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Interest in Long-Acting Injectable PrEP in a Cohort of Men Who have Sex with Men in China

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Abstract

Long-acting injectable (LAI) formulations of antiretrovirals (ARVs) as pre-exposure prophylaxis (PrEP) could be an attractive alternative for men who have sex with men (MSM) who are interested in ARV-based biomedical prevention but will not use a daily pill. This study investigated interest in LAI-PrEP in a cohort of MSM in China and characterized how MSM willing to use only injectable PrEP differed from MSM who would use PrEP regardless of modality or not at all. Demographic, behavioral, and risk perception measures were collected and associations investigated. A licensed LAI-PrEP agent would increase the proportion interested in PrEP by 24.5% over oral PrEP alone. Combining interest in oral and injectable PrEP, 78.5% of the sample could be covered if reported interest in PrEP translated into actual uptake. Partnership factors differentiated those who would be willing to use only LAI-PrEP versus any PrEP modality, while higher self-perception of risk was associated with interest in LAI-PrEP versus no PrEP. The addition of a second PrEP modality could yield increased population coverage of PrEP. Social and behavioral research should be undertaken in parallel with clinical development of injectable PrEP agents to identify characteristics of those who are not interested in oral PrEP but would take advantage of ARV-based prevention with the introduction of an injectable product.

Keywords

HIV; biomedical HIV prevention; PrEP; China; men who have sex with men; long-acting injectable PrEP

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Conflict of interest

The authors declare that they have no conflict of interest.

Introduction

Pre-exposure prophylaxis (PrEP) with the use of daily oral antiretroviral drugs has been shown to be effective and acceptable among men who have sex with men (MSM) in multiple clinical trials, and in demonstration projects across the United States [1–5]. The use of antiretrovirals as PrEP is also recommended by the WHO for HIV-negative individuals at substantial risk of acquiring HIV, particularly in populations in which HIV incidence is greater than 3 per 100 person-years [6].

China has yet to make recommendations with regard to PrEP. However, all available evidence suggests that the incidence rate is above 3 per 100 person-years among MSM in many cities where it has been measured, suggesting that PrEP could be a promising intervention for some MSM there. A recent meta-analysis of incidence studies among MSM in China estimates an annual incidence rate of 5.6 per 100 person years [7]. Data from a cohort that followed over 3600 MSM in Beijing between 2007 and 2012 suggests that the epidemic continues on an upward trend: incidence was 7.1 per 100 person years overall, and increased from a low of about 5 per 100 in 2007 to over 11 per 100 in 2012 [8]. This increasing incidence rate persisted despite men being counseled about safer sex practices, and being provided with condoms and lubricants at every study visit. This suggests the potential relevance of new bio-behavioral intervention strategies such as PrEP to complement traditional education and behavior change interventions.

In the absence of PrEP, researchers have assessed awareness and acceptability of PrEP among at risk populations in China. Two surveys among female sex workers reported that 15.1 and 16.5% had ever heard of PrEP [9, 10]; a survey among HIV-negative partners in serodiscordant couples showed only 2.8% awareness of PrEP [11]. Studies among MSM reported that between 11 and 22% had ever heard of PrEP [12–15]. Despite this low level of awareness, hypothetical willingness to use PrEP in these studies was high, ranging from 64 to 84.6% [11, 12, 14, 15]. In one study among 1402 MSM in China, 64% of participants reported willingness to use PrEP if safe and effective, but only 30% said they would be willing to use PrEP if they have to take a pill every day [14]. In one of the only PrEP implementation studies that has been reported in China, 19.1% expressed willingness to use oral PrEP, but there was only 2.5% uptake when PrEP was actually offered [16].

Long-acting injectable formulations of PrEP could be an attractive alternative for men who would consider biomedical HIV prevention methods but are not interested in a daily pill, for example due to adherence or convenience-related factors [17]. Injectables are a promising area of clinical development and it is possible that a long-acting injectable PrEP product (LAI-PrEP) could be available within 5 years. Just as women have a choice in contraceptive methods, it is possible to imagine a future in which MSM at risk for HIV have a choice of prevention methods, ranging from condoms, to a daily pill, to rectal microbicides, injectable PrEP, and perhaps even an implantable device delivering an effective antiretroviral for prolonged time periods. The aim of this study was to investigate interest in and attitudes toward LAI-PrEP among MSM in two cities in China and how men who were only

interested in the injectable formulation of PrEP differed from those who would use PrEP in any modality or not at all.

Methods

Study Population

Participants were recruited from among members of an ongoing prospective cohort study of HIV-negative MSM conducted at Capital University You'An Hospital in Beijing and China Medical University Number One Affiliated Hospital in Shenyang, in which they were tested for HIV at 8–12 week intervals over 1 year. High HIV incidence among local MSM had been reported [7, 8, 18]. Additional participants were recruited through community-based organizations and peer recruiters. Inclusion criteria were older than age 18, self-report of any condomless anal sex with men in the last 6 months, and HIV- negative result at last HIV-test. The study began recruitment in October 2013, after approval by the Institutional Review Boards of You'An Hospital and Chinese Medical University Number One Affiliated Hospital, and was fully enrolled by January 2014.

Measurement

Participants were introduced to daily oral and LAI-PrEP through a prepared script that explained each intervention, including what is known about its safety and efficacy and a listing of potential short term and long term side effects. For LAI-PrEP, the injections were presented as occurring at 12-week intervals and the likelihood of pain associated with the injection was stressed. Once staff ascertained through the “teach back” approach that participants had a basic understanding of PrEP and the two modalities described, participants were instructed to complete a computer-assisted self- interview. Participants were asked “If the HIV prevention injection were effective and safe, how willing would you be to use it?” and “Assuming that daily oral PrEP is effective and safe, how willing would you be to use it?” Willingness was collected on a 5-point scale (definitely willing, probably willing, uncertain, probably not willing, and definitely unwilling). Those who were “definitely” or “probably” willing were grouped and designated “willing” and compared against the remainder, termed “not willing”. These included participants who were uncertain, and those who were probably not and definitely not willing.

The two outcomes measuring willingness to use oral and injectable PrEP were then integrated and responses divided into four categories: (1) willing to use oral PrEP only; (2) willing to use LAI-PrEP only; (3) willing to use oral PrEP and LAI PrEP (no modality preference); and (4) not willing to use either. The first analysis compared those who would only be willing to use LAI-PrEP (group 2) to those who would use any kind of PrEP (group 3). The second analysis compared those who would only use LAI-PrEP but rejected oral PrEP (group 2) to those who would not use PrEP at all (group 4). Associations with demographic and behavioral factors were investigated for both comparisons.

Demographic Variables

Age was collected as a continuous variable and dichotomized as younger than 30 and 30 years and older. Education was dichotomized as high school or less versus more than high

school. The sex of current sexual partners was collected and respondents categorized as having current male partners only or male and female partners. Sexual partnership type was categorized as “no partner(s)”, “main male partner only”, “any casual male partners”. Those with main partners were asked about their main partners’ HIV status and results coded as “HIV?”, “HIV-”, “uncertain”, and “no steady partner”. Respondents were also asked whether they had previously heard of PrEP (yes vs. no).

Behavioral Variables

Men were asked about any insertive and receptive anal sex in the last 3 months and were categorized into those who reported any receptive sex versus insertive sex only, given the higher risk associated with HIV acquisition for the receptive partner. Any condomless sex, condomless insertive sex and condomless receptive sex in the last 3 months were reported independently. Responses to number of sexual partners in the last 3 months were categorized into no partners, 1–2 partners, or more than 2 partners. History of an STI diagnosis (ever) and drug use at last sex were ascertained and reported as yes vs no.

Perception of HIV Risk

A number of items designed to measure perception of HIV risk were asked on 4-point scales. Items included in the analysis were “In 5 years I will be HIV-infected” (from not likely to very likely), “My sex is higher risk than the sex of my friends” (from disagreement to agreement), “I am afraid of HIV” (from not afraid to very afraid), and a measure to capture whether respondents knew at least one person living with HIV or AIDS (yes or no). Each of these was dichotomized in the analysis. While a number of these items appear to tap a similar construct, the low correlation coefficients resulting from a Spearman test suggest that they were in fact measuring different constructs and were therefore each entered individually into the analysis.

Statistical Analysis

We generated descriptive statistics for demographic, sexual behavior, self-perception of risk, and PrEP-related factors. To test for associations between outcomes and predictors we calculated Chi square statistics, and reported significance for likelihood ratio test. We used a multivariate logistic regression analysis with a backward elimination threshold of $p = 0.10$ to select variables in the final model.

Results

Demographics

Of the 200 men enrolled in this study, 129 were recruited from the ongoing prospective cohort study while 71 were recruited from the community through peer networks. The mean age was 31.6 years, ranging from 18 to 56 years old (Table 1). Close to a third (31.5%, $n = 63$) identified as bisexual while two men identified as heterosexual despite engaging in same- sex sexual activity. Level of education was well-distributed across the subjects, with 22.5% ($n = 45$) having middle school education or less, and 16.5% ($n = 33$) having beyond college education. However, most of the men surveyed considered themselves to belong to the lower or middle socioeconomic status (94.5%). Almost a third of the men (30.5%, $n =$

61) reported that their registered residency (hukou) was outside their current city of residence. Two percent (4/200) of the cohort reported ever exchanging sex or drugs for money. One third (66/200) had previously heard of PrEP.

Sexual Behavior

A wide range of sexual partners in the previous 3 months was reported (0–270), with a mean of 4.6 and a median of two partners. Among respondents, 65.5% (131/200) reported having a steady partner, of whom nine percent had a steady partner who is HIV-infected and 36.6% were uncertain of their steady partners' HIV-status. More than half (55.5%, 111/200) reported having casual partners. Just over ten percent reported having a main female partner (11.5%, 23/200). Close to three-quarters of the cohort (72.5%, 146/200) reported drug-use around the time of the last sex act and one third reported having had a previous STI diagnosis.

As a global measure, frequency of condom use was reported as hardly ever/never ($n = 21$, 10.5%), about half of the time ($n = 22$, 11%), most of the time ($n = 51$, 25.5%) and all the time ($n = 106$, 53%). At a more granular level there was more variation in reported condom use. Reporting behavior over the last 3 months, 34% (68/200) reported condomless anal intercourse (CAI); 17.5% (35/200) reported any condomless receptive anal intercourse (CRAI) and 24.5% (49/200) any condomless insertive anal intercourse (CIAI). Among the 46.5% ($n = 93$) who reported having sex as the receptive partner in the past 3 months, 37.6% ($n = 35$) reported CRAI, twice the proportion of the cohort overall.

Perception of HIV Risk

Respondents had a relatively high perception of risk for their social networks and for themselves: 75.0% (150/200) thought it was likely that one of their friends would become infected in the next 5 years and a lower proportion, yet still the majority (52.5%, 104/198), thought it was likely that they would be infected within the same time period. 43.2% (86/199) rated their sex as “high risk” and 38.7% thought their sex was higher risk than that of their friends.

Willingness to Use PrEP

Over three-quarters (76.0%, 152/200) of the men said they would be probably or very willing to use LAI-PrEP while 54.0% (108/200) would be probably or very willing to use oral PrEP (Fig. 1). The univariate model investigating willingness to use only LAI-PrEP compared to any type of PrEP found associations with demographic factors, relationship factors, and perception of HIV risk (Table 2). Those with less than high school education, having a female partner, having casual partners in the last 3 months, having a steady partner with unknown or negative HIV status, reporting high likelihood of HIV infection in next 5 years, and knowing a PLWHA had higher odds of being interested in LAI-PrEP only. In the multivariate model, higher education (aOR = 0.5, 95% CI 0.2, 1.0), having a female partner, (aOR = 3.1, 95% CI 1.0, 10.2), knowing a PLWHA (aOR = 4.2, 95% CI 1.9, 9.2) and having an HIV-infected steady partner (aOR = 0.0, 95% CI 0.0, 0.3) remained significant.

Injectable Formulation as PrEP Entry Point

Out of 200 respondents, 92 (46.0%) respondents were unwilling to consider oral PrEP. Of these 92 individuals not willing to use oral PrEP, 53.3% (49/92) would consider an injectable PrEP agent. Conversely, of the men who found oral PrEP acceptable, 95.4%, (103/108) were also open to injectable PrEP. Combining men with interest in oral and injectable PrEP, 78.5% (157/200) of the sample could be covered if their professed PrEP-use interest translated into actual uptake of these two PrEP modalities.

Comparing participants who would utilize ARV-based prevention in its injectable formulation to those who remain uninterested in ARV-based prevention regardless of formulation, there were associations of interest in injectable PrEP with age, education, reporting CAI in the last 3 months, history of an STI, main partner's HIV status, perceived likelihood of seroconversion, perception of sex as higher risk than friends, and having an HIV- infected personal acquaintance (Table 3). In the full multivariate model all behavioral factors lost significance and only education (aOR = 0.3, 95% CI 0.1, 0.9) and factors measuring self-perception of risk and proximity to HIV remained significant: having a steady partner who is HIV-positive (aOR = 0.0, 95% CI 0.0, 0.5); reporting fear of HIV (aOR = 8.3, 95% CI 1.4, 48.6); having a personal acquaintance infected with HIV (aOR = 6.1, 95% CI 2.0, 18.6); and (marginally) likelihood of seroconversion in a 5-year timeframe (aOR = 2.7, 95% CI 1.0, 7.7).

Discussion

The findings in this study of relatively low baseline knowledge of PrEP and relatively high willingness to use PrEP is in line with other studies among Chinese MSM [12–15]. The high proportion of participants who note willingness to use LAI-PrEP suggests that an effective, safe, injectable PrEP product would be welcomed by MSM in China. While about half the men responded that they would take oral or injectable PrEP, the addition of injectable PrEP as a prevention option would significantly increase the coverage of PrEP over oral PrEP alone.

To our knowledge, this is the first study to examine interest in LAI-PrEP among MSM in China. Studies in other settings have reported on acceptability of LAI-PrEP modality preferences among MSM in Vietnam [19], the US [20–22], and Thailand [23] with some reporting that LAI- PrEP was a less preferred modality compared to rectal microbicides [19], condoms and non-visible implants [20], and the daily oral pill [23]. Others suggested higher interest in LAI-PrEP [21, 22]. Taken together, these diverse findings suggest that as in the contraceptive field, different modalities will be preferred by different people depending on their priorities, preferences and personal situations.

Five studies have reported on factors associated with MSM's willingness to use oral PrEP in China and examined similar demographic, behavioral, risk perception, and PrEP-related factors. Two studies reported an association with older age and willingness to use PrEP [14, 15], an association that we found when comparing those who would use LAI-PrEP only to those who would not use any type of PrEP. The same two studies reported an association with lower educational attainment and willingness to use PrEP [14, 15]. Similarly, in our

study those with lower education attainment had higher odds of electing LAI-PrEP over no biomedical intervention and over daily oral PrEP. Other demographic factors associated with willingness to use oral PrEP in the literature were lower income and non-local residency, neither of which was significant in our analyses [14, 16].

Behavioral factors found to be associated with willingness in the literature can be grouped into condom-related factors (no condom use at last sex [16], inconsistent condom use in the last 6 months [15], and high barrier to condom use [12]), partner-related factors (not in a current partnership [12], higher number of sexual partners [16], and not finding partners on the internet [14]). History of an STI was found to be associated in one study [14]. Though our study examined all of these behavioral factors, only partner-related factors were significant. Interestingly, compared to men who report only male sexual partners, men who report having a female partner had higher odds of being interested in injectable PrEP. We hypothesize that this may be due to injections being perceived as more private when compared to carrying pill bottles, particularly in the Chinese context in which female partners may not be aware of their male partners' same-sex sexual activity outside their relationship [24]. Investigations of the impact of partnership types on acceptability of PrEP modalities could generate knowledge that would be useful for planning for a future in which MSM have a choice of biomedical prevention options.

The finding that those for whom there is a connection to HIV through either proximal (having a steady HIV? partner) or more distal (knowing a PLWHA) relationships had significantly lower odds of being interested in only injectable PrEP suggests that for these individuals, the critical issue is access to any type of PrEP regardless of modality.

All five studies on PrEP acceptability among Chinese MSM found an association between willingness to use oral PrEP and some measure related to knowledge about HIV, ARV toxicity, or PrEP [12–16]. None of these significant “knowledge” measures were the same across studies, but taken together they suggest that baseline familiarity with HIV/AIDS and knowledge about PrEP increases the acceptability of oral PrEP. Our study did not find this relationship, perhaps because our primary outcome was injectable PrEP rather than oral, about which less is known. In a sophisticated examination of psychosocial factors, Jackson et al. [12] found high perception of HIV as a threat to oneself, low perceived stigma of using PrEP, high perceived benefit of using PrEP, high self-efficacy for oral PrEP use, and depression to be associated with willingness to use oral PrEP. Like Jackson et al., our study found that two measures of perception of HIV risk (high likelihood of seroconversion in the next 5 years, and self-assessment of sexual risk that is higher than friends' risk) to be associated with interested in LAI-PrEP. Perhaps most striking is that over half the cohort believed it is likely that they will seroconvert in the next 5 years. More research is needed to understand this finding, including understanding of the anxiety that such beliefs cause, the relationship between sex and fear, and the implication for what appropriate PrEP messaging might look like in this Chinese population of MSM [25–29].

The comparison between men who are only willing to use injectable PrEP with those who would not use either modality suggests that interest in LAI-PrEP is associated with self-perception of risk rather than behavioral factors. This is in contrast with a similar study

among young MSM in NYC for whom behavioral risk factors were associated with interest in LAI-PrEP [22]. Those for whom the perceived risk of HIV is more concrete or proximal (because they know at least one PLWHA, or think it is likely that they would seroconvert in 5 years) have higher odds of being interested in LAI-PrEP. This suggests that when physicians discuss ARV-based prevention with MSM in China focusing on perception of risk rather than traditional assessments of risk behavior may be more effective in identifying those for whom injectable ARV-based prevention may be acceptable.

Limitations

A limitation of this study was that participants were not asked about their attitudes towards daily pill taking, needles and injections at a general level. Such questions would have allowed us to discern whether attitudes to oral and injectable PrEP were correlated with preferences for medication formulation more generally or were specific to biomedical HIV prevention. Future research in this area would be strengthened by including questions to assess anxiety associated with injections and whether participants have existing routines for taking other daily medications. A second limitation is that the questions assessing interest in injectable PrEP were asked specifically with regard to a 12-week injection interval. The injectable PrEP candidate furthest along in clinical development, the integrase inhibitor Cabotegravir, has since adjusted its injection interval from 12 to 8 weeks and the shorter injection interval may impact acceptability. Finally, to what degree stated interest translates into uptake of given interventions cannot be known, however this type of acceptability research remains essential to inform both clinical development of biomedical prevention modalities and future implementation.

Conclusions

Within 5 years a long-acting injectable PrEP agent is likely to be licensed as a biomedical HIV prevention approach. By that time daily oral PrEP is likely to be available for MSM in China and will be used by certain segments of the MSM population. Findings from this study suggest that the addition of a second PrEP modality could yield increased population coverage of PrEP, particularly for those for whom adherence to a daily pill is untenable. In the intervening years, and in parallel with clinical development, social and behavioral research should be undertaken to identify characteristics of those who would be not interested in oral PrEP but would take advantage of ARV-based prevention with the introduction of an injectable product. Such research would inform the development of effective messaging for an injectable PrEP agent and guidance tools for MSM and providers to choose the most appropriate HIV prevention method for their lifestyles.

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References

1. Grant RM, Lama JR, Anderson PL, McMahan V, Liu AY, Vargas L, et al. Preexposure chemoprophylaxis for HIV prevention in men who have sex with men. *N Engl J Med*. 2010; 363(27):2587–99. [PubMed: 21091279]
2. Hosek SG, Rudy B, Landovitz R, Kapogiannis B, Siberry G, Rutledge B, et al. An HIV preexposure prophylaxis demonstration project and safety study for young MSM. *J Acquir Immune Defic Syndr*. 2017; 74(1):21–9. [PubMed: 27632233]
3. Marcus JL, Volk JE, Pinder J, Liu AY, Bacon O, Hare CB, et al. Successful implementation of HIV preexposure prophylaxis: lessons learned from three clinical settings. *Curr HIV/AIDS Rep*. 2016; 13(2):116–24. [PubMed: 26898645]
4. McCormack S, Dunn DT, Desai M, Dolling DI, Gafos M, Gilson R, et al. Pre-exposure prophylaxis to prevent the acquisition of HIV-1 infection (PROUD): effectiveness results from the pilot phase of a pragmatic open-label randomised trial. *Lancet*. 2016; 387(10013):53–60. [PubMed: 26364263]
5. Molina JM, Capitant C, Spire B, Pialoux G, Cotte L, Charreau I, et al. On-demand preexposure prophylaxis in men at high risk for HIV-1 infection. *N Engl J Med*. 2015; 373(23):2237–46. [PubMed: 26624850]
6. World Health Organization. Guideline on when to start antiretroviral therapy and on pre-exposure prophylaxis for HIV. Guideline on when to start antiretroviral therapy and on pre-exposure prophylaxis for HIV. 2015
7. Xu JJ, Tang WM, Zou HC, Mahapatra T, Hu QH, Fu GF, et al. High HIV incidence epidemic among men who have sex with men in china: results from a multi-site cross-sectional study. *Infect Dis Poverty*. 2016; 5(1):82. [PubMed: 27593703]
8. Jia Z, Huang X, Wu H, Zhang T, Li N, Ding P, et al. HIV burden in men who have sex with men: a prospective cohort study 2007–2012. *Sci Rep*. 2015; 5:11205. [PubMed: 26135810]
9. Peng B, Yang X, Zhang Y, Dai J, Liang H, Zou Y, et al. Willingness to use pre-exposure prophylaxis for HIV prevention among female sex workers: a cross-sectional study in China. *HIV AIDS*. 2012; 4:149–58.
10. Ye L, Wei S, Zou Y, Yang X, Abdullah AS, Zhong X, et al. HIV pre-exposure prophylaxis interest among female sex workers in Guangxi, China. *PLoS ONE*. 2014; 9(1):e86200. [PubMed: 24465956]
11. Mijiti P, Yahepu D, Zhong X, Sun Y, Zhao T, Zhao Z, et al. Awareness of and willingness to use oral pre-exposure prophylaxis for HIV prevention among HIV-serodiscordant heterosexual couples: a cross-sectional survey in Xinjiang, China. *PLoS ONE*. 2013; 8(7):e67392. [PubMed: 23874417]
12. Jackson T, Huang A, Chen H, Gao X, Zhong X, Zhang Y. Cognitive, psychosocial, and sociodemographic predictors of willingness to use HIV pre-exposure prophylaxis among Chinese men who have sex with men. *AIDS Behav*. 2012; 16(7):1853–61. [PubMed: 22538373]
13. Xue H, Liu H, Cai L. Analysis of willingness and influencing factors for usage of pre-exposure prophylaxis among men who have sex with men. *Chin J Prev Med*. 2015; 49(11):973–7.
14. Zhang Y, Peng B, She Y, Liang H, Peng H-B, Qian H-Z, et al. Attitudes toward HIV pre-exposure prophylaxis among men who have sex with men in western China. *AIDS Patient Care STDS*. 2013; 27(3):137–41. [PubMed: 23425017]
15. Zhou F, Gao L, Li S, Li D, Zhang L, Fan W, et al. Willingness to accept HIV pre-exposure prophylaxis among Chinese men who have sex with men. *PLoS ONE*. 2012; 7(3):e32329. [PubMed: 22479320]
16. Ding Y, Yan H, Ning Z, Cai X, Yang Y, Pan R, et al. Low willingness and actual uptake of pre-exposure prophylaxis for HIV-1 prevention among men who have sex with men in Shanghai, China. *Biosci Trends*. 2016; 10(2):113–9. [PubMed: 27052151]
17. Meyers, K., Wu, Y., Golub, S. To switch or not to switch: anticipating choices in biomedical HIV prevention; Poster session presented at: HIV Research for Prevention Conference; October 17–21; Chicago. 2016.

18. Xu J-J, Zhang M, Brown K, Reilly K, Wang H, Hu Q, et al. Syphilis and HIV seroconversion among a 12-month prospective cohort of men who have sex with men in Shenyang, China. *Sex Transm Dis.* 2010; 37(7):432–9. [PubMed: 20375928]
19. Oldenburg CE, Le B, Huyen HT, Thien DD, Quan NH, Biello KB, et al. Antiretroviral pre-exposure prophylaxis preferences among men who have sex with men in Vietnam: results from a nationwide cross-sectional survey. *Sex Health.* 2016; 13(5):465–73.
20. Greene GJ, Swann G, Fought AJ, Carballo-Diequez A, Hope TJ, Kiser PF, et al. Preferences for long-acting pre-exposure prophylaxis (PrEP), daily oral PrEP, or condoms for HIV prevention among U.S. men who have sex with men. *AIDS Behav.* 2017; 21(5):1336–49. [PubMed: 27770215]
21. Parsons JT, Rendina HJ, Whitfield TH, Grov C. Familiarity with and preferences for oral and long-acting injectable HIV pre-exposure prophylaxis (PrEP) in a national sample of gay and bisexual men in the US. *AIDS Behav.* 2016; 20(7):1390–9. [PubMed: 27000145]
22. Meyers K, Rodriguez K, Moeller RW, Gratch I, Markowitz M, Halkitis PN. High interest in a long-acting injectable formulation of pre-exposure prophylaxis for HIV in young men who have sex with men in NYC: a P18 cohort substudy. *PLoS ONE.* 2014; 9(12):e114700. [PubMed: 25502768]
23. Wheelock A, Eisingerich AB, Ananworanich J, Gomez GB, Hallett TB, Dybul MR, et al. Are Thai MSM willing to take PrEP for HIV prevention? An analysis of attitudes, preferences and acceptance. *PLoS ONE.* 2013; 8(1):e54288. [PubMed: 23342121]
24. Chow EP, Wilson DP, Zhang L. What is the potential for bisexual men in China to act as a bridge of HIV transmission to the female population? Behavioural evidence from a systematic review and meta-analysis. *BMC Infect Dis.* 2011; 11(1):242. [PubMed: 21920042]
25. Merchant RC, Corner D, Garza E, Guan W, Mayer KH, Brown L, et al. Preferences for HIV pre-exposure prophylaxis (PrEP) information among men-who-have-sex-with-men (MSM) at community outreach settings. *J Gay Lesbian Ment Health.* 2016; 20(1):21–33. [PubMed: 27076865]
26. Mimiaga MJ, Closson EF, Battle S, Herbst JH, Denson D, Pitts N, et al. Reactions and receptivity to framing HIV prevention message concepts about pre-exposure prophylaxis for Black and Latino men who have sex with men in three urban US cities. *AIDS Patient Care STDS.* 2016; 30(10):484–9. [PubMed: 27749110]
27. Underhill K, Morrow KM, Collieran C, Calabrese SK, Operario D, Salovey P, et al. Explaining the efficacy of pre-exposure prophylaxis (PrEP) for HIV prevention: a qualitative study of message framing and messaging preferences among US men who have sex with men. *AIDS Behav.* 2016; 20(7):1514–26. [PubMed: 25963772]
28. Gamarel KE, Golub SA. Intimacy motivations and pre-exposure prophylaxis (PrEP) adoption intentions among HIV-negative men who have sex with men (MSM) in romantic relationships. *Ann Behav Med.* 2015; 49(2):177–86. [PubMed: 25124457]
29. Golub SA. Tensions between the epidemiology and psychology of HIV risk: implications for pre-exposure prophylaxis. *AIDS Behav.* 2014; 18(9):1686–93. [PubMed: 24719201]

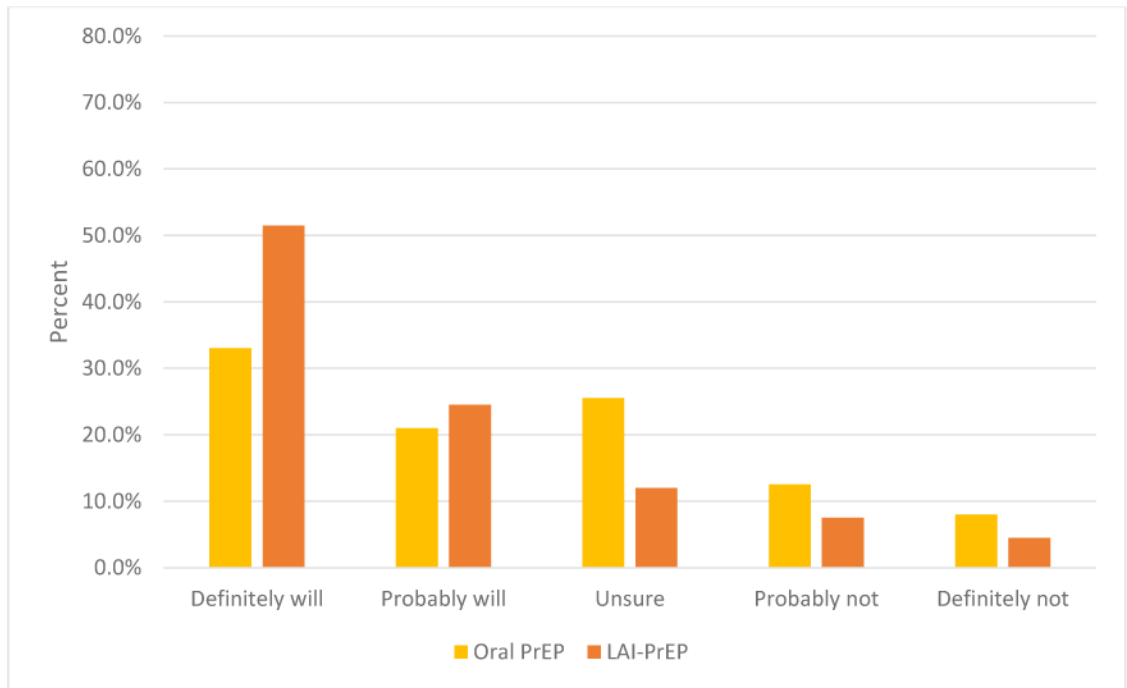


Figure 1.
Distribution of willingness to use oral and LAI PrEP

Table I

Sample characteristics

| Demographics | n (%) |
|--|--------------|
| Age | |
| <30 | 95 (47.5) |
| >30 | 105 (52.5) |
| Education | |
| High school or less | 97 (48.5) |
| More than high school | 103 (51.5) |
| Residency | |
| Local | 139 (69.5) |
| Migrant | 61 (30.5) |
| Socioeconomic status | |
| Low | 100 (50.0) |
| Middle | 88 (44.5) |
| High | 11 (5.5) |
| Sexual orientation | |
| Gay | 135 (67.5) |
| Bisexual | 63 (31.5) |
| Heterosexual | 2 (1.0) |
| Any female partners | |
| Yes | 23 (11.5) |
| No | 177 (88.5) |
| Current male partners | |
| No partner | 35 (17.5) |
| Steady male partner only | 88 (44.0) |
| Any casual partner(s) | 77 (38.5) |
| Heard of PrEP | |
| Yes | 67 (33.5) |
| No | 133 (66.5) |
| Sexual and risk behavior | |
| Sex role in the last 3 months | |
| Insertive sex only | 90 (49.2) |
| Any receptive sex | 93 (50.8) |
| Condomless anal intercourse (CAI) in the last 3 months | |
| Yes | 68 (34.0) |
| No | 132 (66.0) |
| Condomless receptive anal intercourse (CRAI) in the last 3 months | |
| Yes | 35 (17.5) |
| No | 165 (82.5) |
| Condomless insertive anal intercourse (CIAI) in the last 3 months | |

| Demographics | n (%) |
|---|--------------|
| Yes | 49 (24.5) |
| No | 151 (75.5) |
| Partners in last 3 months | |
| No partners | 18 (9.0) |
| 1–2 partners | 61 (30.5) |
| More than 2 partners | 121 (60.5) |
| Steady partner HIV status | |
| HIV+ | 12 (6.0) |
| HIV- negative | 71 (35.5) |
| Unsure of partner status | 48 (24.0) |
| No steady partner | 61 (34.5) |
| History of sexually transmitted infection (STI) diagnosis | |
| Yes | 67 (33.5) |
| No | 133 (66.5) |
| Drug use at last sex | |
| No | 146 (72.5) |
| Yes | 54 (27.5) |
| Perceived risk of HIV | |
| My sex is higher risk than my friends | |
| Disagree | 122 (61.3) |
| Agree | 77 (38.7) |
| In 5 years, I will be HIV-infected | |
| Not Likely | 104 (52.5) |
| Likely | 94 (47.5) |
| I know at least one person living with HIV or AIDS (PLWHA) | |
| Yes | 85 (42.5) |
| No | 115 (57.5) |
| I am afraid of HIV | |
| Not afraid | 40 (20.0) |
| Afraid | 160 (80.0) |

Table II

Factors associated with willingness to use LAI-PrEP only versus any PrEP modality (n=157).

| | Willing to use LAI-PrEP only n (%) | Willing to use any PrEP n (%) | modality | p-value | aOR (95% CI) | p-value |
|------------------------------|---------------------------------------|----------------------------------|----------|---------|---------------------|------------|
| Overall | 49 (31.2) | 108 (68.8) | | | | |
| Demographics | | | | | | |
| Age | | | | | | |
| <30 | 18 (26.1) | 51 (73.9) | | .22 | | |
| >30 | 31 (35.2) | 57 (64.8) | | | | |
| Education | | | | | | |
| High school or less | 30 (37.5) | 50 (62.5) | | .08 | 0.5 (2, 1.0) | .04 |
| More than high school | 19 (24.7) | 58 (75.3) | | | | |
| Residency | | | | | | |
| Local | 32 (29.6) | 76 (70.4) | | .53 | | |
| Migrant | 17 (34.7) | 32 (65.3) | | | | |
| Socioeconomic status | | | | | | |
| Low | 29 (37.2) | 49 (62.8) | | .15 | | |
| Middle | 18 (25.7) | 52 (74.3) | | | | |
| High | 1 (12.5) | 7 (87.5) | | | | |
| Sexual orientation | | | | | | |
| Gay | 35 (32.7) | 72 (67.3) | | .60 | | |
| Bisexual | 14 (28.6) | 35 (71.4) | | | | |
| Heterosexual | 0 (0.0) | 1 (100.0) | | | | |
| Any female partners | | | | | | |
| No | 40 (28.4) | 101 (71.6) | | .03 | ref | |
| Yes | 9 (56.3) | 7 (43.7) | | | 3.1 (1.0, 10.2) | .06 |
| Current male partners | | | | | | |
| No partner | 6 (23.1) | 20 (76.9) | | .02 | | |
| Steady male partner only | 18 (23.1) | 60 (76.9) | | | | |
| Any casual partner(s) | 22 (46.8) | 25 (53.2) | | | | |

| | Willing to use LAI-PrEP only n (%) | Willing to use any PrEP n (%) | modality | p-value | aOR (95% CI) | p-value |
|--------------------------------------|---------------------------------------|----------------------------------|----------|---------|-----------------------|-------------|
| Heard of PrEP | | | | | | |
| Yes | 16 (30.2) | 37 (69.8) | | .84 | | |
| No | 33 (31.7) | 71 (68.3) | | | | |
| Sexual and risk behavior | | | | | | |
| Sex role in the last 3 months | | | | | | |
| Insertive sex only | 22 (32.8) | 45 (67.2) | | .48 | | |
| Any receptive sex | 22 (27.5) | 58 (72.5) | | | | |
| CAI in the last 3 months | | | | | | |
| Yes | 21 (36.8) | 36 (63.2) | | .25 | | |
| No | 28 (28.0) | 72 (72.0) | | | | |
| CRAI in the last 3 months | | | | | | |
| Yes | 10 (32.3) | 21 (67.7) | | .89 | | |
| No | 39 (31.0) | 87 (69.0) | | | | |
| CIAI in the last 3 months | | | | | | |
| Yes | 15 (37.5) | 25 (62.5) | | .33 | | |
| No | 34 (29.1) | 83 (70.9) | | | | |
| Partners in last 3 months | | | | | | |
| No partners | 5 (41.7) | 7 (58.3) | | .28 | | |
| 1-2 partners | 11 (22.9) | 37 (77.1) | | | | |
| More than 2 partners | 33 (34.0) | 64 (66.0) | | | | |
| Steady partner HIV status | | | | | | |
| HIV-negative | 16 (28.1) | 41 (71.9) | | | ref | |
| HIV-positive | 0 (0.0) | 10 (100.0) | | .02 | 0.0 (0.0, 0.3) | .002 |
| Unsure of partner status | 17 (40.5) | 25 (59.5) | | | 1.4 (0.6, 3.5) | .49 |
| No steady partner | 16 (33.3) | 32 (66.7) | | | 1.0 (0.4, 2.5) | .54 |
| History of STI diagnosis | | | | | | |
| Yes | 20 (35.1) | 37 (64.9) | | | | |
| No | 29 (29.0) | 71 (71.0) | | .43 | | |
| Drug use at last sex | | | | | | |

| | Willing to use LAI-PrEP only n (%) | Willing to use any PrEP n (%) | modality | p-value | aOR (95% CI) | Logistic Regression p-value |
|--|---------------------------------------|----------------------------------|----------|---------|-----------------------|--------------------------------|
| No | 37 (30.8) | 83 (69.2) | | .86 | | |
| Yes | 12 (32.4) | 25 (67.6) | | | | |
| Self perception of risk | | | | | | |
| My sex is higher risk than my friends | | | | | | |
| Disagree | 20 (29.0) | 49 (71.0) | | .56 | | |
| Agree | 29 (33.3) | 58 (66.7) | | | | |
| In 5 years, I will be HIV-infected | | | | | | |
| Not Likely | 33 (37.5) | 55 (62.5) | | .07 | ref | .11 |
| Likely | 16 (23.9) | 51 (76.1) | | | 1.9 (0.9, 4.3) | |
| I know at least one PLWHA | | | | | | |
| Yes | 30 (44.1) | 38 (55.9) | | .00 | ref | |
| No | 19 (21.4) | 70 (78.6) | | | 4.2 (1.9, 9.2) | < 0.0001 |
| I am afraid of HIV | | | | | | |
| Not afraid | 10 (27.7) | 26 (72.2) | | .69 | | |
| Afraid | 39 (32.2) | 82 (67.8) | | | | |

Table III
 Factors associated with willingness to use LAI-PrEP as compared to unwilling to use any form of PrEP (n=92)

| | Willing to use LAI-PrEP only n (%) | Not willing to use PrEP n (%) | p-value | aOR (95%CI) | p-value |
|------------------------------|---------------------------------------|----------------------------------|---------|-----------------------|------------|
| Overall | 49 (53.3) | 43(46.7) | | | |
| Demographics | | | | | |
| Age | | | | | |
| <30 | 18 (40.9) | 26 (59.1) | .02 | | |
| >30 | 31 (64.6) | 17 (35.4) | | | |
| Education | | | | | |
| High school or less | 30 (63.8) | 17 (36.2) | .04 | ref | |
| More than high school | 19 (42.2) | 26 (57.8) | | 0.3 (0.1, 0.9) | .04 |
| Residency | | | | | |
| Local | 32 (50.8) | 31 (49.2) | .48 | | |
| Migrant | 17 (58.6) | 12 (41.4) | | | |
| Socioeconomic status | | | | | |
| Low | 29 (56.9) | 22 (43.1) | .42 | | |
| Middle | 18 (50.0) | 28 (50.0) | | | |
| High | 1 (25.0) | 3 (85.0) | | | |
| Sexual orientation | | | | | |
| Gay | 35 (55.6) | 28 (44.4) | .41 | | |
| Bisexual | 14 (50.0) | 14 (50.0) | | | |
| Heterosexual | 0 (0.0) | 1 (100.0) | | | |
| Any female partners | | | | | |
| Yes | 9 (56.3) | 7 (43.8) | .79 | | |
| No | 40 (52.6) | 36 (47.4) | | | |
| Current male partners | | | | | |
| No partner | 6 (40.0) | 9 (60.0) | .44 | | |
| Steady male partner only | 16 (51.6) | 15 (48.4) | | | |
| Any casual partner(s) | 27 (58.7) | 19 (41.3) | | | |

| | Willing to use LAI-PrEP only n (%) | Not willing to use PrEP n (%) | p-value | Logistic regression aOR (95%CI) | p-value |
|--------------------------------------|---------------------------------------|----------------------------------|---------|------------------------------------|-----------------|
| Heard of PrEP | | | | | |
| Yes | 16 (53.3) | 14 (46.7) | .99 | | |
| No | 33 (53.2) | 29 (46.8) | | | |
| Sexual and risk behavior | | | | | |
| Sex role in the last 3 months | | | | | |
| Insertive sex only | 22 (48.9) | 23 (51.1) | .21 | | |
| Any receptive sex | 22 (62.9) | 13 (37.1) | | | |
| CAI in the last 3 months | | | | | |
| Yes | 21 (65.3) | 11 (34.4) | .08 | | |
| No | 32 (53.3) | 28 (46.7) | | | |
| CRAI in the last 3 months | | | | | |
| Yes | 10 (71.4) | 4 (28.6) | .13 | | |
| No | 39 (50.0) | 39 (50.0) | | | |
| CAI in the last 3 months | | | | | |
| Yes | 15 (62.5) | 9 (37.5) | .29 | | |
| No | 34 (50.0) | 34 (50.0) | | | |
| Partners in last 3 months | | | | | |
| No partners | 5 (45.5) | 6 (54.5) | .52 | | |
| 1-2 partners | 11 (45.8) | 13 (54.2) | | | |
| More than 2 partners | 33 (57.9) | 24 (42.1) | | | |
| Steady partner HIV status | | | | | |
| HIV-negative | 16 (53.3) | 14 (46.7) | | ref | |
| HIV+ | 0 (0.0) | 2 (100.0) | .03 | 0.0 (0.0, 0.5) | <.001 |
| Unsure of partner status | 17 (73.9) | 21 (56.8) | | 2.3 (0.5, 9.8) | .09 |
| No steady partner | 16 (43.2) | 21 (56.8) | | 0.7 (0.2, 2.2) | .27 |
| History of STI diagnosis | | | | | |
| Yes | 20 (66.7) | 10 (33.3) | .07 | | |
| No | 29 (46.8) | 33 (53.2) | | | |
| Drug use at last sex | | | | | |

| | Willing to use LAI-PrEP only n (%) | Not willing to use PrEP n (%) | p-value | aOR (95%CI) | Logistic regression p-value |
|--|---------------------------------------|----------------------------------|---------|------------------------|--------------------------------|
| No | 12 (41.4) | 17 (58.6) | | | |
| Yes | 37 (58.7) | 26 (41.3) | .12 | | |
| Perceived risk of HIV | | | | | |
| My sex is higher risk than my friends | | | | | |
| Disagree | 29 (45.3) | 35 (54.7) | | | |
| Agree | 20 (71.4) | 8 (28.6) | .02 | | |
| In 5 years, I will be HIV-infected | | | | | |
| Not Likely | 16 (37.2) | 27 (62.8) | | ref | |
| Likely | 33 (67.3) | 16 (32.7) | .004 | 2.7 (1.0, 7.7) | .06 |
| I know at least one PLWHA | | | | | |
| No | 19(42.2) | 26 (57.8) | | ref | |
| Yes | 30 (63.8) | 17 (36.2) | .04 | 6.1 (2.0, 18.6) | <.001 |
| I am afraid of HIV | | | | | |
| Not afraid | 44 (88.0) | 6 (12.0) | .22 | ref | |
| Afraid | 39 (50.0) | 39 (50.0) | .22 | 8.3 (1.4, 48.6) | .02 |