



HHS Public Access

Author manuscript

Sex Health. Author manuscript; available in PMC 2018 January 22.

Antiretroviral pre-exposure prophylaxis preferences among men who have sex with men in Vietnam: Results from a nationwide cross-sectional survey

Catherine E. Oldenburg^{1,2}, Bao Le³, Hoang Thi Huyen³, Dinh Duc Thien³, Nguyen Hoang Quan³, Katie B. Biello^{1,2}, Amy Nunn⁴, Philip A. Chan⁵, Kenneth H. Mayer^{1,6,7}, Matthew J. Mimiaga^{1,2,8}, and Donn Colby^{3,9}

¹The Fenway Institute, Fenway Community Health, Boston, MA ²Department of Epidemiology, Harvard T.H. Chan School of Public Health, Boston, MA ³Center for Applied Research on Men and Health, Ho Chi Minh City, Vietnam ⁴Department of Behavioral and Social Sciences and the Rhode Island Public Health Institute, Brown University School of Public Health, Providence, RI ⁵Division of Infectious Diseases, The Miriam Hospital, Providence, RI ⁶Department of Global Health and Population, Harvard T.H. Chan School of Public Health, Boston, MA ⁷Department of Medicine, Beth Israel Deaconess Medical Center, Boston, MA ⁸Department of Psychiatry, Massachusetts General Hospital, Boston, MA ⁹SEARCH, Thai Red Cross AIDS Research Centre, Bangkok, Thailand

Abstract

Introduction—The HIV/AIDS epidemic in Vietnam is concentrated in groups including men who have sex with men (MSM). Pre-exposure prophylaxis (PrEP) is a viable strategy for HIV prevention, but knowledge about and preferences for PrEP delivery among Vietnamese MSM are not well understood.

Methods—In 2015, an online survey was conducted via social networking websites for MSM and by peer recruitment. A description of daily oral, long-acting injectable, and rectal microbicide formulations of PrEP was provided to participants. Participants were asked about their prior awareness of and interest in PrEP, and ranked their most preferred PrEP modality. Multivariable logistic regression models were used to assess factors associated with having heard of PrEP, and with preference for each PrEP modality.

Results—Of 548 participants who answered demographic and PrEP-related questions, 26.8% had previously heard of PrEP, and most (65.7%) endorsed rectal microbicides as their most preferred PrEP delivery modality. Commonly-cited perceived barriers to uptake of PrEP included concern about side-effects, perception about being HIV positive, and family/friends finding out about sexual behavior. In multivariable models, older participants less often endorsed rectal microbicides (aOR 0.95 per year, 95% CI 0.91–0.99) and more often endorsed long-acting injectables (aOR 1.08 per year, 95% CI 1.03 to 1.14) as their preferred PrEP modality. Participants

who were willing to pay more for PrEP less often endorsed rectal microbicides (aOR 0.81, 95% CI 0.72–0.92) and more often endorsed long-acting injectables (aOR 1.17, 95% CI 1.01–1.35) and daily oral pills (aOR 1.16, 95% CI 1.00–1.35) as their preferred form of PrEP.

Conclusions—A variety of PrEP modalities were acceptable to MSM in Vietnam, but low knowledge of PrEP may be a barrier to implementation.

INTRODUCTION

The HIV epidemic in Vietnam is concentrated in key populations, including people who inject drugs, sex workers, and men who have sex with men (MSM).^{1–8} Condomless anal sex and other higher-risk sexual behaviors have been shown to be common among MSM in Vietnam, potentiating HIV spread.¹ In most regions in Vietnam, HIV prevalence is increasing markedly among MSM^{1–3}, indicating the need to identify new HIV prevention interventions to address the growing epidemic.

Antiretroviral pre-exposure prophylaxis (PrEP) entails the use of once daily, oral emtricitabine/tenofovir (FTC/TDF) by at risk HIV-uninfected individuals to prevent HIV and has been shown to be efficacious in MSM, heterosexuals in serodiscordant relationships, and people who inject drugs.^{9–12} The efficacy of PrEP is highly linked to adherence.¹³ Several trials among women failed to show efficacy due to low rates of adherence.^{14,15} Among MSM, drug levels consistent with taking FTC/TDF four or more times per week have been shown to be highly effective in protecting against HIV.¹³ Recently, there has been increasing interest in alternative modalities of PrEP delivery, including long-acting injectable PrEP¹⁶ and rectal microbicides, delivered as gels.^{17,18} Long-acting injectables are being developed with a once-quarterly injection schedule that has been shown in macaques to maintain suitable drug levels for protection against HIV.¹⁹ Among women, tenofovir 1% gel has been shown to be effective at prevention of vaginal HIV acquisition when inserted pericoitally¹⁷, although as with oral PrEP, efficacy is highly linked to adherence.¹⁵

Although long-acting injectables and rectal microbicides are not yet ready for wide-scale implementation^{17,19}, these modalities may offer benefits over a daily oral pill. For example, long acting injectables may have benefits in terms of adherence, by eliminating the need to remember to take a pill everyday.¹⁶ Rectal microbicides could be associated with increased adherence because of the frequent use of lubricants during anal intercourse. However, although the acceptability of daily oral PrEP has been established in multiple settings^{20–23}, there are relatively fewer studies assessing acceptability of long-acting injectables¹⁶ and rectal microbicides.^{18,24–27} Ultimately, it is likely that different PrEP modalities will be suitable for different individuals, and that a suite of options may allow for maximum population level benefit.

To date, PrEP programs have not been implemented in Vietnam. There are unique challenges in implementing PrEP in developing countries, including health system financing and infrastructure for provision of the medication and the necessary laboratory monitoring. Individual-level challenges include knowledge, uptake, adherence, and retention in care. However, given that generic medications are frequently available at very low costs, there is opportunity to expand access to PrEP in Vietnam and elsewhere in Southeast Asia. Recently,

there has been increased interest in PrEP implementation in Asia as part of a comprehensive HIV prevention strategy.²⁸ To inform future demonstration projects and implementation of PrEP in Vietnam, we assessed preferences for daily oral, injectable, and rectal microbicide modalities of PrEP, as well as participants' view on potential barriers to uptake and adherence among a nationwide, online sample of Vietnamese MSM.

METHODS

Participants and Procedures

From January to March 2015, an Internet-based survey was conducted among members of seven social networking sites for MSM in Vietnam. These websites are similar to large global social networking websites but are designed specifically for gay and bisexual men in Vietnam, and are not necessarily designed for dating or hook-ups. Banner ads about the survey were posted on major Vietnamese language social networking sites that are frequently used by MSM. Interested participants could click on the banner ad, where they were directed to a page that contained information about the content and purpose of the survey. Participants were instructed that participation was entirely voluntary, they could skip any questions that they felt uncomfortable answering, and that they would not be compensated for participation. Participants provided informed consent by clicking "I agree to participate in the survey" after being informed about the study. The survey took approximately 25 minutes to complete.

Inclusion criteria for the present analysis included individuals who reported being HIV-uninfected, who did not report a transgender gender identity, and who completed questions about PrEP knowledge and preferences. All study procedures were approved by the Institutional Review Boards at The Fenway Institute and the Hanoi School of Public Health.

Measures

PrEP Acceptability—Oral PrEP was described to participants as a daily pill taken by mouth by people who do not have HIV infection but are at risk of acquiring it. They were given information on efficacy of PrEP, including that when taken consistently, PrEP has been shown to reduce the risk of HIV in people who are high risk by approximately 92%, but much less effective if taken inconsistently. Injectable PrEP was described as an injection (or shot) given every three months, and rectal microbicides were described to participants as a gel (like a lubricant) inserted into the rectum before sex. Participants were informed that both injectable PrEP and rectal microbicides are currently under study to determine if they will offer protection against HIV and are not yet available.

Participants were asked if they had ever heard of PrEP (coded as yes versus no, with "I don't know" coded as "no"), how difficult they thought it would be to take oral PrEP every day, and were asked to endorse reasons that could make it difficult to take PrEP every day, including 1) difficulty remembering; 2) travel/migration; 3) alcohol/drug use; 4) fear that partner/spouse might find out; and/or 5) fear that friends/community might find out. Participants were asked to rank their most preferred PrEP method (oral, injectable, or rectal microbicide). Participants were asked to choose reasons why they chose the PrEP method

they prefer, including ease of use, ability to remember to use, ability to hide use from others, and pleasure/enjoyment for rectal microbicides. Finally, participants were asked how much they would be willing to pay for PrEP per month, ranging from unwilling to pay for PrEP to over 1,000,000 Vietnam Dong (VND; ~\$50 USD) in increments of 200,000 VND.

Demographics—Participants were asked their current age, highest level of education completed (dichotomized as University or above versus less than University) and province of residence (coded as Ho Chi Minh City, Hanoi, or other). Participants were also asked to describe their sexual orientation: gay (defined as being attracted to other men), bisexual (defined as being attracted to both men and women), heterosexual (defined as being attracted to women), or questioning (defined as not sure about being attracted to men or women).

Healthcare Utilization—Participants were asked if they had used any health service in the previous 12 months, and if they had had been tested for sexually transmitted infections (STIs) or HIV in the previous 12 months.

HIV Prevention Knowledge—Knowledge of current HIV prevention strategies was assessed with a series of six true/false questions related to currently available HIV prevention strategies. These questions included 1) Using condoms for anal sex can help prevent HIV transmission (*true*); 2) Using condoms for vaginal sex can help prevent HIV transmission (*true*); 3) There is a medicine taken after sex without condoms that can help prevent HIV transmission (*true*); 4) Circumcision can help prevent HIV transmission for men who have sex with women (*true*); 5) Circumcision can help prevent HIV transmission for men who have sex with other men (*false*); 6) There is a highly effective vaccine to protect against HIV infection (*false*). A correct answer was given a score of 1, and correct answers to questions were summed for each individual. The score could range from 0 (none correct) to 6 (all correct).

Sexual Behaviors—Participants were asked about how many male, female, and transgender partners they had had in the previous three months. Participants were also asked how many times they had had receptive and insertive condomless anal sex with another man in the previous three months. Participants were classified as having any condomless receptive or insertive anal sex if they had reported any instance of condomless anal sex as the receptive or insertive partner, respectively, in the previous three months.

Depression and substance use—Depressive symptoms were measured using the 10-item Center for Epidemiologic Studies Depression Scale (Cronbach's $\alpha=0.80$).^{29,30} Participants were classified as having significant depressive symptoms if they had a score of 10 or above on the CES-D 10. Problematic alcohol use was measured using the 3-item AUDIT scale, a short-form of the 10-item AUDIT scale that has been shown to be effective at detecting problematic alcohol use among men and women.³¹

Statistical Analyses

Descriptive characteristics for the study sample were calculated with percentages for categorical variables and medians and interquartile range (IQR) for continuous variables. A

series of logistic regression models were used to assess factors associated with having heard of PrEP and preference for oral daily, injectable, and rectal microbicide modalities of PrEP. A bivariate logistic regression model was built for each independent variable of interest with having heard of PrEP as the dependent variable, and a multivariable model was then built with the following independent predictors: age, province of residence (Ho Chi Minh City, Hanoi, or other), education (coded as university or above versus below university), if the respondent reported being sexually active with another man in the previous 12 months, any use of health services in the past 12 months, HIV and STI testing in the past 12 months, HIV knowledge score, condomless receptive and insertive anal sex in the previous 3 months, depression, and alcohol dependency. One logistic regression model per modality preference was built. A series of bivariate models for each modality preference and each independent variable of interest was built. Then separate multivariable logistic regression models were built for each modality preference with the same independent predictors described above.

Due to relatively large amounts of missing data for sexual behaviors and psychosocial variables, multiple imputation of sexual behaviors and depression and alcohol dependency variables was used for the primary analysis. Missing data were imputed 20 times using a multivariate normal regression. This process used age, current province, education, being sexually active in the previous 12 months, use of health services in the past 12 months, HIV and STI testing in the past 12 months, and HIV knowledge score. All analyses were run in Stata 13.1 (StataCorp, College Station, TX).

RESULTS

Of 2,816 individuals who clicked the banner ads, 2,598 (99.2%) consented and began the survey, 1,774 (68.3%) answered all demographic questions, and 548 (30.9%) completed all PrEP questions, which comprised the analytic sample. The median age of the study sample was 22 years (IQR 20 to 25 years), and approximately two-thirds of the sample resided in Ho Chi Minh City (Table 1). Most (83.2%) participants identified as gay. Participants generally were generally aware that condoms were effective at preventing HIV transmission for anal (95%) and vaginal (94%) sex, but less often were aware of PEP (22%), and only 53% knew correctly that there is not currently a highly effective vaccine for HIV. Participants who did not drop out of the survey and answered PrEP questions were similar in demographic characteristics to those who did not, although those who dropped out of the survey after answering demographic questions had slightly lower education (71.5% completed university or above education versus 78.5%), were more often bisexual (17.6% versus 12.6%), and were less often sexually active in the previous year (68.2% versus 77.4%; Supplemental Table 1).

Approximately one quarter (26.8%) of participants had previously heard of PrEP (Table 2). After all participants were introduced to the concept of daily oral PrEP, the most common concerns about uptake of PrEP included side effects (48.0%) and concerns about taking a pill every day (32.2%). Difficulty remembering was the most-commonly (68.8%) cited concern about adhering to PrEP. Most (65.7%) participants indicated that they would prefer rectal microbicide gel administration of PrEP compared to long-acting injectable (17.0%) or daily oral PrEP (17.3%). Reasons for preferring rectal microbicide included enjoying using

lubricants while having sex (79.4%) and perception that it is easier to remember than a daily pill (55.3%). Reasons for preferring long-acting injectable PrEP included that it is easier to remember than a daily pill (71.0%) and easier to conceal from members of their community (58.1%). Reasons for indicating a preference for daily oral PrEP included that it would be easier to stop (53.7%), particularly if there were any side effects (34.4%).

Table 3 lists factors associated with having heard of PrEP. Factors independently associated with increased odds of having heard of PrEP including having tested for HIV in the previous 12 months (aOR 1.75, 95% CI 1.08 to 2.82), a higher HIV knowledge score (aOR 1.33 per one-unit increase in score, 95% CI 1.07 to 1.64), and having had condomless receptive anal intercourse in the previous three months (aOR 1.84, 95% CI 1.08 to 3.13). Participants reporting living in Hanoi had lower odds of having heard of PrEP compared to participants living in Ho Chi Minh City (aOR 0.44, 95% CI 0.19 to 1.01), although this difference was not statistically significant.

Table 4 lists factors associated with a preference for rectal microbicide, injectable, or daily oral PrEP. Older participants less often reported rectal microbicides as their preferred form of PrEP (aOR 0.95 per one-year increase in age, 95% CI 0.91 to 0.99), whereas older participants had increased odds of indicating injectable PrEP to be their preferred PrEP modality (aOR 1.08 per one-year increase in age, 95% CI 1.03 to 1.14). Participants who were willing to pay more for PrEP had reduced odds of indicating rectal microbicides to be their preferred PrEP modality (aOR 0.81 per one-unit increase in amount willing to pay for PrEP, 95% CI 0.72 to 0.92), whereas participants who were willing to pay more for PrEP had increased odds of indicating a preference for injectable PrEP (aOR 1.17 per one-unit increase in amount willing to pay for PrEP, 95% CI 1.01 to 1.35) and daily oral PrEP (aOR 1.16, 95% CI 1.00 to 1.35). Models were robust to sensitivity analyses using a missing indicator to account for missing data in sexual behavior, depression, and alcohol use measures, as well as models in which these variables were not included (Supplemental Table 2).

DISCUSSION

In this study, we demonstrated that Vietnamese MSM who use social networking sites expressed a strong preference for rectal microbicides over other PrEP delivery modalities. Although there is a large body of literature concerning acceptability of daily oral PrEP globally, considerably less research has considered acceptability of newer alternative modalities of PrEP delivery.^{16,18,21,23,32–34} Previous studies in the United States³⁵, Thailand²⁵, and Peru^{18,36} have demonstrated acceptability of rectal microbicides for HIV prevention among MSM. The results of the current study indicate that PrEP implementation programs in Vietnam may benefit from offering a variety of PrEP modalities, should they be shown to be effective.

As expected, relatively few participants in this survey had previously heard of PrEP. PrEP is not currently available in Vietnam, and it is likely that those who reported having heard of PrEP did so through the Internet or foreign connections from countries where PrEP is available. Importantly, this survey was based online and the main recruitment strategy was

via Internet websites for MSM. These individuals may be more connected to social networking that would involve discussion of PrEP, and may have greater access to information from outside of the country, than individuals who use the Internet less. An important component of a successful PrEP implementation program will be engaging individuals who are at risk for HIV in PrEP care. The results of this study suggest that individuals who are more engaged in existing HIV prevention activities (i.e., those who have greater knowledge of HIV prevention strategies and have recently tested for HIV) are more aware of PrEP than those who are less engaged. In addition, the low response rate to PrEP questions may be indicative of low knowledge and, potentially, interest in PrEP. Low awareness may have led individuals to skip PrEP-related questions if they did not know what it was or did not think it would be useful for them. Low acceptability of PrEP found in this survey is likely reflective of low levels of awareness and knowledge. In the United States, acceptability of PrEP has increased as awareness increased³⁷, and it is possible that a similar pattern will be seen in Vietnam as PrEP implementation projects are rolled out. Consideration should be given to strategies for dissemination of information related to PrEP, such as via online platforms and social networking websites for MSM, to maximize effectiveness of PrEP implementation programs in Vietnam.

Daily oral PrEP has proven efficacy and almost certainly will be the first PrEP modality introduced in Vietnam, and plans are underway for demonstration projects. The results of this study offer some important insights into potential barriers to PrEP uptake and adherence among Vietnamese MSM. The most common hypothetical concern related to daily oral PrEP uptake was concern related to side effects, which is in line with previous results from Vietnam that suggested that male sex workers would be less willing to use PrEP if it had side effects.²⁰ PrEP implementation programs may benefit from education that side effects tend to be mild and self-limiting.⁹ The most commonly-cited perceived barrier to adherence to PrEP was difficulty remembering to take the pill. Until PrEP modalities that do not require regular adherence are approved and implemented, strategies that help patients remember to take their pills, such as alarms or text message reminders, may maximize effectiveness of PrEP.³⁸

Participants who indicated preference for rectal microbicides were less likely to endorse being willing to pay more for PrEP compared to those who indicated a preference for daily oral PrEP or long-acting injectables. Individuals who indicated a preference for rectal microbicides were generally younger. Younger men may be less willing or less able to pay for the medication, which may have implications for PrEP implementation. Cost has been previously cited as a potential barrier to uptake of PrEP.³⁹ Younger age and lower levels of education have previously been associated with HIV among MSM in Vietnam.⁴⁰ Identification of HIV prevention strategies that work for younger MSM is therefore a priority. The results of the present study indicate that offering individuals multiple options for PrEP delivery may be the most acceptable for different individuals, and potentially for individuals during different periods of their lives.

Individuals with a CESD score suggestive of depression more frequently indicated a preference for injectable PrEP. An association between depression and adherence to antiretroviral therapy has been noted among HIV-infected individuals.⁴¹ It is possible that

individuals with depressive symptomology recognize that they have difficulty engaging in self-protective behavior, such as condom use⁴², and view the long-acting injectable as a way to mitigate self-regulation challenges and remain protected from HIV. Given the potential advantages of long-acting injectables with respect to adherence, this PrEP modality may be especially well-suited to individuals who are depressed in conjunction with interventions to treat depression.

The results of this study must be considered in the context of several limitations. As an online survey, the survey had non-response and attrition. The degree of attrition and non-response was similar to other online surveys.^{43,44} Demographic characteristics were roughly balanced between individuals who completed the PrEP questions and those who did not, however there may have been differences in participants who did and did not complete PrEP questions that could affect estimates. We attempted to account for bias potentially introduced by missing data for items that were towards the end of the survey, including depression and alcohol dependency, and related to sexual behaviors, for which a substantial proportion of participants reported that they preferred not to answer the questions. This survey relied on self-reported measures, and thus may be affected by social desirability bias. Although we asked about recent condomless receptive and insertive anal intercourse, we did not ask participants about their preferred sexual position. It is possible that individuals who refer rectal anal intercourse may also prefer rectal microbicides, but that this association was missed with how sexual position data was collected. Participants were limited in their responses to preferences for PrEP modalities by the options presented in the survey. The survey did not include questions such as acceptability or preference for intermittent PrEP. Understanding whether alternative PrEP dosing strategies, such as pericoital dosing, are acceptable to potential users will be important questions to ask in future studies.

Finally, to participate in this study, participants had to have access to the Internet. Individuals living in rural areas of Vietnam or with lower socioeconomic status may have reduced access to the Internet or less frequent use of the sites on which this survey was advertised. Internet coverage in the general population is estimated at more than 35% of the population, which is the 18th highest in the world.⁴⁵ In urban settings, coverage approaches 50%.⁴⁶ One survey in Ho Chi Minh City reported that among MSM in the community 99.1% had ever used the Internet and that 73% had sought sexual partners via the Internet.⁴⁶ The majority of participants in this survey were from Ho Chi Minh City, which may be an oversample due to social networks and Internet access. Furthermore, the majority of the participants in the study reported two or fewer sexual partners in the previous three months. This sample may be a less sexually active sample that may see less benefit in daily or injectable forms of PrEP and thus may other modalities preferable. While we cannot quantify how different this sample is from MSM more broadly in Vietnam, this study may not be generalizable to all MSM in Vietnam.

Despite these limitations, this report presents one of the first reports of PrEP knowledge and acceptability in Vietnam. Our results suggest that PrEP implementation in Vietnam will require more education and may benefit from multiple PrEP modalities, should they prove to be efficacious and become available. PrEP is a promising HIV prevention strategy to address the rapidly expanding HIV epidemic among MSM in Vietnam. In preparation for

implementation of PrEP, qualitative work and demonstration projects are needed to refine implementation strategies for this key population.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

Acknowledgments

This study was supported by a Harvard Global Health Institute Fellowship. CEO was supported by a National Institute of Drug Abuse T32 NRSA (T32DA013911; PI: Flanigan) and National Institute of Mental Health R25 (MH083620, PI: Flanigan).

References

1. Garcia MC, Meyer SB, Ward P. Elevated HIV prevalence and risk behaviours among men who have sex with men (MSM) in Vietnam: a systematic review. *BMJ Open*. 2012; 2:e001511–1.
2. Hoang TV, Tuan NA, Mills SJ, et al. Results from the HIV/STI integrated biological and behavioral surveillance (IBBS) in Vietnam: 2005–2006. 2006
3. Hoang TV, Tuan NA, Vi LNL, et al. Results from the HIV/STI integrated biological and behavioral surveillance (IBBS) in Vietnam – Round II 2009. :2009.
4. Oldenburg CE, Perez-Brumer AG, Reisner SL, et al. Global Burden of HIV among Men Who Engage in Transactional Sex: A Systematic Review and Meta-Analysis. *PLoS ONE*. 2014; 9:e103549. [PubMed: 25068720]
5. Baral S, Poteat T, Stromdahl S, Wirtz AL, Guadamuz T, Beyrer C. Worldwide burden of HIV in transgender women: a systematic review and meta-analysis. *The Lancet Infectious Diseases*. 2013; 13:214–22. [PubMed: 23260128]
6. Baral S, Beyrer C, Muessig K, et al. Burden of HIV among female sex workers in low-income and middle-income countries: a systematic review and meta-analysis. *The Lancet Infectious Diseases*. 2012; 12:538–49. [PubMed: 22424777]
7. Le L-VN, Nguyen TA, Tran HV, et al. Correlates of HIV infection among female sex workers in Vietnam: Injection drug use remains a key factor. *Drug and Alcohol Dependence*. 2015; 150:46–53. [PubMed: 25765480]
8. Nadol P, O’connor S, Duong H, et al. Findings from Integrated Behavioral and Biologic Survey among Males Who Inject Drugs (MWID) — Vietnam, 2009–2010: Evidence of the Need for an Integrated Response to HIV, Hepatitis B Virus, and Hepatitis C Virus. *PLoS ONE*. 2015; 10:e0118304. [PubMed: 25692469]
9. Grant RM, Lama JR, Anderson PL, et al. Preexposure Chemoprophylaxis for HIV Prevention in Men Who Have Sex with Men. *N Engl J Med*. 2010; 363:2587–99. [PubMed: 21091279]
10. Grant RM, Anderson PL, McMahan V, et al. Uptake of pre-exposure prophylaxis, sexual practices, and HIV incidence in men and transgender women who have sex with men: a cohort study. *The Lancet Infectious Diseases*. 2014; 14:820–9. [PubMed: 25065857]
11. Choopanya K, Martin M, Suntharasamai P, et al. Antiretroviral prophylaxis for HIV infection in injecting drug users in Bangkok, Thailand (the Bangkok Tenofovir Study): a randomised, double-blind, placebo-controlled phase 3 trial. *The Lancet*. 2013; 381:2083–90.
12. Baeten JM, Donnell D, Ndase P, et al. Antiretroviral Prophylaxis for HIV Prevention in Heterosexual Men and Women. *N Engl J Med*. 2012; 367:399–410. [PubMed: 22784037]
13. Anderson PL, Glidden DV, Liu A, et al. Emtricitabine-Tenofovir Concentrations and Pre-Exposure Prophylaxis Efficacy in Men Who Have Sex with Men. *Science Translational Medicine*. 2012; 4:151ra125–5.
14. Thigpen MC, Kebaabetswe PM, Paxton LA, et al. Antiretroviral Preexposure Prophylaxis for Heterosexual HIV Transmission in Botswana. *N Engl J Med*. 2012; 367:423–34. [PubMed: 22784038]

15. Marazzo J, Ramjee G, Nair G. Pre-exposure prophylaxis for HIV in women: daily oral tenofovir, oral tenofovir/emtricitabine, or vaginal tenofovir gel in the VOICE study (MTN 003). 2013
16. 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:e114700. [PubMed: 25502768]
17. Hladik F, Burgener A, Ballweber L, et al. Mucosal effects of tenofovir 1% gel. *Elife*. 2015; 4:e04525.
18. Peinado J, Lama JR, Galea JT, et al. Acceptability of Oral versus Rectal HIV Preexposure Prophylaxis among Men Who Have Sex with Men and Transgender Women in Peru. *Journal of the International Association of Providers of AIDS Care (JIAPAC)*. 2013; 12:278–83. [PubMed: 23422742]
19. Andrews CD, Spreen WR, Mohri H, et al. Long-acting integrase inhibitor protects macaques from intrarectal simian/human immunodeficiency virus. *Science*. 2014; 343:1148–51. [PubMed: 24526311]
20. Oldenburg CE, Biello KB, Colby D, et al. Engagement with Peer Health Educators Is Associated with Willingness to Use Pre-Exposure Prophylaxis Among Male Sex Workers in Ho Chi Minh City, Vietnam. *AIDS Patient Care and STDs*. 2014; 28:109–12. [PubMed: 24601733]
21. Young I, McDaid L. How Acceptable are Antiretrovirals for the Prevention of Sexually Transmitted HIV?: A Review of Research on the Acceptability of Oral Pre-exposure Prophylaxis and Treatment as Prevention. *AIDS Behav*. 2013; published online July 30. doi: 10.1007/s10461-013-0560-7
22. Mimiaga MJ, Case P, Johnson CV, Safren SA, Mayer KH. Preexposure Antiretroviral Prophylaxis Attitudes in High-Risk Boston Area Men Who Report Having Sex With Men: Limited Knowledge and Experience but Potential for Increased Utilization After Education. *J Acquir Immune Defic Syndr*. 2009; 50:77–83. [PubMed: 19295337]
23. Yang D, Chariyalertsak C, Wongthanee A, et al. Acceptability of Pre-Exposure Prophylaxis among Men Who Have Sex with Men and Transgender Women in Northern Thailand. *PLoS ONE*. 2013; 8:e76650. [PubMed: 24116132]
24. Newman PA, Cameron MP, Rongprakhon S, Tepjan S, Scarpa R. Acceptability and Preferences for Hypothetical Rectal Microbicides among a Community Sample of Young Men Who Have Sex with Men and Transgender Women in Thailand: A Discrete Choice Experiment. *AIDS Behav*. 2015:1–14. [PubMed: 24668254]
25. Newman PA, Rongprakhon S, Tepjan S. A social ecology of rectal microbicide acceptability among young men who have sex with men and transgender women in Thailand. *J Int AIDS Soc*. 2013; 16doi: 10.7448/IAS.16.1.18476
26. Giguere R, Dolezal C, Bauermeister JA, et al. Influence of Partner Type on Acceptability and Likelihood of Use of a Rectal Microbicide Among Young Men Who Have Sex With Men in the United States and Puerto Rico. *Journal of Sex Research*. 2015:1–10.
27. Murphy DA, Lea T, de Wit JF, et al. Interest in using rectal microbicides among Australian gay men is associated with perceived HIV vulnerability and engaging in condomless sex with casual partners: results from a national survey. *Sexually Transmitted Infections*. 2015; 91:266–8. [PubMed: 25416839]
28. Lo Y-R, Kato M, Phanuphak N, et al. Challenges and potential barriers to the uptake of antiretroviral-based prevention in Asia and the Pacific region. *Sex Health*. 2014; doi: 10.1071/SH13094
29. Zhang W, O'Brien N, Forrest JI, et al. Validating a Shortened Depression Scale (10 Item CES-D) among HIV-Positive People in British Columbia, Canada. *PLoS ONE*. 2012; 7:e40793. [PubMed: 22829885]
30. Oldenburg C, Biello KB, Colby D, et al. Stigma related to sex work among men who engage in transactional sex with men in Ho Chi Minh City, Vietnam. *Int J Public Health*. 2014; 59:833–40. [PubMed: 24858522]

31. Gual A, Segura L, Contel M, Heather N, Colom J. AUDIT-3 and AUDIT-4: Effectiveness of two short forms of the alcohol use disorders identification test. *Alcohol and Alcoholism*. 2002; 37:591–6. [PubMed: 12414553]
32. 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. [PubMed: 23342121]
33. Mimiaga MJ, Closson EF, Kothary V, Mitty JA. Sexual Partnerships and Considerations for HIV Antiretroviral Pre-Exposure Prophylaxis Utilization Among High-Risk Substance Using Men Who Have Sex with Men. *Arch Sex Behav*. 2013; 43:99–106.
34. Lorente N, Fugon L, Carrieri MP, et al. Acceptability of an ‘on-demand’ pre-exposure HIV prophylaxis trial among men who have sex with men living in France. *AIDS Care*. 2011:1–10.
35. Kubicek K, Arauz-Cuadra C, Kipke MD. Attitudes and Perceptions of Biomedical HIV Prevention Methods: Voices from Young Men Who Have Sex with Men. *Arch Sex Behav*. 2015; 44:487–97. [PubMed: 25633499]
36. Kinsler JJ, Galea JT, Peinado J, Segura P, Montano SM, Sanchez J. Lubricant use among men who have sex with men reporting receptive anal intercourse in Peru: implications for rectal microbicides as an HIV prevention strategy. *International Journal of STD & AIDS*. 2010; 21:567–72. [PubMed: 20975090]
37. Krakower DS, Mimiaga MJ, Rosenberger JG, et al. Limited Awareness and Low Immediate Uptake of Pre-Exposure Prophylaxis among Men Who Have Sex with Men Using an Internet Social Networking Site. *PLoS ONE*. 2012; 7:e33119. [PubMed: 22470438]
38. Finitsis DJ, Pellowski JA, Johnson BT. Text Message Intervention Designs to Promote Adherence to Antiretroviral Therapy (ART): A Meta-Analysis of Randomized Controlled Trials. *PLoS ONE*. 2014; 9:e88166. [PubMed: 24505411]
39. Golub SA, Gamarel KE, Rendina HJ, Surace A, Lelutiu-Weinberger CL. From Efficacy to Effectiveness: Facilitators and Barriers to PrEP Acceptability and Motivations for Adherence Among MSM and Transgender Women in New York City. *AIDS Patient Care and STDs*. 2013; 27:248–54. [PubMed: 23565928]
40. Nguyen TA, Nguyen HT, Le GT, Detels R. Prevalence and Risk Factors Associated with HIV Infection Among Men Having Sex with Men in Ho Chi Minh City, Vietnam. *AIDS Behav*. 2007; 12:476–82. [PubMed: 17594139]
41. Gonzalez JS, W BA, Psaros C, Safren SA. Depression and HIV/AIDS Treatment Nonadherence: A Review and Meta-analysis. *J Acquir Immune Defic Syndr*. 2011; 58:181–7. [PubMed: 21857529]
42. Biello KB, Colby D, Closson E, Mimiaga MJ. The Syndemic Condition of Psychosocial Problems and HIV Risk Among Male Sex Workers in Ho Chi Minh City, Vietnam. *AIDS Behav*. 2013; published online Oct 1. doi: 10.1007/s10461-013-0632-8
43. Weatherburn P, Schmidt AJ, Hickson F, et al. The European Men-Who-Have-Sex-With-Men Internet Survey (EMIS): Design and Methods. *Sex Res Soc Policy*. 2013; published online May 7. doi: 10.1007/s13178-013-0119-4
44. Biello KB, Rosenberger JG, Novak DS, Robertson AM, Mayer KH, Mimiaga MJ. Epidemiology of Sexual Health in the Virtual Environment: A Multinational Online Survey of Spanish- and Portuguese-Speaking Men who use an Internet Sexual Networking Site. *AIDS Behav*. 2014; 18:1675–85. [PubMed: 24980249]
45. Vietnam Internet Network Information Center. Report on Vietnam Internet Resources 2012. :2012.
46. Justimus P, Colby D, Mai Doan Anh T, Balestre E, Becquet R, Orne-Gliemann J. Willingness to Use the Internet to Seek Information on HIV Prevention and Care among Men Who Have Sex with Men in Ho Chi Minh City, Vietnam. *PLoS ONE*. 2013; 8:e71471. [PubMed: 23977048]

Table 1Descriptive characteristics of study sample (N=548^{*})

	N (%)
Age, years (median, IQR)	22 (20 to 25)
Current Province	
Ho Chi Minh City	371 (67.7%)
Hanoi	47 (8.6%)
Other	130 (23.7%)
University or above versus less than university education	428 (78.1%)
Sexual identity	
Gay/homosexual	456 (83.2%)
Bisexual	69 (12.6%)
Heterosexual	4 (0.7%)
Unsure/questioning	35 (6.4%)
Sexually active, past 12 months	424 (77.4%)
Used any health service, past 12 months	355 (64.8%)
STI tested in the past 12 months	72 (13.1%)
HIV tested in the past 12 months	196 (35.8%)
HIV knowledge score (median, IQR)	4 (3 to 4)
Condomless receptive anal intercourse, past 3 months	145/418 (34.7%)
Condomless insertive anal intercourse, past 3 months	140/411 (34.1%)
Total number of partners, past 3 months (median, IQR)	1 (0 to 3)
Depression	194/440 (44.1%)
Alcohol dependency	155/462 (33.6%)

N=number; IQR=interquartile range; STI=sexually transmitted infection

^{*} Not all participants completed behavior questions. Denominators shown where different.

Table 2Preferences for PrEP modality (N=548^{*})

	N (%)
Heard of PrEP	147 (26.8%)
Perceived barriers to taking PrEP	
Concerns about efficacy	85/454 (18.7%)
Concerns about side effects	218/454 (48.0%)
Do not want to take pill every day	146/454 (32.2%)
Concern about perception about being HIV positive	127/454 (28.0%)
Concern about family/friends learning about sexual behavior	117/454 (25.8%)
Perceived barriers to adherence to PrEP	
Difficulty remembering	271/394 (68.8%)
Travel/migration	100/394 (25.4%)
Alcohol/drug use	58/394 (14.7%)
Fear that spouse/partner will find out	90/394 (22.8%)
Fear that friends/community will find out	132/394 (33.5%)
Perception of daily oral PrEP effectiveness	
Not at all effective	25 (4.6%)
Slightly effective	59 (10.8%)
Moderately effective	108 (19.7%)
Very effective	41 (7.5%)
I don't know	314 (57.4%)
Interested in taking daily oral PrEP	306/465 (65.8%)
Interested in taking long-acting injectable	353/506 (69.8%)
Interested in rectal microbicides	438/513 (85.4%)
Maximum amount willing to pay for PrEP per month	
Not willing to pay for PrEP	72 (13.1%)
100,000 VND (~4 USD)	199 (36.3%)
200,000 VND (~9 USD)	178 (32.5%)
400,000 VND (~18 USD)	52 (9.5%)
600,000 VND (~28 USD)	20 (3.7%)
800,000 VND (~37 USD)	6 (1.1%)
>1,000,000 VND (>~46 USD)	21 (3.8%)
Preference for rectal microbicide	360 (65.7%)
Preference for injectable PrEP	93 (17.0%)
Preference for daily oral PrEP	95 (17.3%)

N=number; PrEP=pre-exposure prophylaxis; VND=Vietnamese dong; USD= United States dollar

* Not all participants completed behavior questions. Denominators shown where different.

Author Manuscript

Author Manuscript

Author Manuscript

Author Manuscript

Table 3

Factors associated with having heard of PrEP (N=548)

	Bivariate		Multivariable	
	OR (95% CI)	P	aOR (95% CI)	P
Age, years (median, IQR)	1.06 (1.01 to 1.10)	0.01	1.04 (0.99 to 1.09)	0.10
Current Province				
Ho Chi Minh City	1.00		1.00	
Hanoi	0.47 (0.21 to 1.03)	0.06	0.44 (0.19 to 1.01)	0.052
Other	0.57 (0.35 to 0.93)	0.02	0.63 (0.38 to 1.06)	0.08
University or above versus less than university education	1.52 (0.93 to 2.47)	0.10	1.25 (0.72 to 2.17)	0.43
Sexual identity				
Gay/homosexual	0.57 (0.16 to 1.95)	0.37	0.59 (0.15 to 2.28)	0.44
Bisexual	0.54 (0.15 to 1.90)	0.33	0.64 (0.16 to 2.51)	0.52
Heterosexual	NA	NA	NA	NA
Unsure/questioning	0.74 (0.22 to 2.53)	0.63	0.99 (0.27 to 3.67)	0.98
Sexually active, past 12 months	1.07 (0.68 to 1.69)	0.77	0.66 (0.37 to 1.19)	0.17
Used any health service, past 12 months	1.33 (0.88 to 1.99)	0.17	1.07 (0.68 to 1.70)	0.77
STI tested in the past 12 months	2.05 (1.22 to 3.42)	0.006	1.37 (0.75 to 2.51)	0.31
HIV tested in the past 12 months	2.06 (1.40 to 3.04)	<0.001	1.75 (1.08 to 2.82)	0.02
HIV knowledge score (median, IQR)	1.42 (1.16 to 1.73)	0.001	1.33 (1.07 to 1.64)	0.009
Condomless receptive anal intercourse, past 3 months	1.39 (0.91 to 2.12)	0.12	1.84 (1.08 to 3.13)	0.03
Condomless insertive anal intercourse, past 3 months	0.82 (0.53 to 1.29)	0.40	0.60 (0.34 to 1.09)	0.09
Total number of partners, past 3 months	1.02 (0.97 to 1.07)	0.47	1.01 (0.95 to 1.08)	0.68
Depression	0.95 (0.63 to 1.42)	0.80	0.89 (0.57 to 1.40)	0.62
Alcohol dependency	0.87 (0.56 to 1.36)	0.54	0.80 (0.49 to 1.31)	0.37

N=number; PrEP=pre-exposure prophylaxis; VND=Vietnamese dong; USD= United States dollar

Table 4
Factors associated with preference for rectal microbicides, injectable PrEP and oral PrEP (N=548)

	Preference for Rectal Microbicide		Preference for Injectable PrEP		Preference for Oral PrEP	
	OR (95% CI)	aOR (95% CI)	OR (95% CI)	aOR (95% CI)	OR (95% CI)	aOR (95% CI)
Age	0.95 (0.92 to 0.99)	0.95 (0.91 to 0.99)	1.06 (1.02 to 1.11)	1.08 (1.03 to 1.14)	1.01 (0.96 to 1.06)	1.00 (0.95 to 1.06)
Current Province						
Ho Chi Minh City	1.00	1.00	1.00	1.00	1.00	1.00
Hanoi	0.89 (0.48 to 1.66)	0.91 (0.47 to 1.75)	1.52 (0.74 to 3.15)	1.71 (0.79 to 3.70)	0.75 (0.32 to 1.75)	0.66 (0.27 to 1.59)
Other	1.34 (0.87 to 2.06)	1.27 (0.80 to 2.02)	0.91 (0.52 to 1.57)	0.98 (0.54 to 1.76)	0.69 (0.39 to 1.21)	0.68 (0.37 to 1.23)
University or above versus less than university education	0.95 (0.62 to 1.45)	1.17 (0.72 to 1.89)	1.03 (0.60 to 1.77)	0.80 (0.43 to 1.46)	1.06 (0.62 to 1.82)	1.01 (0.56 to 1.84)
Sexual identity						
Gay/homosexual	1.94 (0.58 to 6.46)	1.68 (0.49 to 5.82)	0.89 (0.31 to 2.55)	0.94 (0.29 to 3.04)	0.58 (0.15 to 2.27)	0.59 (0.14 to 2.51)
Bisexual	1.81 (0.54 to 6.09)	1.53 (0.44 to 5.31)	0.92 (0.31 to 2.74)	0.94 (0.29 to 3.05)	0.62 (0.15 to 2.47)	0.71 (0.17 to 3.05)
Heterosexual	NA	NA	4.47 (0.59 to 33.6)	8.91 (0.92 to 86.2)	4.42 (0.43 to 45.0)	3.34 (0.27 to 41.6)
Unsure/questioning	2.03 (0.60 to 6.81)	1.85 (0.53 to 6.49)	1.33 (0.46 to 3.85)	1.35 (0.42 to 4.35)	0.28 (0.06 to 1.31)	0.28 (0.06 to 1.40)
Sexually active, past 12 months	0.85 (0.55 to 1.30)	0.68 (0.40 to 1.16)	0.81 (0.48 to 1.36)	0.91 (0.48 to 1.75)	1.69 (0.93 to 3.05)	2.12 (1.05 to 4.30)
Used any health service, past 12 months	1.27 (0.88 to 1.83)	1.46 (0.97 to 2.20)	0.79 (0.50 to 1.25)	0.70 (0.42 to 1.17)	0.87 (0.55 to 1.37)	0.79 (0.48 to 1.32)
STI tested in the past 12 months	0.80 (0.48 to 1.33)	0.70 (0.39 to 1.28)	0.98 (0.50 to 1.90)	0.96 (0.44 to 2.08)	1.44 (0.78 to 2.63)	1.71 (0.84 to 3.51)
HIV tested in the past 12 months	1.08 (0.75 to 1.57)	1.29 (0.82 to 2.04)	1.10 (0.69 to 1.75)	1.22 (0.69 to 2.15)	0.80 (0.50 to 1.28)	0.56 (0.31 to 1.01)
HIV knowledge score	1.03 (0.87 to 1.23)	1.05 (0.87 to 1.28)	1.06 (0.85 to 1.32)	1.01 (0.79 to 1.29)	0.90 (0.72 to 1.11)	0.91 (0.72 to 1.15)
Condomless receptive anal intercourse, past 3 months	1.06 (0.71 to 1.60)	1.00 (0.60 to 1.67)	0.79 (0.46 to 1.34)	0.96 (0.49 to 1.88)	1.14 (0.68 to 1.92)	1.03 (0.56 to 1.92)
Condomless insertive anal intercourse, past 3 months	1.27 (0.83 to 1.92)	1.59 (0.95 to 2.66)	0.84 (0.50 to 1.44)	0.89 (0.44 to 1.83)	0.81 (0.47 to 1.39)	0.55 (0.29 to 1.07)
Total number of partners, past 3 months	0.98 (0.94 to 1.03)	1.00 (0.95 to 1.05)	0.92 (0.93 to 1.04)	0.96 (0.90 to 1.04)	1.04 (0.99 to 1.08)	1.03 (0.98 to 1.09)
Depression	0.74 (0.49 to 1.11)	0.74 (0.48 to 1.13)	1.84 (1.12 to 3.05)	1.94 (1.13 to 3.33)	0.88 (0.53 to 1.44)	0.85 (0.51 to 1.42)

	Preference for Rectal Microbicide		Preference for Injectable PrEP		Preference for Oral PrEP	
	OR (95% CI)	aOR (95% CI)	OR (95% CI)	aOR (95% CI)	OR (95% CI)	aOR (95% CI)
Alcohol dependency	1.04 (0.69 to 1.57)	1.16 (0.75 to 1.78)	0.98 (0.58 to 1.64)	0.92 (0.53 to 1.61)	0.95 (0.58 to 1.58)	0.90 (0.52 to 1.54)
Maximum willing to pay for PrEP	0.82 (0.73 to 0.92)	0.81 (0.72 to 0.92)	1.19 (1.04 to 1.36)	1.17 (1.01 to 1.35)	1.13 (0.98 to 1.30)	1.16 (1.00 to 1.35)

N=number; PrEP=pre-exposure prophylaxis; VND= Vietnamese dong; USD= United States dollar