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PrEP eligibility, HIV risk perception, and willingness to use PrEP among high-risk men who have sex with men in India: A cross-sectional survey

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ABSTRACT

HIV pre-exposure prophylaxis (PrEP) is not yet included in India's national AIDS program, with demonstration projects for MSM in planning stages. In order to support PrEP roll-out for MSM, we assessed: (1) associations between guideline-informed PrEP eligibility, HIV risk perception, and perceived PrEP benefits and costs, with willingness to use PrEP (WTUP); and (2) correlates of non-WTUP among PrEP-eligible MSM. Data were collected from MSM ($n = 197$) sampled from cruising sites in Mumbai and Chennai. More than half (58.4%) reported inconsistent condom use with male partners, 88.3% >1 male partner, and 48.6% engaging in sex work (all past month). Overall, 76.6% reported they would "definitely use" PrEP. Among 92.9% deemed PrEP-eligible, 79.2% reported WTUP. In adjusted analyses, PrEP eligibility (aOR = 5.31, 95% CI 1.11, 25.45), medium (aOR = 2.41, 95% CI 1.03, 5.63) or high (aOR = 13.08, 95% CI 1.29, 132.27) perceived HIV risk, and greater perceived benefits (aOR = 1.13, 95% CI 1.03, 1.24) were associated with higher odds of WTUP. Among PrEP-eligible MSM, non-WTUP was associated with low HIV risk perception and lower perceived benefits. Facilitating accurate risk assessment and promoting awareness of PrEP benefits and eligibility criteria may increase PrEP uptake among MSM in India.

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Introduction

HIV pre-exposure prophylaxis (PrEP) is safe and highly effective if taken as prescribed (Chou et al., 2019). The World Health Organization (WHO, 2015) recommends PrEP for individuals at "substantial risk", including men who have sex with men (MSM). India has a concentrated HIV epidemic, with high national HIV prevalence estimates (~4.3–7.0%) among MSM (National AIDS Control Organisation [NACO], 2015, 2017; Solomon et al., 2015). PrEP demonstration projects in India have been conducted among female sex workers (Reza-Paul et al., 2016, 2019), with projects among MSM in planning stages.

Numerous studies in Western countries have assessed willingness to use PrEP, but scant data is available on PrEP awareness and willingness to use PrEP among MSM in India. In a survey of MSM and transgender women ($n = 400$) in South India, 93% had no prior PrEP awareness; but once information on PrEP was provided, 99% reported willingness to use it (Uthappa et al., 2018). Neither perceived nor "calculated" HIV risk significantly predicted willingness to use PrEP; however, "calculated risk" scores were not based on available PrEP guidelines (Uthappa et al., 2018). A qualitative study among MSM in India highlighted potential barriers to PrEP uptake, such as PrEP stigma, sexual stigma, and concerns about side-effects (Chakrapani et al., 2015). Anecdotal evidence suggests that some MSM in metro cities, such as Mumbai, who can afford PrEP are taking it as prescribed by private practitioners or from over-the-counter purchases.

HIV risk perception, a key construct in several behaviour change models (e.g., Health Belief Model), may be an important factor in PrEP uptake (Plotzker et al., 2017). However, the relationship between perceived HIV risk and actual risk is not always concordant (Gerrard et al., 1996; Koh & Yong, 2014). Several studies suggest that high perceived HIV risk and/or actual risk may, or may not, predict willingness to use PrEP. For example, an earlier study of MSM ($n = 629$) in New York City indicated that 78% of participants who were eligible for PrEP did not perceive themselves to be at sufficiently high risk to need PrEP (Gallagher et al., 2014). Similarly, a qualitative study in Toronto reported that many at-risk MSM did not perceive themselves to need PrEP (Newman et al., 2018). In addition to risk perception, empirical findings based on rational choice

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theory have shown that perceived benefits (e.g., stealth use, user-controlled administration) and perceived costs (e.g., need to undergo HIV testing, side-effects, anticipated PrEP-related stigma) influence willingness to use PrEP (Chakrapani et al., 2015; Yi et al., 2017).

The identification of factors that contribute to willingness to use PrEP (WTUP) and that explain why some at-risk but PrEP-eligible MSM are not willing to use PrEP may support the development of tailored interventions to increase PrEP uptake in India. Accordingly, we assessed: (1) the associations between guideline-informed PrEP eligibility, HIV risk perception, and perceived benefits and costs of using PrEP, with hypothetical WTUP (see Figure 1); and (2) correlates of non-willingness to use PrEP among PrEP-eligible MSM.

Methods

In the first quarter of 2017, we conducted an interviewer–administered Tablet-Assisted Survey Interview (TASI) among 600 MSM recruited through community-based organisations (CBOs) in Mumbai ($n = 300$) and Chennai ($n = 300$), India. Participants in each city were randomly assigned to a discrete choice experiment (DCE) to identify acceptability and preferences for one of three HIV prevention technologies (PrEP, HIV vaccines, and rectal microbicides) that were new or in the pipeline. The data for the current analysis are drawn from the PrEP arm of the DCE ($n = 200$).

Participants were recruited using chain-referral sampling, combining purposive sampling of initial seeds and chain sampling based on subsequent participant referrals (Teddlie & Yu, 2007), which had been deemed effective for community-based research with vulnerable communities (Valerio et al., 2016). Trained peer outreach workers at participating study sites recruited initial seeds based on their personal peer network size and eligibility. Eligible participants included those who were 18-years-old or older, sexually active in the previous month, willing to provide consent for participation and willing to refer their peers. Participants were paid an honorarium of 300 INR (~ $4 USD) for the 35- to 45-minute survey interview and INR 50 for each successful referral. The study protocol was approved by the Research Ethics Boards of the University of Toronto, Ontario, Canada, and The Humsafar Trust, Mumbai, India.

Measures

Demographic characteristics

Demographic characteristics included age, education, occupation, monthly income, marital status, and self-reported sexual identity: gay, bisexual, *kothi* (feminine/receptive), double-decker (insertive and receptive), or *panthi* (masculine/insertive) (Chakrapani et al., 2007).

Sexual risk behaviour

Sexual risk behaviour measures assessed: number and types of male partners in the past month, frequency of anal sex, consistency of condom use with different types of male partners in the past month, alcohol use before last anal sex, diagnosis of sexually transmitted infections (STIs) in the past year, HIV testing frequency, and perceived risk of contracting HIV. A dichotomous variable for inconsistent condom use (no vs. yes) with any type of male partner was created from responses to four items on condom use with different types (regular, casual, paying, and paid) of male partners.

PrEP eligibility criteria

We used five indicators of PrEP eligibility based on international guidelines: (1) condomless anal sex (past-month) (British HIV Association [BHIVA], 2018; Centers for Disease Control and Prevention [CDC], 2018; European AIDS Clinical Society [EACS], 2020), (2) STI diagnosis (past year) (BHIVA, 2018; CDC, 2018; EACS, 2020), (3) sex work (past month) (Bekker et al., 2016; BHIVA, 2018), (4) >1 male partner (past month) (CDC, 2018), and (5) alcohol use before last anal sex (Bekker et al., 2016). Participants who screened positive for any one of these criteria were categorised as PrEP eligible.

HIV risk perception

Each participant was asked to assess "My chances of getting infected with HIV are" using a six-point scale: 1 = zero, 2 = almost zero, 3 = small, 4 = moderate, 5 = large, 6 = very large. For analysis, we created a categorical variable: low (1 and 2), medium (3 and 4), and high (5 and 6) perceived HIV risk.

PrEP awareness and source of information

Prior PrEP awareness was assessed by asking, "Before taking part in this interview, have you heard or read anything about antiretroviral drugs used for HIV prevention?" This was followed by a question, "From where did you get information about PrEP?" A brief description of PrEP based on AIDS Vaccine Advocacy Coalition (AVAC, 2017) and US CDC (CDC, 2019) factsheets were then provided to all participants before proceeding with the questionnaire.

Perceived benefits and costs of taking PrEP

We measured perceived benefits of taking PrEP using a 6-item scale (e.g., "It could prevent me from getting

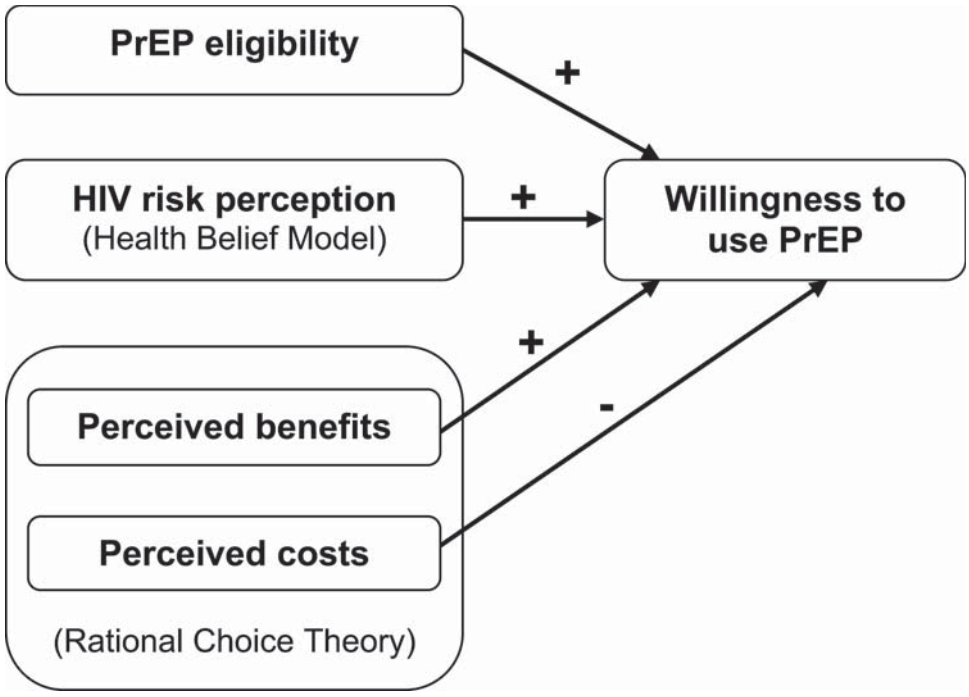

Figure 1. Conceptual framework showing potential associations between hypothesized predictors and willingness to use PrEP.

HIV" and "It would reduce my worry about getting HIV") (see Table 1). Perceived costs were measured with five items (e.g., "I would worry about what my [MSM] friends think of me" and "I would worry that people would think I am HIV-positive if I am on PrEP"). Each scale exhibited good reliability (Cronbach's alphas 0.86 and 0.85, respectively). One dichotomous item assessed, "Would you take PrEP if you still had to use condoms?"

Willingness to use PrEP

Willingness to use PrEP was assessed by asking, "Would you use PrEP as soon as it becomes available?" Participants responded using a 4-point Likert scale (1 = yes, definitely; 2 = yes, probably; 3 = no, probably not; 4 = no, definitely not). For logistic regression analysis, responses were dichotomised as "yes, definitely" (1 = yes) vs. the remaining responses (0 = no).

Data analysis

The analysis was restricted to 197 MSM, excluding three MSM who self-reported as HIV positive. Descriptive statistics were calculated for sociodemographic characteristics, behavioural indications for PrEP, HIV risk perception, perceived benefits and costs of PrEP, and willingness to use PrEP. Logistic regression models were fitted to examine the associations between PrEP eligibility, perceived HIV risk, perceived benefits of PrEP and willingness to use PrEP. Adjusted odds ratios (aOR) and 95% confidence intervals (CIs) were estimated. As interactions between perceived risk of contracting a disease and perceived benefits of a prevention tool have been reported (Fair et al., 2012), we examined potential interactions between perceived HIV risk and perceived benefits of PrEP by adding a cross-product term of these variables in a separate logistic regression model. Given that WTUP was a common outcome (>10%), for sensitivity analyses we used log-binomial and Poisson regression with robust variance to check whether the findings were similar to logistic regression models (Barros & Hirakata, 2003).

We used a linear regression model to assess whether PrEP eligibility scores (0–5) were associated with perceived HIV risk scores (1–6). A logistic regression model was fitted to identify factors associated with non-willingness to use PrEP among PrEP-eligible MSM.

Covariates included in the regression models were age, marital status, identity, HIV testing history, and use of PrEP if one still needed to use condoms. The latter two variables were included as independent predictors since HIV testing history may be associated with perceived HIV risk and need to use condoms may be associated with WTUP. In sensitivity analyses, the regression results did not change when these two variables were removed from the model. All analyses were performed using Stata 16.

Table 1. Perceived benefits and costs of PrEP among MSM ($N = 197$).

	Strongly disagree *n* (%)	Disagree *n* (%)	Neutral *n* (%)	Agree *n* (%)	Strongly agree *n* (%)
Perceived benefits of PrEP					
It could prevent me from getting HIV	4 (2.0)	3 (1.5)	8 (4.1)	83 (42.1)	99 (50.3)
It would reduce my worry about getting HIV	1 (.5)	11 (5.6)	13 (6.6)	79 (40.1)	93 (47.2)
It would prevent me from getting HIV from forced sex	4 (2.0)	15 (7.6)	9 (4.6)	89 (45.2)	80 (40.6)
I could tell my partners that I am protected against HIV	4 (2.0)	16 (8.1)	6 (3.0)	91 (46.2)	80 (40.6)
It would allow me to have sex with a partner who is HIV-positive	48 (24.4)	55 (27.9)	24 (12.2)	30 (15.2)	40 (20.3)
It would allow me to have sex with more sexual partners	8 (4.1)	46 (23.4)	32 (16.2)	59 (29.9)	52 (26.4)
Perceived costs of PrEP					
I would worry about what my MSM friends thinks of me	109 (55.3)	71 (36.0)	6 (3.0)	8 (4.1)	3 (1.5)
I would worry about what my family thinks of me	91 (46.2)	70 (35.5)	10 (5.1)	23 (11.7)	3 (1.5)
I would worry about what my regular male sex partner thinks of me	91 (46.2)	76 (38.6)	7 (3.6)	20 (10.2)	3 (1.5)
I would worry that I have to get an HIV test before getting PrEP	59 (29.9)	69 (35.0)	16 (8.1)	45 (22.8)	8 (4.1)
I would worry that people would think I am HIV-positive if I am on PrEP	73 (37.1)	87 (44.2)	13 (6.6)	19 (9.6)	5 (2.5)

Results

Sample characteristics

Participants' mean age was 26.5 years (SD 6.5) and mean monthly income was INR 12,195 ($161 USD). One-third (33.5%) completed a college degree, and 81.2% were currently single. Over two-thirds (68.0%) self-identified as *kothi*, double-decker, or gay (see Table 2). Over one-third (36.5%; $n = 72/197$) reported having heard of PrEP prior to the survey; of these, 80.5% ($n = 58/72$) received information about PrEP from their peers, and 51.3% ($n = 37/72$) from CBOs.

PrEP eligibility criteria

Of the five criteria for PrEP eligibility, 58.4% reported inconsistent condom use with male partners in the past month, 6.6% physician-diagnosed STIs in the past year, 32.8% alcohol use before last anal sex, 88.3% >1 male partner past month, and 48.6% engaging in sex work (see Table 1). Overall, 92.9% were PrEP-eligible based on meeting any of these criteria.

HIV risk perception and perceived benefits and costs

Nearly half (49.2%) of participants indicated medium, and 6.1% high HIV risk perception, respectively. Among PrEP-eligible MSM ($n = 183$), 57.3% ($n = 105/183$) reported medium/high risk perception. The mean score of perceived benefits of PrEP was 23.2 (SD 4.9; range, 6–30) and perceived costs of PrEP was 9.6 (SD 4.1; range, 5–25) (see Table 2).

Willingness to use PrEP

Three-fourths (76.6%; $n = 151/197$) of participants reported WTUP. Among those with medium and high HIV risk perception ($n = 109$), 86.2% ($n = 94/109$) reported WTUP. Among PrEP-eligible MSM ($n = 183$), 79.2% ($n = 145/183$) reported WTUP.

Associations between PrEP eligibility, HIV risk perception, perceived benefits/costs of PrEP, and willingness to use PrEP

Three logistic regression models were fitted to examine the associations between PrEP eligibility, HIV risk perception, and WTUP (see Table 3). In Model 1, HIV risk perception was included with other predictors/covariates; in Model 2, PrEP eligibility was included; and in Model 3, both HIV risk perception and PrEP eligibility were included (see Table 3). In Model 1, medium and high HIV risk perception were significantly associated with higher odds of WTUP. In Model 2, PrEP eligibility was significantly associated with higher odds of WTUP. In Model 3, both PrEP eligibility and HIV risk perception were significantly associated with higher odds of WTUP.

PrEP-eligible MSM had higher odds (aOR = 5.31, 95% confidence interval [CI] 1.11–25.45, $p = .03$) of reporting WTUP compared to MSM who did not meet PrEP eligibility criteria. MSM who had medium (aOR = 2.41, 95% CI 1.03–5.63, $p = .04$) or high risk perception (aOR = 13.08, 95% CI 1.29–132.27, $p = .02$) had higher odds of WTUP compared to those with low HIV risk perception (see Table 3). Similarly, MSM with higher scores on perceived benefits of PrEP (aOR = 1.13, 95% CI 1.03–1.24, $p = .01$) had higher odds of WTUP. Perceived costs of PrEP, prior awareness of PrEP, forced sex victimisation, age, sexual identity, HIV testing frequency, and marital status were not independently associated with WTUP. MSM who reported they would take PrEP even if they still had to use condoms had higher odds (aOR = 2.68, 95% CI 1.15–6.26, $p = .02$) of WTUP. Sensitivity analyses using Poisson regression models provided similar results (not shown); log-binomial regression models did not converge.

Table 2. Bivariate associations between sociodemographic characteristics, sexual behaviors, HIV risk perception and PrEP eligibility with willingness to use PrEP among MSM ($N = 197$).

Variable	Total *n* (%)	Willingness to use PrEP		χ^2 value	*p* value
		No ($n = 46$)	Yes ($n = 151$)		
Age group (years)					
≤25	105 (53.3)	18 (39.1)	87 (57.6)	4.84	.02
≥26	92 (46.7)	28 (60.9)	64 (42.4)		
Monthly income (INR)					
<10,000 ($138 USD)	101 (51.3)	56(51.4	45 (51.1)	0.001	.97
10,000 and above	96 (48.7)	53 (48.6)	43 (48.9)		
Education					
Higher secondary school or lower	131 (66.5)	28 (60.9)	103 (68.2)	0.85	.35
Graduate degree or higher	66 (33.5)	18 (39.1)	48 (31.8)		
Marital status					
Married	37 (18.8)	12 (26.1)	25 (16.6)	2.10	.14
Single	160 (81.2)	34 (73.9)	126 (83.4)		
Forced sex victimization (past year)					
No	164 (83.2)	37 (80.4)	127 (84.1)	0.34	.55
Yes	33 (16.8)	9 (19.6)	24 (15.9)		
Sexual identity[a]					
Kothi/double-decker/gay	134 (68.0)	30 (65.2)	104 (68.9)	0.21	.64
Others (panthi/ bisexual)	63 (32.0)	16 (34.8)	47 (31.1)		
HIV test (past year)					
No	32 (16.2)	7 (15.2)	25 (16.6)	0.04	.82
Yes	165 (83.8)	39 (84.8)	126 (83.4)		
Frequency of anal sex					
Low	125 (64.1)	26 (59.1)	99 (65.6)	0.62	.43
High	70 (35.9)	18 (40.9)	52 (34.4)		
Prior awareness of PrEP					
No	125 (63.5)	35 (76.1)	90 (59.6)	4.13	.04
Yes	72 (36.5)	11 (23.9)	61 (40.4)		
HIV risk perception					
No risk	88 (44.7)	31 (67.4)	57 (37.7)	12.75	.002
Low/ medium risk	97 (49.2)	14 (30.4)	83 (55.0)		
High risk	12 (6.1)	1 (2.2)	11 (7.3)		
Guideline-informed PrEP eligibility					
No	14 (7.1)	8 (17.4)	6 (4.0)	9.61	.002
Yes	183 (92.9)	38 (82.6)	145 (96.0)		
PrEP-eligibility criteria					
Inconsistent condom use with male partners (past month)					
No	82 (41.6)	22 (47.8)	60 (39.7)	0.95	.33
Yes	115 (58.4)	24 (52.2)	91 (60.3)		
STI diagnosis (past year)					
No	184 (93.4)	43 (93.5)	141 (93.4)	0.0006	.98
Yes	13 (6.6)	3 (6.5)	10 (6.6)		
>1 male partner (past month)					
No	23 (11.7)	10 (21.7)	13 (8.6)	5.89	.01
Yes	174 (88.3)	36 (78.3)	138 (91.4)		
Alcohol use before last anal sex					
No	131 (67.2)	31 (70.5)	100 (66.2)	0.27	.59
Yes	64 (32.8)	13 (29.5)	51 (33.8)		
Sex work (past month)					
No	93 (51.4)	17 (43.6)	76 (53.5)	1.20	.27
Yes	88 (48.6)	22 (56.4)	66 (46.5)		

[a]Identities were dichotomised on the basis of predominant sexual orientation: kothi, double-decker and gay men (predominantly attracted towards men); and panthi and bisexual-identified men (attracted towards both men and women).

In logistic regression modelling, a significant interaction was found between HIV risk perception and perceived benefits of PrEP (interaction term aOR = 1.07, 95% CI 1.001–1.15, $p = .04$) in predicting WTUP (see Figure 2). At higher scores of perceived benefits of PrEP, any increase in HIV risk perception substantially increases the probability of WTUP. In the linear regression model to predict perceived HIV risk score from PrEP eligibility score, PrEP eligibility ($b = .17$, 95% CI .005–.35, $p = .04$) was identified as a significant predictor. Other covariates, such as age, marital status, forced sex victimisation, and frequency of anal sex were not significantly associated with perceived HIV risk.

Factors associated with non-willingness to use PrEP among PrEP-eligible MSM

Among PrEP-eligible MSM ($n = 183/197$; 92.9%), those indicating low HIV risk perception had higher odds of reporting non-willingness to use PrEP (aOR = 2.77, 95% CI 1.15–6.69, $p = .02$) compared to those with medium HIV risk perception. Further, those reporting higher perceived benefits of PrEP had lower odds of reporting non-willingness to use PrEP (aOR = .85, 95% CI .77–.95, $p = .005$) (Table 4).

Discussion

To achieve UNAIDS targets of zero new infections by 2030, an integral part of the United Nations Sustainable Development Goals (UNAIDS, 2016), it is critical to understand factors influencing willingness to use PrEP among at-risk MSM. We found that most participants were eligible for PrEP based on international guidelines and were willing to use it. PrEP eligibility and perceived HIV risk were significantly and independently associated with WTUP. However, a subgroup of PrEP-eligible MSM reported non-willingness to use PrEP, which was associated with low HIV risk perception and low perceived benefits of PrEP.

In the present study, PrEP eligibility significantly predicted HIV risk perception, possibly indicating correct self-assessment of HIV risk behaviours. While several studies have shown discordance between HIV risk perception and "objective risk" (Gallagher et al., 2014; Wilton et al., 2016), other studies have shown concordance (Dubin et al., 2019) or no association (Uthappa et al., 2018). In terms of risk behaviours, several studies have reported that high-risk MSM are willing to use PrEP (Bullinger et al., 2019; Frankis et al., 2016; Kesler et al., 2016; Xie et al., 2019). Participants in this study were primarily recruited from cruising sites served by CBOs; it is possible that communication with HIV prevention outreach workers may have contributed to their accurate self-assessment of risk.

Table 3. Factors associated with willingness to use PrEP (WTUP) among MSM: Multivariable logistic regression results ($N = 197$).

Variables	Model 1: Perceived HIV risk as the key predictor of WTUP	Model 2: PrEP eligibility criteria as the key predictor of WTUP	Model 3: Both perceived HIV risk and PrEP eligibility as key predictors of WTUP
	aOR (95% CI)	aOR (95% CI)	aOR (95% CI)
PrEP eligibility – Yes (vs. No)		4.38 (1.09, 17.53)*	5.31 (1.11, 25.45)*
HIV risk perception (*Ref.* Low risk)			
Medium	2.66 (1.16, 6.10)*		2.41 (1.03, 5.63)*
High	10.41 (1.03, 104.52)*		13.08 (1.29, 132.27)*
Perceived benefits of PrEP (score)	1.14 (1.04, 1.25)**	1.13 (1.03, 1.23)**	1.13 (1.03, 1.24)*
Perceived costs of PrEP (score)	0.92 (0.83, 1.01)	0.91 (0.83, 1.01)	0.92 (0.84, 1.02)
Prior awareness of PrEP Yes (vs. No)	0.95 (0.36, 2.48)	1.00 (0.40, 2.52)	1.00 (0.38, 2.64)
Age ≥26 years (vs. ≤25 years)	0.71 (0.30, 1.68)	0.68 (0.29, 1.60)	0.69 (0.29, 1.65)
Identity – panthi/bisexual (vs. kothi/gay/double-decker)	0.91 (0.37, 2.23)	0.76 (0.32, 1.81)	0.96 (0.39, 2.39)
Marital status – single (vs. married)	2.09 (0.74, 5.93)	1.72 (0.63, 4.67)	2.37 (0.82, 6.81)
Forced sex victimization (past year) – Yes (vs. No)	0.86 (0.31, 2.38)	0.99 (0.36, 2.75)	0.76 (0.26, 2.15)
HIV testing (past year) – Yes (vs. No)	0.68 (0.22, 2.09)	0.67 (0.22, 2.00)	0.64 (0.21, 1.99)
Frequency of anal sex – High (vs. Low)	0.94 (0.42, 2.09)	0.72 (0.32, 1.60)	0.78 (0.34, 1.78)
Would take PrEP if still had to use condoms – Yes (vs. No)	2.46 (1.08, 5.61)*	2.53 (1.12, 5.69)*	2.68 (1.15, 6.26)*

Note: aOR = Adjusted Odds Ratio, CI = Confidence Interval.
* $p < .05$, ** $p < .01$.

Similar to the present findings, several studies have identified an association between perceived benefits of PrEP and WTUP (Hu et al., 2018; John et al., 2019). Although in our study, perceived cost of PrEP was not associated with WTUP, others have reported that perceived barriers to using PrEP may decrease WTUP (Yi et al., 2017). Our finding that perceived HIV risk interacted with perceived benefits of PrEP was novel: when both were high, the probability of reporting WTUP was very high. Promoting accurate self-risk assessment and providing education on PrEP benefits may act synergistically to increase uptake among PrEP-eligible MSM. A dual-process model (cognition- and emotion-based paths) of decision-making suggests that promoting accurate self-risk assessment alone may be insufficient to increase PrEP uptake, as prior negative emotional experiences, such as discrimination in health care settings, may influence even PrEP-eligible MSM not to use PrEP (Meyers et al., 2020).

Our finding that MSM who have medium/high HIV risk perception are more likely to meet PrEP-eligibility criteria and more willing to use PrEP suggests that once a national PrEP program is initiated in India, it is likely to be accessed by at-risk MSM. However,

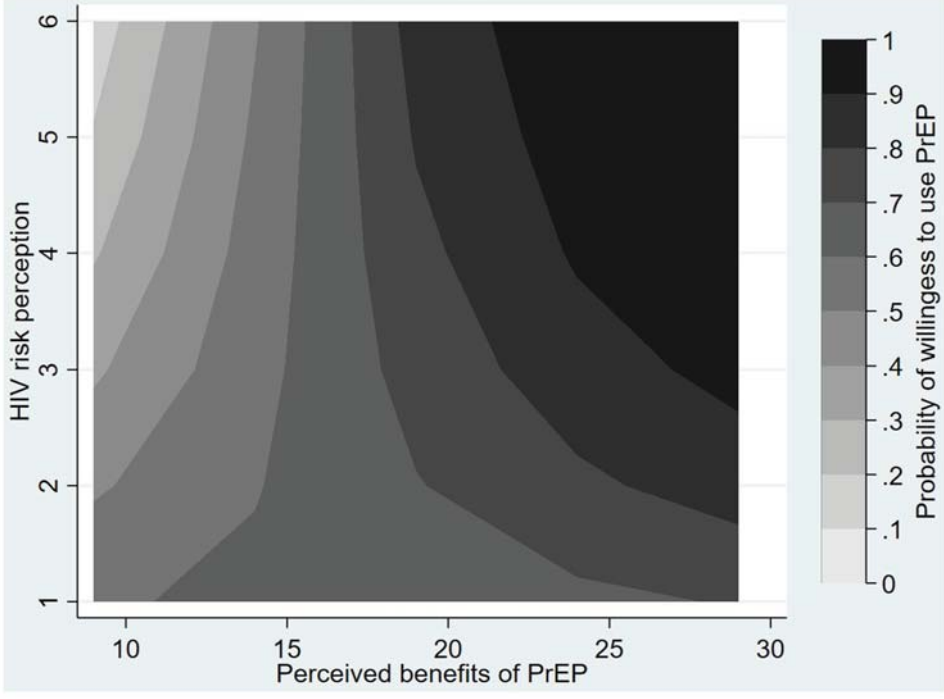

Figure 2. Contour plot: Interaction between perceived HIV risk and perceived benefits of PrEP in predicting willingness to use PrEP.

Table 4. Factors associated with non-willingness to use PrEP among MSM: Multivariable logistic regression results ($N = 197$).

Variables	Adjusted odds ratio (aOR)	95% confidence interval (CI)	*p* value
HIV risk perception (*Ref.* Low risk)			
Medium risk	2.77	1.15, 6.69	.02
High risk	0.25	0.02, 2.86	.26
Perceived benefits of PrEP (score)	0.85	0.77, 0.95	.005
Perceived costs of PrEP (score)	1.08	0.97, 1.20	.14
Prior awareness of PrEP	1.01	0.35, 2.87	.97
Age ≥ 26 years (vs. ≤25 years)	1.22	0.49, 3.05	.65
Sexual identity – panthi/bisexual (vs. kothi/gay/double-decker)	0.73	0.27, 1.95	.53
Marital status – single (vs. married)	0.36	0.12, 1.08	.07
Forced sex victimization (past year) – Yes (vs. No)	1.26	0.44, 3.61	.65
HIV testing (past year) – Yes (vs. No)	0.98	0.29, 3.20	.97
Would take PrEP if still had to use condoms – Yes (vs. No)	0.37	0.15, 0.90	.02

given persistent sexual stigma in the aftermath of the 2018 decriminalisation of adult consensual same-sex relations in India (Dixit, 2020), it is crucial to create an enabling environment by ensuring that MSM receive non-discriminatory, culturally competent services in accessing PrEP programs. The associations of low perceived HIV risk and low perceived benefits of PrEP, respectively, with non-willingness to use PrEP is consistent with studies across low-, middle- and high-income countries (Yi et al., 2017; Zhabokritsky et al., 2019). Given the lack of prior awareness of PrEP among MSM in this study, consistent with studies from other LMIC (Yi et al., 2017), PrEP awareness campaigns using peer outreach workers, traditional media and online communications are needed in India.

Limitations and strengths

This study has several limitations and strengths. Due to the mixed sampling method, our findings may not be generalisable to all MSM who visit cruising sites in India; however, we successfully recruited a diverse, high-risk and non-clinic-based sample of MSM for whom PrEP would be beneficial. Similar chain-referral methods could be deployed through peer outreach workers to support PrEP roll-out. The level of prior awareness of PrEP among this sample is higher than that reported by other studies from India (Chakrapani et al., 2015; Uthappa et al., 2018), possibly reflecting participants' interactions with CBOs or increases in awareness over time. However, prior awareness and WTUP may be lower among MSM who are not engaged with CBOs. HIV risk perception was assessed with a single item; however, this is similar to several other studies of HIV risk (Gerrard et al., 1996; Koh & Yong, 2014). Finally, stated intention to use PrEP may not translate into actual uptake; nevertheless, it is important to assess WTUP in advance of availability in order to develop and disseminate evidence-informed interventions to accelerate uptake.

Conclusions

HIV risk perception and guideline-indicated PrEP eligibility were individually and jointly associated with willingness to use PrEP among MSM recruited from cruising sites in India. However, among a subgroup of PrEP-eligible MSM, low HIV risk perception and low perceived benefits of PrEP were associated with non-willingness to use PrEP. Promoting accurate self-assessment of risk and educating MSM on potential benefits of PrEP as well as potential risks may support uptake. Combination prevention approaches that integrate evidence-informed individual-level interventions to accelerate PrEP uptake with structural interventions to promote culturally competent, non-discriminatory environments for MSM in healthcare settings (Beattie et al., 2012; Chakrapani et al., 2007; Woodford et al., 2016) and provide free or subsidised PrEP (Chakrapani et al., 2015) can optimise coverage among at-risk MSM in India.

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