
PrEP awareness and knowledge					
Correct PrEP efficacy knowledge					
No	69 (67.0)	34 (33.0)	0.03	Ref.	Ref.
Yes	46 (52.9)	41 (47.1)		1.38	0.64–2.96
Never heard of PrEP	93 (69.9)	40 (30.1)		1.21	0.60–2.42
Friends' attitudes toward PrEP					
Don't know/oppose	119 (73.5)	43 (26.5)	<0.001	Ref.	Ref.
No strong opinion	45 (60.8)	29 (39.2)		1.24	0.60–2.53
In favor	44 (50.6)	43 (49.4)		2.59**	1.32–5.07
Sexual health strategies					
HIV testing					
<2 times a year	51 (76.1)	16 (23.9)	0.02	Ref.	Ref.
≥2 times a year	157 (61.3)	99 (38.7)		1.14	0.48–2.72
STI testing					
<2 times a year	103 (75.2)	34 (24.8)	<0.001	Ref.	Ref.
≥2 times a year	99 (58.9)	69 (41.1)		2.08*	1.07–4.06
Bivariable analysis: t-test					
	Stage 1: precontemplation, mean (SD)	Stage 2: contemplation, mean (SD)	p	aOR	95% CI
Psychosocial factors					
Condom use self-efficacy (no alpha—single item)	3.30 (1.1)	2.79 (1.1)	<0.001	0.61***	0.47–0.78
Perceived benefits (alpha=0.76)	3.49 (0.7)	3.79 (0.6)	<0.001	1.95**	1.28–2.98

For the bivariable analysis, only significant results are shown. The level of significance was set at $p < 0.05$. Seven demographic variables (age, city of residence, education level, employment status, monthly income, sexual orientation, and living status) were controlled for in the final multivariable regression model.

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

aOR, adjusted odds ratio; CI, confidence interval; SD, standard deviation.

between objective identification and self-perceived PrEP candidacy has been identified as a major barrier to PrEP uptake in previous studies of PrEP implementation.^{40–43} Several North American studies have shown that the use of HIV risk assessment tools helped individuals who were PrEP eligible to self-identify as appropriate candidates for PrEP.^{41,44} However, one recent randomized controlled trial of MSM in the United States found that providing an objective risk score alone did not increase PrEP uptake,⁴⁵ and another study suggests that the use of risk-based approaches potentially impedes uptake as they unwittingly reinforce stigma associated with a pleasurable and active sex life that is categorized as “risky” by such screening tools.⁴⁶ Screening tools that encourage people to see themselves as PrEP candidates by presenting PrEP as a healthy, positive choice should be piloted as PrEP implementation begins.

Neither individual risk factors nor perceived risk of HIV was found to be associated with PrEP Contemplation or

PrEP preparation in our analysis. This differs from research that has documented a positive association between HIV-related risk behaviors (e.g., condomless anal sex and anal sex with casual partners) and willingness to use or actual utilization of PrEP.^{22,47–50} Although risk-framed messaging has been utilized widely in HIV prevention programs to facilitate uptake of prevention strategies such as testing,^{51,52} our data suggest the importance of incorporating nonrisk-framed approaches to promote PrEP. One approach to help potential users identify their candidacy for PrEP is through gain-framed messaging,^{46,53} that is, to focus on health benefits that PrEP may bring rather than emphasizing HIV risks exclusively and framing PrEP as a targeted strategy for “high-risk” populations,^{37,54} as has been done commonly in PrEP programs in the United States. Studies are needed to test the acceptability and appropriateness of gain-framed, sex-positive PrEP messaging strategies for MSM in the Chinese context.

TABLE 5. FACTORS ASSOCIATED WITH PREPARATION

	<i>Bivariable analysis</i>			<i>Multivariable regression</i>	
	<i>Stage 2: contemplation, n (%)</i>	<i>Stage 3: PrEPparation, n (%)</i>	<i>p</i>	<i>aOR</i>	<i>95% CI</i>
Overall	86 (74.8)	29 (25.2)			
Demographics					
Sex of partners in the past 6 months					
Only men	62 (82.7)	13 (17.3)	0.01	Ref.	Ref.
Not only men	24 (60.0)	16 (40.0)		10.04*	1.32–76.12
PrEP awareness and knowledge					
Heard of PrEP ^a					
No	37 (92.5)	3 (7.5)	<0.01	Ref.	Ref.
Yes	49 (65.3)	26 (34.7)		0.96	0.14–6.61
Heard of PrEP from social networks					
No	65 (82.3)	14 (17.7)	<0.01	Ref.	Ref.
Yes	21 (58.3)	15 (41.7)		4.22	0.97–18.35
Heard of PrEP from medical providers					
No	79 (80.6)	19 (19.4)	0.001	Ref.	Ref.
Yes	7 (41.2)	10 (58.8)		8.31*	1.26–54.79
Know a PrEP user					
No	71 (85.5)	12 (14.5)	<0.01	Ref.	Ref.
Yes	15 (46.9)	17 (53.1)		10.68**	2.11–54.06

For the bivariable analysis, only significant results are shown. The level of significance was set at $p < 0.05$. Seven demographic variables (age, city of residence, education level, employment status, monthly income, sexual orientation, and living status) were controlled for in the final multivariable regression model.

^aFisher's exact test was used for these calculations due to small expected values.

* $p < 0.05$, ** $p < 0.01$.

The association between psychosocial factors and PrEP contemplation provides further insights into the design of PrEP education and messaging strategies. Studies in the United States have found that having concerns about PrEP impedes PrEP uptake.^{55,56} Similarly, qualitative and quantitative studies examining PrEP uptake among Chinese MSM in a national demonstration project have found concerns about side effects to be a major barrier to PrEP uptake.^{20,57,58} However, our study did not find such an association. Some researchers have suggested that traditional Chinese beliefs that taking preventive medication daily is harmful to one's health would operate as a barrier to PrEP for people in China.^{57,59} An additional analysis of our 15 individual hypothesized psychosocial measures showed no association between negative perception about taking preventive medicine every day and PrEP contemplation or PrEPparation. Rather, we found perceived benefits of PrEP scale, and having lower condom use self-efficacy to be significantly associated with PrEP Contemplation. This suggests further that gain-framed messaging, which involves communicating accurately about potential benefits of PrEP use (such as intimacy,⁶⁰ empowerment,⁶¹ and reduced anxiety about HIV⁶²), might be an effective strategy in future PrEP education for Chinese MSM. Culturally appropriate strategies to improve PrEP contemplation and uptake and implementation studies should take these factors into account.

We saw a stark difference in the proportion of people who reported intention to take PrEP (Stage 3b, 88/115) and those who knew where to access PrEP (Stage 3a, 32/115). Although this discrepancy is likely due to the lack of official channels to access PrEP in China, we know that access to PrEP remains a key issue in PrEP implementation even

after approval in the United States,⁶³ especially among Black and Latino MSM^{64,65} and Black women.^{66,67} Therefore, it will be critical to develop PrEP programs that make equitable access to HIV prevention services central to their design at their very inception. In the Chinese context, this will mean designing services that make PrEP accessible to diverse populations: MSM who are out and those who are not out; people in large urban centers and in third-tier cities; and urban residents and migrant workers.

In our sample of 323 men who were PrEP eligible, 3.1% reported informal PrEP use. This result is consistent with previous studies among sexually active MSM before oral FTC/TDF was licensed for HIV prevention in other settings.^{21,68–70} We also observed that some informal PrEP users did not seek medical advice before initiation nor were they adherent to the dosing or quarterly testing schedule. Suboptimal use of PrEP in a medically unsupervised way poses both health risks to the users as well as implementation challenges and ethical issues to HIV prevention programs.^{71–73} Policy changes to make PrEP officially available along with tailored implementation programs to ensure equal access among populations are needed urgently to mitigate the risk of informal PrEP use.

Limitations

This study has some limitations. First, data were collected in a convenience sample that consisted of men who were recruited through CBOs, VCT sites, peer referral, and other means. It is unclear whether our results would apply to hidden “hard-to-reach” MSM who have little or no engagement with MSM CBOs and HIV services. Second, our study is a

one-time cross-sectional survey and it is unclear how intention to use PrEP and uptake of PrEP will change over time. Future research is needed to capture trends in PrEP uptake among MSM in China. Finally, due to the limited number of informal PrEP users in our sample, we were unable to perform analysis to explore factors associated with informal PrEP use. Future research, especially qualitative work, is needed to examine why these men chose to use PrEP informally.

Conclusion

Our study identified factors associated with intention to use PrEP and uptake of PrEP by mapping potential users onto a “PrEP Cascade” and described informal PrEP use among Chinese MSM. To prepare for PrEP implementation in China, continued efforts need to be made to increase PrEP awareness and comprehension through sex-positive, gain-framed messaging strategies, to build health care providers’ and counselors’ capacity to provide MSM-competent sexual health services, and to utilize social network and peer-based approaches to improve PrEP uptake and delivery.

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Author Disclosure Statement

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