Importance of Risk Perception: Predictors of PrEP Acceptance Among Thai MSM and TG Women at a Community-Based Health Service

Rosalyn Plotzker, MD, MPH, Pich Seekaew, MPH,† Jureeporn Jantarapakde, RN, MSc,† Supabhorn Pengnonyang, BSc, MSc,† Deondara Trachunthong, MSc,† Danai Linjongrat, BS,‡ Surang Janyam, MEd,§ Thitiyanun Nakpor, BA,|| Sutinee Charoenying, MPA,¶ Stephen Mills, PhD, MPH,¶ Ravipa Vannakit, MSc,# Michael Cassell, PhD,# Praphan Phanuphak, MD,† Cheewanan Lertpiriyasuwat, MD,** and Nittaya Phanuphak, MD, PhD†*

Background: HIV prevalence among Thai men who have sex with men (MSM) and transgender women (TG) are 9.15% and 11.8%, respectively, compared with 1.1% in the general population. To better understand early adopters of pre-exposure prophylaxis (PrEP) in Thailand, we analyzed biobehavioral and sociodemographic characteristics of PrEP-eligible MSM and TG.

Setting: Four Thai urban community clinics between October 2015 and February 2016.

Methods: Sociodemographics, HIV risk characteristics, and PrEP knowledge and attitudes were analyzed in association with PrEP initiation among eligible Thai MSM and TG. Adjusted analysis explored factors associated with PrEP acceptance. We then analyzed HIV risk perception, which was strongly associated with PrEP initiation.

Results: Of 297 participants, 55% accepted PrEP (48% of MSM, 54% of TG). Perceived HIV risk levels were associated with PrEP acceptance [odds ratio (OR): 4.3; 95% confidence interval (95% CI): 1.5 to 12.2. OR: 6.3; 95% CI: 2.1 to 19.0. OR: 14.7; 95% CI: 3.9 to 55.1; for minimal, moderate, and high perceived risks, respectively]. HIV risk perception was associated with previous HIV testing (OR: 2.2; 95% CI: 1.4 to 3.5); inconsistent condom use (OR: 1.8; 95% CI: 1.1 to 2.9); amphetamine use in the past 6 months (OR: 3.1; 95% CI: 1.1 to 8.6); and uncertainty in the sexually transmitted infection history (OR: 2.3; 95% CI: 1.4 to 3.7). Approximately half of those who reported either inconsistent condom use (46%), multiple partners (50%), group sex (48%), or had baseline bacterial sexually transmitted infection (48%) perceived themselves as having no or mild HIV risk.

Conclusions: HIV risk perception plays an important role in PrEP acceptance. Perception does not consistently reflect actual risk. It is therefore critical to assess a client's risk perception and provide education about HIV risk factors that will improve the accuracy of perceived HIV risk.

Key Words: HIV prevention, pre-exposure prophylaxis, HIV risk perception, men who have sex with men, transgender women, Thailand

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INTRODUCTION

In 2014, an estimated 450,000 people were reported as diagnosed and living with HIV/AIDS in Thailand. Less than 8000 were newly diagnosed with HIV, versus over 28,000 14 years prior. Annual AIDS mortality similarly decreased during that time, from over 55,000 in 2000 to approximately 19,000 in 2014.[1] These data represent a downward trend in new cases, along with an increase in lifespan among Thai HIV-infected individuals. Both are owed in part to improved treatment regimens, better care-access, as well as aggressive HIV prevention efforts.

The downward trend is not equally steep across all groups. Among men who have sex with men (MSM), the prevalence remains high, most notably in urban areas such as Bangkok. In 2010, approximately 550,000 MSM lived in Thailand (excluding Male Sex Workers, MSW), as well as an estimated 75,000 transgender women (TG) and 18,000 MSWs.[2] A 2014 study showed an HIV prevalence rate of 11.9% among MSWs, compared with 1.1% prevalence among the general adult population.[2] Most recently, as per the 2014 HIV Integrated Biological and Behavioral Surveillance Survey (IBBSS),[3] the countrywide prevalence of HIV among MSM was 9.15%, with more than a 100% increase in prevalence among MSM below 25 year old—from 5.3% in 2012 to

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From the *Mount Sinai Hospital, New York, NY; †Thai Red Cross AIDS Research Centre, Bangkok, Thailand; ‡Rainbow Sky Association of Thailand, Bangkok, Thailand; §Service Workers In Group Foundation, Bangkok, Thailand; ||Sisters Foundation, Chonburi, Thailand; ¶FHI 360 and USAID LINKAGES Project, Bangkok, Thailand; #Office of Public Health, U.S. Agency for International Development Regional Development Mission Asia, Bangkok, Thailand; and **Department of Disease Control, Ministry of Public Health, Nonthaburi, Thailand.

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Correspondence to: Rosalyn Plotzker, MD, MPH, 300 Frank H Ogawa Plaza, Suite 520 Oakland, CA 94612 (e-mail: Rosalyn.plotzker@ucsf.edu).

10.99% in 2014.[4] Within Bangkok, estimated HIV prevalence among MSM ranges from 20% to 30%, and neither incidence nor prevalence has shown significant decline in the past decade.[5–8] With regard to TG, median HIV prevalence among those in Bangkok, Chiang Mai, Phuket, and Ratchaburi was 11.8%.[9] Despite impressive achievements in HIV prevention, thousands of MSM and TG require effective HIV prophylaxis, especially those in their early and formative years of sexual activity.

Pre-exposure prophylaxis (PrEP)—tenofivir-emtricitabine (TDF/FTC)—is an antiretroviral approach to preclude HIV infection. Shortly after the iPrex trial, the Center for Disease Control and Prevention released guidelines for its use among MSM.[10] The daily oral dose of TDF/FTC has been proven effective in multiple clinical and pragmatic trials.[11] Yet, barriers to PrEP use exist among Thai MSM and TG.[12] Potential hurdles include limited knowledge, stigma, expense, one's own HIV risk perception, and access to the drug itself. Many Thai MSM and TG would be willing to take daily oral PrEP, despite potential inconvenience and cost.[13] However, willingness to accept and adhere to PrEP has not been well explored.

To obtain information for the development of national PrEP guidelines for Thailand, the Department of Disease Control (DDC) under the Ministry of Public Health (MOPH) is collaborating with the Thai Red Cross AIDS Research Centre (TRCARC), the United States Agency for International Development Regional Development Mission for Asia (USAID/RDMA), Family Health International (FHI) 360, and the Thailand Ministry of Public Health-US CDC Collaboration (TUC) to evaluate the use of PrEP among MSM and TG. The purpose of this analysis is to study the acceptance rate of PrEP use among MSM and TG clients of community-based clinic sites, and the factors influencing PrEP acceptance.

METHODS

The PrEP substudy is a prospective observational cohort study, assessing acceptance of PrEP among HIV-uninfected MSM and TG. Participants were recruited from the overall Test and Treat project,[14] a TRCARC study evaluating the offering of antiretroviral therapy (ART) immediately after same day HIV diagnosis among Thai MSM and TG, regardless of CD4 count, in line with Thai National Guideline Recommendations since 2014.[15] Test and Treat participants who tested HIV uninfected were referred for the PrEP substudy. This analysis specifically considers participants from community-based clinic sites in Bangkok (Rainbow Sky Association of Thailand or RSAT and Service Workers IN Group or SWING, overseen by TRCARC) and Pattaya (SWING and Sisters, overseen by Queen Savang Vadhana Memorial Hospital). All clinics serve clients with high HIV incidence and are experienced in providing sexual health services to at-risk MSM and TG. Enrollment in the PrEP substudy began in both Bangkok and Pattaya in October 2015. This study was reviewed and approved by the institutional review board of the Faculty of Medicine, Chulalongkorn University, which oversees the study conducted by the TRCARC. Data included in this analysis pertain to participants who enrolled up to February 19, 2016.

MSM and TG who were at least 18 years of age, of Thai nationality, and able to speak and write Thai were HIV uninfected by third generation HIV 1 & 2 antibody testing and reported condomless anal intercourse (CAI) within 6 months were referred for the PrEP substudy. As per self-report, participants must also have had no symptoms of acute HIV infection within the previous 6 weeks. Those with recent acute HIV infection symptoms were referred for further clinical care, and could be reevaluated for PrEP initiation during the next 6-month period.

Target MSM and TG participants in this project were initially recruited by extensive community outreach as part of the overall Test and Treat project. Strategies included incentive-based targeted search; recruitment through social networks; communication materials such as leaflets, flyers, and advertising media; and social media channels such as Adamslove.org—Thailand's official gay men's health organization website—and other popular websites among MSM and TG.

Participants who tested HIV uninfected for Test and Treat were invited to the PrEP substudy. Those interested received documents with background information for consideration. Trained project staff members were available at all clinic sites to discuss questions related to the study before deciding whether or not to participate. Participants were assured that their decision would not entail penalty or forfeiture of any benefits from other services in the service delivery unit.

A questionnaire completed during the Test and Treat project enrollment assessed sociodemographic characteristics, HIV risk behavior, knowledge, attitude, and awareness about PrEP. This information was made available to the PrEP substudy at the time of referral.

Participants who met all eligibility criteria and volunteered to take PrEP were dispensed their first bottle of TDF/FTC prescribed as 1 pill per day at no charge as part of a comprehensive package of HIV prevention services, and scheduled for a follow-up appointment for 1 month. If at 1 month, the participant reported no side effects or issues concerning nonadherence to medication, then he/she was asked to make a follow-up visit in months 3, 6, 9, and 12, which were all free of charge.

At enrollment, participants who accepted PrEP underwent tests for HBsAg and anti-HBs, and creatinine clearance (CrCl). Participants found to have CrCl < 60 mL/min, were told to immediately discontinue PrEP, were referred for further clinical care, and were told they could be reevaluated for PrEP initiation during the next 6 months. If no hepatitis B immunity was present, they were advised to receive hepatitis B vaccination. If a participant tested positive for HBsAg and wished to use oral PrEP, he/she was referred to a physician to determine treatment for hepatitis B in tandem using PrEP. Participants using PrEP who had HBsAg positive results were advised to take a follow-up SGPT test in month 3 after stopping the medication to monitor any relapse of hepatitis symptoms, which may occur after stopping the medication.

Blood was collected for testing for syphilis. Pharyngeal swab, urine, and rectal swab samples were collected to test for *Neisseria gonorrhea* and *Chlamydia trachomatis*. Participants

were informed of any positive result, referred for sexually transmitted infection (STI) treatment, and received support for partner notification.

Eligible participants who declined PrEP were informed that they could return at any anytime within 6 months for initiation of PrEP, if they desired to do so.

Measures

HIV testing was conducted using third generation rapid antibody test for enrollment and shipped for fourth generation Alere Determine HIV 1/2 (Alere Medical Co., Ltd., Matsuhidal, Matsudo-shi, Chiba, Japan); followed by second and third rapid HIV 1 & 2 antibody assays with DoubleCheck-Gold Ultra HIV 1 & 2 (Orgenics, Yavne, Israel) and SD Bioline HIV 1/2 (Standard Diagnostics, Inc., Hagal-dong Giheung-gu, Yongin-si, Korea). Serologic testing for syphilis was conducted using a *Treponema pallidum* hemagglutination assay screening with venereal disease research laboratory or rapid plasma antigen assay confirmation. Serologic testing for creatinine, anti-HBs, and HBsAg were performed, as discussed above. Nucleic acid amplification test was used to test for oral, anal, neovaginal, and urethral *N. gonorrhea* and *C. trachomatis*.

Sociodemographic and HIV risk behavioral data were collected through trained interviewers using standardized questionnaires at the time of Test and Treat project enrollment. Questions were codeveloped and reviewed with PrEP researchers from the TUC and USAID/RDMA team. They were then piloted with representatives from community-based organizations including SWING, RSAT, and Sisters. The final set of questions was then used to develop a self-administered questionnaire. This assessed sociodemographic characteristics, previous HIV testing, sexual risk behaviors including number of partners, age of first intercourse, group sex, and condom use behaviors within specific sexual contexts (eg, CAI with a known HIV positive partner; CAI as a sex worker, etc); illicit drug use including amphetamine use within the past 6 months, as well as injection drug use; circumcision; history of STI diagnosis, and history of STI symptoms within the past 6 months.

We measured HIV risk perception using a cognitive self-assessment of HIV risk (no risk, minimal, moderate, and high). Knowledge about PrEP was assessed using a question set that evaluated the participant's understanding of PrEP's purpose, effectiveness, how it should be taken, potential side effects, and appropriate medical follow-up while using PrEP. A question set assessing attitude toward PrEP included questions about feelings of embarrassment and anxiety; potential barriers such as cost, aversion to taking pills; fear of side effects; and fear of disclosing one's sexuality to family, peers, and coworkers.

Statistical Analysis

Descriptive statistics were used to characterize participants who accepted PrEP, and those who declined, as shown in Table 1. Continuous variables were expressed as mean values with standard deviation or medians with interquartile ranges (IQR), and categorical variables were expressed as percentages. Unadjusted between-group comparisons used χ^2, Fisher exact, *t*-, and Wilcoxon rank-sum tests as appropriate.

Univariate binary logistic regression was used to select independent variables potentially associated with PrEP acceptance within a multivariable analysis. All variables collected were considered in this step of the data analysis. Variables that resulted in an odds ratio (OR) with a corresponding *P*-value <0.1 in univariate analysis were selected to be included in a multivariable binary logistic regression to determine significant predictors of PrEP acceptance in an adjusted model ($P < 0.05$).

A similar approach of univariate logistic regression ($P < 0.10$) followed by multivariable logistic regression ($P < 0.05$) was used to identify independent variables associated with HIV risk perception in an adjusted model. Rather than binary logistic regression, ordinal logistic regressions were used in light of the categorical outcome variable.

Finally, a descriptive table illustrates proportions of participants with specific HIV risk characteristics (STI present at baseline, reported inconsistent condom use, group sex, and drug use behaviors); we compare these risk characteristics to corresponding perceptions of HIV risk.

All statistical analyses were performed using STATA version 14.1.

RESULTS

Baseline Measurements

Of 297 HIV-uninfected MSM and TG, 55% accepted PrEP (48% of MSM and 54% of TG). Baseline HIV risk measurements are shown in Table 1. Knowledge and attitudes toward PrEP are shown in Table 2 and described below. Demographics and baseline STI can each be found in Supplemental Digital Content Tables 1 and 2, http://links.lww.com/QAI/B78.

Demographics

There were no significant demographic differences between those who accepted PrEP and those who declined. Median age of enrolled participants was 25 years (IQR: 21.9–30.2); 43.4% were MSM, 56.5% TGW. Just under a fourth (23%) were either a student or unemployed and 36% worked in the service/entertainment industry. Median monthly income was 12,000 THB ($350) (IQR: 9700–20,000 THB). About one-quarter (24%) had received a Bachelor's degree or higher.

HIV Risk Characteristics

HIV risk perception ($P < 0.001$), inconsistent condom use ($P = 0.036$), and previous STI diagnosis and symptoms ($P < 0.001$) were significantly different between PrEP acceptors compared with those who declined.

With regard to HIV risk self-assessment, 13.5% reported "no risk"; 37% "minimal," 29.6% "moderate"; and 18.9% "high." Half of participants (49.8%) were first time HIV-testers. Most participants (74.1%) were uncircumcised.

TABLE 1. Baseline HIV Risk Characteristics and Behaviors [n (%)]

Characteristics	Overall (N = 297)	Decline PrEP (N = 134)	Accept Prep (N = 163)	*P* Decline Versus Accept
Age at first sexual intercourse, yr				
Median (IQR)	17 (15–19)	17 (15–19)	17 (15–18)	0.687‡
<17	131 (14.3)	60 (14.5)	71 (45)	0.828*
Missing	11 (3.7)	5 (3.7)	6 (3.8)	
Number of sexual partners in the past 6 mo				
No partner	1 (0.3)	0 (0.0)	1 (0.6)	0.403*
Single partner	33 (11.1)	19 (14.2)	14 (8.6)	
Multiple partners	145 (48.8)	64 (47.8)	101 (62)	
No answer/Missing	118 (39.7)	51 (38.1)	67 (41)	
HIV perceive risk in the past 6 mo§				
No risk	40 (13.5)	31 (23.1)	9 (5.5)	**<0.001***
Minimal	110 (37)	48 (35.8)	62 (38)	
Moderate	88 (29.6)	33 (24.6)	55 (34)	
High	56 (18.9)	19 (14.2)	37 (23)	
Missing	3 (1)	3 (2.2)	0 (0)	
Condom use in the past 6 mo§				
Safe sex	81 (27.3)	44 (32.8)	37 (23)	**0.036***
Unprotected sex	209 (70.4)	85 (63.4)	124 (76)	
No answer/Missing	7 (2.4)	5 (3.7)	2 (1.2)	
Male circumcision				
Yes	24 (8.1)	6 (4.5)	18 (11)	0.073*
No	220 (74.1)	102 (76.1)	118 (72)	
No answer	27 (9.1)	15 (11.2)	12 (7.4)	
Missing	26 (8.8)	11 (8.2)	15 (9.2)	
IV drug use, Ever				
Never used	266 (89.6)	121 (90.3)	145 (89)	0.082†
Ever used	9 (3.0)	1 (0.8)	8 (4.9)	
No answer/Missing	22 (7.4)	12 (9)	10 (6.1)	
Any Drug used in the past 6 mo				
No	162 (54.6)	72 (53.7)	90 (55)	0.621*
Yes	118 (39.7)	56 (41.8)	62 (38)	
No answer/Missing	17 (5.7)	6 (4.5)	11 (6.7)	
Amphetamine use in past 6 mo				
Yes	275 (92.6)	125 (93.3)	150 (92)	>0.99†
No	16 (5.4)	7 (5.2)	9 (5.5)	
Missing	6 (2)	2 (1.5)	4 (2.5)	
Any STI symptoms or diagnosis in the past 6 mo§				
No	178 (59.9)	95 (70.9)	83 (51)	**<0.001***
Yes	23 (7.7)	11 (8.2)	12 (7.4)	
Not sure	82 (27.6)	22 (16.4)	60 (37)	
Refuse to answer	14 (4.7)	6 (4.5)	8 (4.9)	
Had group sex in the past 6 mo				
No	244 (82.2)	119 (88.8)	125 (77)	0.070*
Yes	29 (9.8)	9 (6.7)	20 (12)	
Missing	24 (8.1)	6 (4.5)	18 (11)	

*χ^2 test
†Fisher exact test.
‡Wilcoxen rank sum.
§Statistically significant.
Bold *P* values indicate statistical significance.

Median age of first sexual intercourse was 17 years (IQR: 15–19). Approximately half (48.8%) reported having multiple sexual partners; the majority (70.4%) reported condomless intercourse within 6 months, although just a tenth (9.8%) reported group sex within 6 months. Approximately one-third (30.3%) tested positively at enrollment for chlamydia,

TABLE 2. Baseline PrEP Knowledge and Attitudes [n (%) Unless Otherwise Specified]

Characteristics	Overall (N = 297)	Decline PrEP (N = 134)	Accept Prep (N = 163)	*P* Decline Versus Accept
Knowledge about PrEP [shown as n/N (%)]				
Purpose of PrEP is HIV protection	265/274 (96.7)	115/120 (95.8)	150/154 (97.4)	0.511†
PrEP is an ART for HIV patients‡	184/270 (68.1)	91/118 (77.1)	93/152 (61.2)	**0.005***
Should use a condom while on PrEP	225/271 (83.0)	101/119 (84.9)	124/152 (81.6)	0.473*
Effective when taken correctly	258/272 (94.8)	111/118 (94.1)	147/154 (95.5)	0.608*
Must be HIV negative to use PrEP	246/273 (90.1)	106/118 (89.8)	140/155 (90.3)	0.893*
Those on PrEP still need HIV testing	222/273 (81.3)	93/119 (78.1)	129/154 (83.8)	0.238*
Side effects possible, but will recover after first month	184/270 (68.1)	86/119 (72.3)	98/151 (64.9)	0.197*
Must test for HIV if symptoms such as fever, sore throat, head ache, rash, or lymphadenitis occur while on PrEP	217/274 (79.2)	94/119 (79.0)	123/155 (79.35)	0.941*
Can start PrEP without laboratories, except HIV (False)	128/271 (47.2)	49/118 (41.5)	79/153 (51.63)	0.098*
If forget to take only 1 pill; must stop PrEP because protection no longer effective (False)	186/273 (68.1)	78/119 (65.5)	108/154 (70.13)	0.420*
Attitudes toward PrEP				
Embarrassed to take PrEP for HIV protection	N =277	N = 121	N = 156	0.121†
Yes definitely	9 (3.2)	7 (5.8)	2 (1.3)	
Yes maybe	10 (3.6)	6 (5.0)	4 (2.6)	
Probably not	36 (13.0)	14 (11.6)	22 (14.1)	
Definitely not	222 (80.1)	94 (77.7)	128 (82.1)	
Feel anxious to take PrEP	N= 270	N = 117	N = 153	0.095†
Yes definitely	12 (4.4)	9 (7.7)	3 (2.0)	
Yes maybe	74 (27.4)	34 (29.1)	40 (26.1)	
Probably not	61 (22.6)	27 (23.1)	34 (22.2)	
Definitely not	123 (45.6)	47 (40.2)	76 (49.7)	
Barriers of taking PrEP	N = 278	N = 122	N = 156	
Cost	70 (25.2)	27 (22.1)	43 (27.6)	0.300*
Side effects	139 (50.0)	67 (54.9)	72 (46.2)	0.147*
Don't like to take drug‡	43 (15.5)	30 (24.6)	13 (8.3)	**<0.001***
Forget to take drug	162 (58.3)	74 (60.7)	88 (56.4)	0.476*
Afraid of family knowing	35 (12.6)	18 (14.7)	17 (10.9)	0.336*
Afraid of partner knowing	30 (10.8)	16 (13.1)	14 (9.0)	0.270*
People will know they are gay or TG	10 (3.6)	6 (4.9)	4 (2.6)	0.343†
People will think they have HIV	84 (30.2)	33 (27.0)	51 (36.5)	0.309*
Used other HIV preventions	13 (4.7)	8 (6.6)	5 (3.2)	0.189*
Other	3 (1.1)	0 (0.0)	3 (1.9)	0.259†
Taking PrEP makes hope to protect against HIV	N = 278	N = 122	N = 156	0.625†
Yes definitely	219 (78.8)	93 (76.2)	126 (80.8)	
Yes maybe	56 (20.1)	27 (22.1)	29 (18.6)	
Probably not	1 (0.4)	1 (0.8)	0 (0)	
Definitely not	2 (0.7)	1 (0.8)	1 (0.6)	

*χ^2 test.
†Fisher exact test.
‡Statistically significant.

gonorrhea, and/or syphilis (74%, 43%, 14.4%, respectively, among those who tested positive for any STI at baseline). In addition, a few (7.7%) reported having been either diagnosed with an STI, or having had STI symptoms within 6 months. However, over 1 in 4 (27.7%) reported STI history uncertainty.

Drug use was a less common risk factor. Under half (39.7%) reported drug use within 6 months, and only a small minority (5.4%) used amphetamines or injected drugs during that period(1.7%).

Knowledge and Attitudes Toward PrEP

We found a significant difference in understanding that PrEP is an ART between PrEP acceptors and non-acceptors ($P = 0.005$). An aversion to taking pills was also

TABLE 3. Logistic Regression: Determinants of PrEP Acceptance

	Response	OR	SE	*P*	95% Confidence Interval
HIV risk perception* (versus none)	Minimal	4.27	2.29	0.007	1.50 to 12.21
	Moderate	6.33	3.54	0.001	2.11 to 18.96
	High	14.72	9.92	<0.001	3.93 to 55.14
History of STI, or Sx w/in 6 mo (versus no)	Yes	0.74	0.43	0.603	0.23 to 2.31
	Uncertain	1.94	0.80	0.111	0.86 to 4.37
Circumcised* (versus yes)	No	0.22	0.14	0.021	0.06 to 0.79
	Not answered	0.10	0.10	0.015	0.02 to 0.64
Group Sex (versus no)	Yes	2.00	1.21	0.251	0.61 to 6.57
Knowledge: PrEP is an ART for treating HIV-infected patients* (versus false)	True	2.11	0.77	0.039	1.04 to 4.30
Knowledge: need laboratory testing while on PrEP (versus true)	False	1.53	0.51	0.203	0.80 to 2.93
Attitude: embarrassed to take PrEP (versus yes)	Maybe	0.45	0.78	0.645	0.01 to 13.57
	Probably not	0.41	0.622	0.558	0.02 to 7.87
	Definitely not	0.37	0.55	0.502	0.02 to 6.70
Attitude: feels anxious to take PrEP (versus yes)	Maybe	5.90	7.29	0.151	0.52 to 66.52
	Probably not	4.70	5.85	0.214	0.41 to 53.94
	Definitely not	6.74	8.25	0.119	0.61 to 74.39
Averse to taking pills* (versus no)	Yes	0.177	0.09	0.001	0.06 to 0.50
Ever injected drugs (versus no)	Yes	3.45	4.39	0.329	0.29 to 41.62
	Not answered	0.51	0.41	0.401	0.11 to 2.44

*Statistically significant.

significantly different between PrEP acceptor and nonacceptors ($P < 0.001$).

Most participants demonstrated understanding PrEP with regard to purpose (96.7%), effectiveness (94.8%), eligibility (ie, must be HIV negative) (90.1%), adherence (68.1%), side effects (68.1%), and the need for medical monitoring (81.3%). Approximately half (47.2%) knew that laboratory tests besides HIV tests were needed. Finally, most (83%) understood the need to use condoms with PrEP to protect against other STIs.

The vast majority of participants did not feel embarrassed to take PrEP (93.1%), and under one-third (31.8%) reported anxiety toward taking PrEP. Of other potential barriers, 25% expressed concern regarding cost, half (50%) reported concerns about side effects, and just over half (58%) were uncertain about daily adherence. Although only a few (15%) reported pill aversion, this was negatively associated PrEP acceptance. A minority expressed concerns related to stigma: Approximately a third (30.2%) worried that others would think they had HIV, whereas some feared their PrEP would be discovered by family (12.8%) or a partner (10.8%).

TABLE 4. Ordinal Logistic Regression: Determinants of HIV Risk Perception

HIV Risk Characteristic (Versus "No")	OR	SE	*P*	95% Confidence Interval
Previous HIV testing*	2.21	0.52	0.001	1.40 to 3.50
Positive urine chlamydia	1.94	1.14	0.263	0.61 to 6.15
Inconsistent condom use*	1.76	0.46	0.031	1.05 to 2.94
Ever use injection drugs	1.31	0.32	0.268	0.81 to 2.11
History of bacterial STI diagnosis or symptoms within the past 6 mo				
Yes	1.33	0.55	0.489	0.59 to 3.00
Uncertain*	2.26	0.59	0.002	1.36 to 3.76
Amphetamine use in past 6 mo*	3.14	1.62	0.027	1.14 to 8.64

*Statistically significant.

PrEP Acceptance—Adjusted Multivariable Model

Table 3 presents ORs of independent variables potentially associated with PrEP acceptance within an adjusted model. PrEP acceptance was positively associated with HIV risk perception [OR: 4.3 (1.5–12.2), 6.3 (2.1–19.0), and 14.7 (3.9–55.1) for minimal, moderate, and high risk, respectively]; as well as knowing PrEP is not an ART [OR: 2.1 (1.0–4.3)]. Participants who reported an aversion to pills were much less likely to accept PrEP [OR: 0.11 (0.06–0.50)]. Finally, being either uncircumcised [OR: 0.21 (0.06–0.79)] or refusing to answer [OR: 0.10 (0.02–0.64)] was associated with decreased PrEP acceptance.

HIV Risk Perception

We further examined associations between independent variables and the magnitude of HIV risk perception, as identified with ordinal logistic regression in Table 4. Increased HIV risk perception was associated with having had a HIV test [OR: 2.2 (1.4–3.5)]; inconsistent condom use

TABLE 5. HIV Risk Characteristic Compared With HIV Risk Perception

	Perceived HIV Risk				
HIV Risk Characteristic	**None**	**Minimal**	**Moderate**	**High**	***P***
Inconsistent condom use‡ 208 (70%)	20 (9.2)	75 (36)	70 (33.65)	45 (20.67)	**0.015***
Any STI present 87 (29%)	8 (9.2)	34 (39.1)	29 (33.3)	16 (18.4)	0.500*
Multiple partners 143 (48%)	16 (11.2)	55 (38.5)	46 (32.17)	26 (18.18)	0.599*
Group sex 29 (10.7%)	2 (7.0)	12 (41)	8 (27.6)	7 (24.1)	0.566*
Any drug use 117 (39.8%)	16 (5.5)	44 (43.8)	33 (35)	24 (22.3)	0.52*
Amphetamine use in 6 mo‡ 16 (5.4%)	2 (12.5)	2 (12.5)	5 (31.25)	7 (43.75)	**0.039**†
Ever use injection drugs 9 (3%)	0 (0)	2 (22)	4 (44)	3 (33)	N/A (due to small n)

*χ^2 test.
†Fisher exact test.
‡Statistically significant.
Bold *P* values indicate statistical significance.

[OR: 1.8 (1.1–2.9)]; amphetamine use [OR: 3.1 (1.1–8.6)]; and STI history uncertainty [OR: 2.3 (1.4–3.7)].

We then compared HIV risk perception magnitudes across HIV risk characteristics. Table 5 provides descriptive data of the distribution of HIV risk perception across different HIV risk characteristics. Inconsistent condom use and amphetamine use showed a significant variation in magnitude of HIV risk perception. Importantly, large proportions of participants with HIV risk characteristics perceive their risk to be minimal or none: 46% of those who reported unsafe condom use; 48% of those with a bacterial STI at baseline; 50% of those with multiple partners; and 48% of those who participated in group sex.

DISCUSSION

This analysis used data collected from Thai MSM (including MSW) and TG who were referred for PrEP after determining that they were HIV uninfected in a community-based setting and had self-reported HIV risk behaviors. Within this context, 55% of participants accepted PrEP as a method of HIV prevention alongside other behavioral HIV prevention strategies. In adjusted multivariable analysis, we demonstrate that PrEP acceptance as part of an HIV prevention package was strongly associated with one's perception of personal HIV risk, consistent with recent recognition of the importance of risk perception in HIV prevention efforts.[16–18] This emphasizes the need for discussion about self-assessment of HIV risk when counseling MSM and TG clients on whether PrEP would be an appropriate HIV prevention option.

No demographic variables were associated with likelihood of PrEP acceptance. Similarly, HIV risk characteristics such as reported inconsistent condom use, age of first intercourse, having multiple sexual partners, or STI presence at baseline were not directly related to PrEP uptake. However, inconsistent condom use and amphetamine use within the previous 6 months raised one's perceived HIV risk, suggesting an indirect association with PrEP uptake that is mediated by how these factors raise one's sense of HIV risk, as illustrated in Figure 1. Still, there remains a concern that other risk characteristics are not strongly considered when a client determines self-risk.

Interestingly, being uncircumcised was associated with lower PrEP acceptance compared with circumcised participants. In Thailand, Muslim men undergo circumcision at age 6–15 years. Although age of circumcision was not asked here, in a similar TRCARC study cohort, the median age of circumcision was 10 years (unpublished data). Here, 9 men reported being Muslim (Supplemental Digital Content Table 1, http://links.lww.com/QAI/B78), whereas 22 reported circumcision.

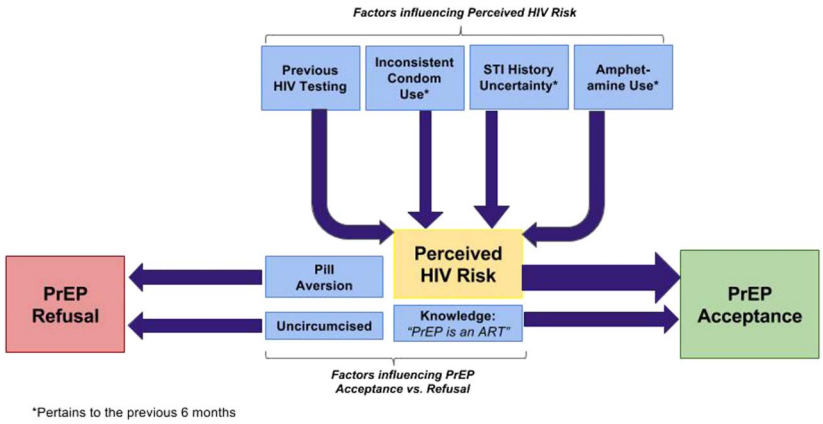

FIGURE 1. A Conceptual Model of PrEP Acceptance vs. Decline: the choice to use or decline PrEP is influenced by a number of factors, most notably one's perceived likelihood HIV infection. Further upstream, one's history of HIV testing, condom use, STI history, and amphetamine use are each associated with the magnitude of HIV risk perceived by a MSM or TG.

This proportion suggests that circumcision was more likely for health reasons than religious practice. It may imply that circumcised participants are more health conscious and more likely to accept PrEP compared with their uncircumcised counterparts.

Most participants demonstrated good knowledge of PrEP across all topics assessed. Yet, only an understanding that PrEP is also ART treatment predicted PrEP acceptance. Of potential barriers, an aversion to taking a daily pill was the single "attitude" that decreased acceptance, consistent with previous studies.[19,20] Those with pill aversion may benefit from development of PrEP in injectable or rectal form. Overall these findings support earlier research which demonstrated that PrEP was an acceptable option for Thai MSM and TG despite barriers such as cost and inconvenience.[13]

In our exploration of HIV risk perception determinants, we found the degree of magnitude to be associated with previous HIV testing, self-reported inconsistent condom use, uncertainty of STI history, and amphetamine use within 6 months in an adjusted model (although reported amphetamine use within 6 months was low). These illustrate several points on how one might estimate self-HIV risk in light of HIV- and STI-related experiences. Previous HIV testing may signify recognition of possible exposure, or may have been an educational experience regarding HIV risk factors.[21–24] Inconsistent condom use is a well-recognized risk factor and is known to be associated with higher risk perception among MSM in Asia.[25] However, many MSM and TG take calculated risks with regard to barrier protection,[26–28] and condom negotiation remains an issue for both MSM and TG.[29–31] In addition, reported uncertainty with regard to STI history may represent one's deep-seated, perceived risk (and perceived or real symptoms) associated with "real exposure" to HIV from past high-risk unprotected event(s).

Across all measured HIV risk behaviors, approximately half of participants in any given risk behavior category assessed their risk to be "none" or "low." This discordance between estimated versus real world HIV risk is especially concerning. It presents a challenge to PrEP promoters, as it suggests that a client's perception does not reliably reflect actual risk. Thus, both actual and perceived risk should be explored—especially among PrEP decliners—to reach high-risk individuals who may benefit from additional counseling, and encouragement to include PrEP as part of a combination HIV prevention package.

Knowledge around HIV and STI prevention with PrEP and condoms in this study was high, which could be the result of extensive community education efforts carried out by TRCARC and other partners in the country. However one's knowledge does not consistently translate into practice, and a client may not intuitively apply concepts of risk to herself or himself.[18,31] Therefore, it is crucial to explore interventions that could empower key populations to effectively apply knowledge to the calculation of self-risk.

This study has several limitations. First, it is limited to the context of community clinic settings, and does not assess for potential differences that might arise in a hospital facility. Also, although we did not find participant sex to be a significant predictor of PrEP acceptance in multivariable analysis, previous studies show that the context of HIV prevention for TG and MSM has important cultural differences. Further investigation on these nuances regarding PrEP acceptance and HIV risk perception in specifically TG or MSM communities could fine tune the understanding of associations here. Finally, a high proportion (39.7%) of participants lacked data on whether they had multiple sexual partners, which limited our assessment of this variable.

In summary, our findings suggest that both HIV risk perception and HIV risk behaviors are keystones in the effort to expand PrEP distribution to key populations such as MSM and TG. Discussions with clients about PrEP use should include assessment of one's HIV risk perception to guide the conversation. Additional and specific efforts must be made to delve into clients' actual risk behaviors and educate clients who estimate their risk to be low, as our data show a high proportion of participants underestimated their risk. Finally, our study supports existing evidence that PrEP is an acceptable addition to HIV prevention services for MSM and TG. Moving forward, HIV risk perception and risk education must be incorporated into PrEP distribution strategies to improve PrEP uptake and create a comprehensive strategy of HIV prevention.

REFERENCES

1. Thai National AIDS Committee. *Thailand Ending AIDS: 2014 Thailand AIDS Response Progress Report*. Bangkok, Thailand: Ministry of Health; 2014.
2. *(Thai) NAC 2015 Thailand AIDS Response Progress Report*. Available at: http://www.unaids.org/sites/default/files/country/documents/THA_narrative_report_2015.pdf. Accessed October 17, 2016.
3. *Country Fact Sheet: Thailand 2014*. AIDSinfo, UNAIDS Web. 2016. Available at: http://aidsinfo.unaids.org/. Accessed March 10, 2017.
4. *HIV Prevalence Among Men Who Have Sex with Men—by Age [Thailand]*. AIDSinfo, UNAIDS Web. 2016. Available at: http://aidsinfo.unaids.org/#submenu1.
5. Van Griensven F, Varangrat A, Wimonsate W, et al. Trends in HIV prevalence, estimated HIV incidence, and risk behavior among men who have sex with men in Bangkok, Thailand, 2003–2007. *J Acquir Immune Defic Syndr*. 2010;53:234–239.
6. Beyrer C, Baral SD, van Griensven F, et al. Global epidemiology of HIV infection in men who have sex with men. *Lancet*. 2010;380:367–377.
7. van Griensven F, de Lind van Wijngaarden JW. A review of the epidemiology of HIV infection and prevention responses among MSM in Asia. *AIDS*. 2010;24:S30–S40.
8. Sapsirisavat V, Phanuphak N, Keadpudsa S, et al. Psychosocial and behavioral characteristics of high-risk men who have sex with men (MSM) of unknown HIV positive serostatus in Bangkok, Thailand. *AIDS Behav*. 2016;20:386–397.
9. Sirinirund P, Limanond B, Saonuam P, et al, eds. 2012 Thailand AIDS response progress report. *Prevention*. 2013;1.13.1:1–334.
10. Smith D, Grant R, Weidle P, et al. Interim guidance: preexposure prophylaxis for the prevention of HIV infection in men who have sex with men. *MMWR Morb Mortal Wkly Rep*. 2011;60:65–68.
11. U.S. Food and Drug Administration. *FDA Approves First Drug for Reducing the Risk of Sexually Acquired HIV Infection*. 2012. Available at: http://www.fda.gov/NewsEvents/Newsroom/PressAnnouncements/ucm312210.htm. Accessed March 10, 2017.
12. Tangmunkongvorakul A, Chariyalertsak S, Amico KR, et al. Facilitators and barriers to medication adherence in an HIV prevention study among men who have sex with men in the iPrEx study in Chiang Mai, Thailand. *AIDS Care*. 2013;25:961–967.
13. Wheelock A, Eisingerich AB, Ananworanich J, et al. Are Thai MSM willing to take PrEP for HIV prevention? An analysis of attitudes, preferences and acceptance. *PLoS One*. 2013;8:e54288.
14. *Study to Evaluate the Feasibility of Community-based Test and Treat Strategies Among Men Who Have Sex with Men and Transgender Women to Increase the Uptake of HIV Testing and Treatment Services in*

Thailand [Internet]. Available at: https://www.clnicaltrials.gov/ct2/show/NCT02383602.
15. Manosuthi W, Ongwandee S, Bhakeecheep S, et al; for the Adults and Adolescents Committee of the Thai Natinal HIV Guidelines Working Group. Guidelines for antiretroviral therapy in HIV-1 infected adults and adolescents 2014, Thailand. *AIDS Res Ther.* 2015;12:12.
16. Hargreaves JR, Delany-Moretlwe S, Hallett TB, et al. The HIV prevention cascade: integrating theories of epidemiological, behavioural, and social science into programme design and monitoring. *Lancet HIV.* 2013;3:e318–e322.
17. Wiwattanacheewin K, Sindhu S, Teitelman A, et al. Predictors of intention to use HIV testing service among sexually experienced youth in Thailand. *AIDS Educ Prev.* 2015;27:139.
18. Khawcharoenporn T, Kendrick S, Smith K. HIV risk perception and preexposure prophylaxis interest among a heterosexual population visiting a sexually transmitted infection clinic. *AIDS Patient Care STDs.* 2012;26:222–233.
19. Gilmore HJ, Liu A, Koester KA, et al. Participant experiences and facilitators and barriers to pill use among men who have sex with men in the iPrEx pre-exposure prophylaxis trial in San Francisco. *AIDS Patient Care STDs.* 2013;27:560–566.
20. van Griensven F, Thienkrua W, Sukwicha W, et al. Sex frequency and sex planning among men who have sex with men in Bangkok, Thailand: implications for pre-and post-exposure prophylaxis against HIV infection. *J Int AIDS Soc.* 2010;13:13.
21. Khawcharoenporn T, Chunloy K, Apisarnthanarak A. Uptake of HIV testing and counseling, risk perception and linkage to HIV care among Thai university students. *BMC Public Health.* 2016;16:556.
22. Kennedy CE, Fonner VA, Sweat MD, et al. Provider-initiated HIV testing and counseling in low-and middle-income countries: a systematic review. *AIDS Behav.* 2013;17:1571–1590.
23. Obermeyer CM, Osborn M. The utilization of testing and counseling for HIV: a review of the social and behavioral evidence. *Am J Public Health.* 2007;97:1762–1774.
24. Abdurahman S, Seyoum B, Oljira L, et al. Factors affecting acceptance of provider-initiated HIV testing and counseling services among outpatient clients in selected health facilities in Harar Town, Eastern Ethiopia. *HIV AIDS (Auckl).* 2015;7:157–165.
25. Koh KC, Yong LS. HIV risk perception, sexual behavior, and HIV prevalence among men-who-have-sex-with-men at a community-based voluntary counseling and testing center in Kuala Lumpur, Malaysia. *Interdiscip Perspect Infect Dis.* 2014;2014.
26. Thienkrua W, Todd CS, Varangrat A, et al. P4. 062 group sex, drugs, and internet use among men who have sex with men (MSM) in Bangkok, Thailand. *Sex Transm Infect.* 89(suppl 1):A308. 2013.
27. Hoff CC, Chakravarty D, Bircher AE, et al. Attitudes towards PrEP and anticipated condom use among concordant HIV-negative and HIV-discordant male couples. *AIDS Patient Care STDs.* 2015;29:408–417.
28. Curran J, Berry K, Sangsuk K. Organizational network analysis of organizations that serve men who have sex with men and transgender people in Chiang Mai, Thailand. 2014.
29. Sevelius JM, Keatley J, Calma N, et al. "I am not a man": trans-specific barriers and facilitators to PrEP acceptability among transgender women. *Glob Public Health.* 2016;11:1060–1075.
30. Vutthikraivit P, Lertnimitr B, Chalardsakul P, et al. Prevalence of HIV testing and associated factors among young men who have sex with men (MSM) in Bangkok, Thailand. *J Med Assoc Thai.* 2014;97(suppl 2): S207–S213.
31. Stringer EM, Sinkala M, Kumwenda R, et al. Personal risk perception, HIV knowledge and risk avoidance behavior, and their relationships to actual HIV serostatus in an urban African obstetric population. *J Acquir Immune Defic Syndr.* 2004;35:60–66.