Title: *Measuring PrEP Preferences Among At-Risk Military Populations: Results of an Adaptive Choice Based Conjoint Analysis Study*

Authors: José I Gutierrez, PhD, FNP-BC[a], Alex Dubov, PhD[b], Frederick Altice, MD[c,d], and David Vlahov, PhD, RN[a,d]

Authors' Affiliation:
[a] Yale School of Nursing, 400 West Campus Drive, Orange, CT 06477, United States
[b] Loma Linda University, Griggs Hall 11065, Loma Linda, CA 92350, United States
[c] Yale School of Medicine, 333 Cedar Street, New Haven, CT 06510, United States
[d] Yale School of Public Health, Department of Epidemiology-Microbial Diseases, 60 College St, New Haven, CT 06510, United States

Correspondence:
José Gutierrez, jose.gutierrez@aya.yale.edu

Citation:
Gutierrez JI, Vlahov D, et al. Measuring PrEP Preferences Among At-Risk Military Populations: Results of an Adaptive Choice Based Conjoint Analysis Study. *(Under review)*

Dr. Xiao-Bing Fu, Editor-in-Chief
Dr. Qing-Jie Li, Honorary Editor-in-Chief
Military Medical Research

July 27, 2020

Dear Drs. Fu and Li:

I am writing to submit our manuscript titled "Measuring PrEP Preferences Among At-Risk Military Populations: Results of an Adaptive Choice Based Conjoint Analysis Study" for consideration for publication as a research article within the Military Medical Research journal.

Pre-exposure prophylaxis (PrEP) is a medication that effectively prevents HIV infection when taken correctly yet is underutilized within the military health care system. For this study, we identified the preferred characteristics of an ideal PrEP delivery program within the military health care system through an anonymous, conjoint analysis survey of at-risk, U.S. military members. Our findings reveal that a military, on-base health care setting is most preferred for PrEP delivery, yet also indicate a need for quality clinical interactions that are sensitive to sexual identity, mental health, and decision autonomy.

Given the low uptake of PrEP by at-risk military members, we believe that the findings presented in our paper will appeal to key infectious disease stakeholders and policymakers who subscribe to Military Medical Research. Our results will allow your readers to understand which characteristics of a military PrEP delivery program are most attractive to the distinct preferences of this vulnerable population. In doing so, we hope our research will advance evidence-informed PrEP delivery programs within the military health care system tailored to the preferences of U.S. military members most at risk for acquiring HIV.

All listed authors confirm that this manuscript has not been previously published, nor is it currently under consideration by any other journal. Furthermore, all authors have approved the contents of this paper and have agreed to MMR's submission policies.

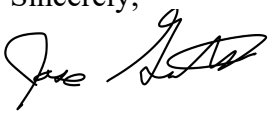
Should our manuscript be selected for peer review, we would like to suggest the following reviewers that would be able to objectively evaluate our findings and interpretation based on their research background and expertise.

- **Liana Fraenkel, MD, MPH,** Yale University/Berkshire Medical Center, liana.fraenkel@yale.edu (expertise: conjoint analysis, decision science, preference behavior)
- **José A. Bauermeister, PhD, MPH,** University of Pennsylvania, bjose@upenn.edu (expertise: HIV/AIDS & PrEP science, health-seeking & sexual behaviors of at-risk populations)
- **Patrick W. Kelley, MD, DrPH,** Fairfield University, pkelley@fairfield.edu (expertise: military preventative medicine, global infectious disease control)

- **Jason F. Okulicz, MD,** Uniformed Services University of the Health Sciences/U.S. Air Force HIV Medical Evaluation Unit, jason.f.okulicz.mil@mail.mil (expertise: infectious diseases and PrEP use among military populations)

Each of the authors named on the manuscript has contributed to the development, interpretation and drafting of this manuscript. To the best of our knowledge, the named authors have no conflicts of interest.

Sincerely,



José I Gutierrez Jr., PhD, FNP-BC
Yale University, School of Nursing
E: jose.gutierrez@aya.yale.edu
T: 309-335-4242

Additional Contact Information:

Attn: José I Gutierrez Jr., PhD, FNP-BC
Fellow, National Clinician Scholars Program
University of California, San Francisco
E: jose.gutierrez2@ucsf.edu
T: 309-335-4242

47

ABSTRACT

BACKGROUND. Pre-exposure prophylaxis (PrEP) effectively prevents HIV infection, yet its uptake remains low among U.S. military men who have sex with men (MSM). Research shows that health services matching preferences produce favorable outcomes. Therefore, an early step for planning program design is to characterize and identify preferences for improved PrEP delivery within this population.

METHODS. HIV-negative military MSM were recruited through a closed, LGBT military social media group. Participants completed an anonymous survey presenting five experimentally varied attributes of interest related to PrEP administration (dosing method, provider type, visit location, lab work evaluation location, and dispensing venue). Relative importance and part-worth utility scores were generated using Hierarchical Bayes (HB) estimation, and the randomized first choice model was used to examine participation interest across eight possible PrEP program scenarios.

RESULTS. Among the 429 participants and the eight scenarios that varied the five attributes into delivery profiles, the most preferred scenario (69.9%) featured a daily pill or long-term PrEP injection, military provider, smartphone/telehealth visit, lab evaluation on-base, and on-base medication pick-up. Responses indicated the need for providers to familiarize themselves with PrEP prescription knowledge and to provide interactions sensitive to sexual identity, mental health, and decision autonomy.

CONCLUSION: These results suggest that a military setting is preferred over a civilian or off-site one, yet more importantly, it points to a high value placed on the quality of clinical interactions. High interest in long-acting implants and injections also suggest potential markets for future PrEP engagement.

TRIAL REGISTRATION. Not applicable.

KEYWORDS. Conjoint analysis, pre-exposure prophylaxis, PrEP, preference, decision science, HIV, military health, infectious disease

BACKGROUND

Each year, there are approximately 350 new cases of human immunodeficiency virus (HIV) infections within members of the U.S. military; with those most affected being younger, Black, and men who have sex with men.(1-5) When taken correctly, Pre-exposure Prophylaxis (PrEP) effectively prevents HIV infection,(6-9) yet the current PrEP cascade within the U.S. military suggests sub-optimal uptake; with an estimated 16% of eligible members taking PrEP and members of color remaining under-represented in terms of treatment.(2) Identifying the factors that drive uptake within this population remains a priority.

The field of PrEP science has explored multiple avenues of PrEP access pathways, delivery mechanisms, and dosing methods to circumvent the geographic, psychological, and adherence barriers that exist and impede PrEP engagement.(10-17) Currently, military PrEP engagement depends on geographic proximity to a large medical facility with specialty services, as evidenced by 41% of all military PrEP prescriptions originating from military medical centers in three locations in the U.S. Additionally, 60% of all military PrEP prescriptions occur only after consultation with an infectious disease specialist.(2) Data are sparse on military MSM's most preferred program characteristics within a PrEP delivery program.

Health services designed around preferences in terms of product type, delivery method, and location settings have been shown to produce improved treatment outcomes and retention to care.(18-20) Stated preference methods, such as conjoint analysis, quantify preference data of new market entrants and product characteristics; also called *attributes*.(15, 16, 21-25) The central theory of conjoint analysis is that products or

programs are viewed as a composition of various attributes that possess a certain amount of value (part-worth utility score) determined by preference. By quantifying this value (part-worth utility scores) for preferred attributes, these scores can then be entered into market simulation models to predict how respondents might respond to *any* potential combination of attribute levels.(15, 16, 21-25) Using conjoint analysis, the purpose of this study was to identify the preference factors that are most influential to at-risk U.S. military MSM's decision to take PrEP within the military healthcare system.

METHODS

A convenience sample of self-reported HIV-negative, U.S. military MSM and trans-individuals were recruited between March and April 2020 through a closed Facebook group with an internal membership of over 7,000 LGBT U.S. military members. The group administrators placed monthly advertisements describing the study on the group's main forum. Those interested could click on a link to access an online study disclosure form with a 'click to consent' procedure. An option to provide an e-mail address that was not linked to survey responses was offered to participants who opted to receive $5 compensation for questionnaire completion. The study was approved by the Yale University Institutional Review Board.

To collect and quantify respondent preference data, an adaptive choice-based conjoint (ACBC) survey instrument was developed based on a review of the literature and in-depth input from PrEP experts and U.S. military MSM.(2-5, 10, 11, 13, 14, 26-35).(36-38) With a focus on modifiable PrEP program characteristics, the final survey design was composed of five different PrEP program delivery attributes of interest that included: **dosing method** (*daily pill, on-demand pill regimen [two pills before sex, one*

pill for two days after], rectal douche [before sex], injection [every 2 months], implant [once a year]), **provider type** (*military, civilian*), **visit location** (*on-base, off-base, smartphone app*), **dispensing venue** (*on-base, off-base, mail delivery*), and **lab evaluation** (*on-base, off-base, home-based mail kit*). The survey was piloted with 11 members within the targeted social media group for concept testing, and the descriptions and wording of three attribute categories and two attribute level choices were revised for clarification based on feedback. Additionally, we collected demographical data to include age, race, ethnicity, rank type (officer, enlisted or warrant officer), military branch, geographic region, PHQ2(39) and HIRI-MSM risk score,(40) as well as measures to explore levels of disclosure discomfort and anticipated stigma within interactions with a health care provider.

ANALYSIS

The final survey instrument was loaded into Lighthouse Studio 9, and an experimental design module was used to pre-test the design with 500 simulated respondents for optimal choice task configuration. The final design produced a survey where each level within an attribute was seen at least three times per respondent; achieving a high degree of precision at the individual level with a standard of error of <0.03 and all efficiencies reporting at 1.00.(41)

Table 1 displays the CONSORT diagram of respondent enrollment and exclusion. To ensure the integrity of the data and eliminate random or duplicate responders, security features within the Sawtooth software and servers recognize returning study participants through the use of internet browser cookies and IP addresses. It also prevents repeated or duplicate attempts to retake the survey.(42) Additionally, as extensive pilot testing

required at least 10 to 15 minutes, responses completed in less than 10 minutes (or if a respondent selected the same answer for all items) were excluded. Also, the root likelihood (RLH) fit statistic for each respondent was analyzed to evaluate within-respondent choice consistency. RLH, which has a probability value from 0 to 1.0, was used to discriminate between respondents who answered choice-questions consistently or randomly.(43) The survey design was tested by 1,000 computer-generated mock respondents to determine the median RLH for 'random responders' at the 95% percentile (0.5178 RLH). Survey respondents with an RLH below this score were excluded, as the inclusion of 'random responders' can affect the calculation of preference scores and participation rates.(43)

For conjoint analyses, the Hierarchical Bayes (HB) procedure was used to estimate part-worth utility scores (PWUS) on an individual level for its accuracy and efficiency,(44, 45) and was used to analyze the PWUS of the aggregated sample across all 16 attribute levels. The resulting PWUS of the levels under each attribute category are zero-centered; meaning that the sum of the level scores under each attribute category equal to zero. Scores that are further away from zero (0) indicate a stronger positive or negative preference for the level choice in relation to the other level choices under the same attribute.(38, 41, 45) After identifying each attribute level PWUS, the attribute relative importance scores (RIS) can then be calculated to characterize the magnitude of influence that each attribute category has on the respondents preference decision-making. The RIS for this study was calculated by dividing the range of PWUS for levels under each attribute by the sum of the ranges, and then multiplying by 100.(46, 47) Therefore, if an attribute RIS is 45%, then this means that 45% of an individual's decision making

for product engagement will be influenced by preferences within that attribute category. The PWUS were then used to predict the rate of participation among eight hypothetical PrEP program scenarios. PrEP program scenarios were configured after a variety of currently available or currently feasible PrEP program models, as well as best- and worst-case scenarios based on the highest and lowest PWUS among the attribute levels. For the aggregate sample, participation rates for these PrEP scenarios were generated using the randomized first choice model; in which PWUS are summed across the levels corresponding to each option, and then exponentiated and rescaled, so they sum to 100.(46, 47) This approach is based on the assumption that respondents or consumers will prefer a product with the highest composite utility (or value) adjusting for both attribute and program variability.(46) The randomized choice model accounts for variation in each participant's total utility for each option and error in point estimates of the utility, and has been shown to have better predictive ability than other shares of preference models.(47) All data analyses were performed using XLSTAT and Sawtooth Lighthouse Studio 9.0.

RESULTS

Participants. Table 2 shows the descriptive statistics of the 429 respondents that met the required elapsed survey time and RLH consistency cut-off. Overall, mean age was 30 years old, 96.7% identified as cis-gendered male (2.6% identified as trans-female, and 0.7% identified as trans-male), 72% were white, 72.5% were of non-Hispanic ethnicity, 46.4% were of officer rank, 54.1% had at least a bachelor's degree or above, and 48.7% were within the U.S. Army branch. Overall, 62.7% screened positive for

depressive symptoms, 89.3% were defined as having a high objective risk for acquiring HIV,(40) and 83.0% reported condomless receptive anal sex within the prior six months.

In interactions with their primary care provider (PCP), 36.8% were "somewhat-" or "extremely" uncomfortable with talking about sex with their PCP, 48.1% were "somewhat" or "very" fearful of being judged by their PCP for their gay/MSM identity, and 45.2% were fearful for becoming mistreated by their PCP for their gay/MSM identity as well. Furthermore, 64.1% of respondents found it "somewhat" or "very" important that their PCP affirms or show interest in the participant's sexual identity concerning their care, and 78.4% of members found it important that their PCP provides a high degree of medication decision-making autonomy for taking PrEP.

Table 3 shows the relative importance scores (RIS) of the five attributes, and Table 4 shows the part-worth utility scores (zero-centered) for each attribute level. For this study, the *dosing method* was the most critical attribute among the participants with a relative importance score (RIS) of 45.2%; suggesting that the participant's decision-making process to participate in a PrEP program is most influenced by the level choice within the *dosing method* attribute. For *dosing method*, a daily pill was the most preferred option, although the bi-monthly PrEP injection and yearly implant were also preferred to a slightly lesser degree. The on-demand pill regimen and before-sex rectal PrEP douche were less preferred within the aggregate sample.

The *provider type* attribute was the second most important attribute to respondents, although to a much lesser degree at 15.8% (RIS). Looking at level within this attribute, there was a higher preference for a military than a civilian healthcare provider. The *PrEP visit location* attribute was the third most important attribute

(RIS=14.5%). Respondents preferred to have a virtual medical visit through a smartphone app or on-base location more than an off-base visit location the most. For the *laboratory evaluation location* attribute (RIS=13.4%), participants preferred to provide specimens for assays to initiate or continue PrEP on-base rather than a location off-base, or through a self-collected, home-based mail-in kit. *PrEP dispensing venue* had the least influence on participants' decision-making (RIS=11.0%), with participants preferring to receive or pick-up their PrEP medication on-base over a mail delivery service or a location off-base.

We utilized the randomized first choice model to estimate the participation interest rate that individuals would have towards a variety of hypothetical PrEP program configurations.(47) For this study, the relative importance and part-worth utility scores were used to construct eight PrEP program scenarios for currently available or feasible PrEP program models (Scenarios 1 through 5), and hypothetical PrEP program models for dosing methods still in development at the time of the survey (i.e., PrEP injection, implant, rectal douche) (Scenarios 6 through 8).

Table 4 describes the eight PrEP program scenarios and displays the rates of participation interest across the individual PrEP program configurations. These same eight scenarios are also referenced in Tables 5 and 6.

Scenario 1 and 2 represent on-base military PrEP delivery. Scenario 1 (Standard Military Daily Pill) best represents the current state of an on-base, daily pill PrEP program within the military healthcare system today; scoring a total participation rate of 66.4% for the aggregate sample. Scenario 2 (Standard Military Daily Pill + Smartphone) utilized the smartphone app option within the current daily pill military PrEP program; resulting in a 3% increase in projected participation to a total of 69.6%.

Scenario 3 (Best Case Military On-Demand) introduces an on-demand pill regimen within a best-case military setting (military provider, smartphone app visit, on-base location for lab work, and on-base location to receive PrEP medication); resulting in a 67.6% participation rate. Scenario 4 (Military Home-Based PrEP) is a distance-based program configured for military members whose personal or work-related circumstances compel the individual to see a military provider via a smartphone app and mail-delivery options; resulting in a participation rate of 65.2% among the total sample.

Scenario 5 (Standard Civilian Daily Pill) was configured to represent a civilian-equivalent, off-base, daily pill PrEP program that circumvents the military and on-base aspects of a PrEP program; with 57.7% of the aggregate sample interested in such a program.

Scenarios 6 through 8 (Best Case Military Injection, Best Case Military Implant, Best Case Military Rectal Douche, respectively) are hypothetical scenarios that utilize conceptual PrEP dosing methods currently in development.(10, 14) By presenting each of these dosing methods within a best-case delivery scenario (military provider, smartphone app visit, on-base location for lab work, and on-base location to receive medication), respondents reported a higher participation rate of 69.6% for Scenario 6 (Best Case Military Injection) and 68.5% for Scenario 7 (Best Case Military Implant). Conversely, Scenario 8 (Best Case Military Rectal Douche) scored the lowest participation rate of all scenarios at 51.6%.

DISCUSSION

The significant findings from this study reveal that respondents prefer the convenience of daily pill PrEP services on-base over civilian and off-base settings, yet

also indicate a priority to address MSM-specific needs in the context of their care. Despite an overall willingness to disclose same-sex activity, almost half of respondents were fearful of being judged or mistreated by their PCP for their gay/MSM identity. Additionally, over half of the respondents had a positive screening score for depressive symptoms, and the majority of members engage in risk behaviors that categorize them as having a high risk for acquiring HIV. With a growing body of literature suggesting a link between depression and sexual risk behaviors among MSM,(48-50) it may be beneficial for healthcare providers to provide PrEP clinics that are sensitive and inclusive to sexual identity and to remain vigilant to address factors related to mental and sexual health. Also important to members is valuing a high level of medication decision-making autonomy for taking PrEP. Thus, healthcare providers' efforts to offer military members with the necessary information and support about PrEP medication, without pressuring the member into making a specific choice, may enhance the interaction experience for an individual seeking PrEP within the military healthcare setting.

Results of the conjoint experiment found the *dosing method* attribute to be the most critical and influential preference factor within a PrEP delivery program. The strong preference for a daily pill (and when available, the PrEP injection and PrEP implant) suggests that a demand remains for alternative short and long-acting PrEP methods within this population. The apparent benefit to long-acting agents is that it lifts the burden of a daily pill from a user; an advantage for an individual with adherence concerns or an unpredictable work schedule. Military service's expeditionary nature often entails military members to relocate, deploy, or miss regular follow-up appointments due to specific duties.(51, 52) Therefore, the availability of alternative PrEP modalities that can

sustain a protective level of medication with fewer, longer medication administrations may be an attractive component for members interested in PrEP. While not as important as the dosing methods, respondents additionally preferred seeing a military provider, interacting through a smartphone telehealth visit, and utilizing on-base locations for laboratory evaluation and medication pick-up.

A preference to see a military provider for PrEP services remains prevalent among the total sample; suggesting that it is the military healthcare provider that will be central to the success of a military PrEP program. In a survey of military health care providers regarding PrEP knowledge and prescription habits, 49% of them rated their knowledge as poor and only 29% had ever prescribed it. Additionally, 60% of members received their PrEP prescription after seeing an infectious disease specialist;(2) suggesting that military primary care providers may not feel comfortable prescribing PrEP or may be referring members to specialists for PrEP services. Therefore, supporting primary care providers with the necessary training and resources to comfortably prescribe PrEP may help members engage in services; particularly since it's been shown that an increase in PrEP knowledge has been associated with an increase in prescribing habits.(53)

This study has limitations. First, this study utilized self-report measures from a convenience sample recruited from an online social media group comprised of U.S. military members who identify as LGBT. While there was no way to verify actual eligibility for inclusion/exclusion criteria due to the anonymous nature of the survey, the literature examining MSM recruitment via online methods versus in-person had found similar samples of HIV/STI prevalence and HIV-testing patterns among MSM.(54, 55)

However, these findings may not be generalizable to at-risk military members who do not identify as being MSM or LGBT. Additionally, while quantifying preferences does not guarantee intention or ultimately behavior, it can be an innovative first step and provide a foundation to successfully inform PrEP initiatives.

CONCLUSION

This study provides an initial description of the preferences and interest for PrEP by U.S. military service members with a high risk of acquiring HIV. Our results indicate that PrEP interest among this population is most likely to be successful when PrEP is offered as a daily pill, injection, or implant, with a medical visit performed with a military healthcare provider through a telehealth smartphone app. Additionally, allowing on-base locations to provide laboratory samples and to receive PrEP medication can also facilitate program preference. PrEP engagement will further be enhanced by ensuring that medical providers and facilities are knowledgeable and comfortable prescribing PrEP services. Offering an affirming environment sensitive to health care concerns related to mental and sexual health will also be important, as well as provide participants the decision autonomy to take PrEP without pressure. Consequently, key populations, stakeholders, and policymakers will be better equipped for scale-up of PrEP among at-risk populations within the U.S. military.

ACKNOWLEDGEMENTS

The authors would like to acknowledge Carmen Portillo and Nancy R. Reynolds for their contributions to this manuscript. Research reported in this publication was supported by F31 grant number 1F31NR018620-01A1 by the National Institute of Nursing Research (NINR).

LIST OF ABBREVIATIONS

PrEP (Pre-exposure prophylaxis), MSM (men who have sex with men), HIV (human immunodeficiency virus), LGBT (lesbian, gay, bi & transgender), HB (Hierarchical Bayes), ACBC (adaptive choice-based conjoint), PHQ2 (Patient Health Questionnaire-2), HIRI-MSM (HIV Incidence Risk Index for men who have sex with men), CONSORT (Consolidated Standards of Reporting Trials), IP (internet protocol), RLH (root likelihood), PWUS (part-worth utility scores), RIS (relative importance score), PCP (primary care provider)

DECLARATIONS

ETHICS APPROVAL & CONSENT TO PARTICIPATE. The study was approved by the Yale University Institutional Review Board (IRB Protocol ID: 2000024612). Social media group administrators placed monthly advertisement links describing the study on the group's main forum. Interested participants could click on a link to access an online study disclosure form with a 'click to consent' procedure.

CONSENT FOR PUBLICATION. Not applicable.

AVAILABILITY OF DATA & MATERIALS. The datasets used and/or analyzed during the current study are available from the corresponding author on reasonable request.

COMPETING INTERESTS. The authors declare that they have no competing interests.

FUNDING. Research reported in this publication was supported by the National Institute of Nursing Research (NINR), under award number 1F31NR018620-01A1. Its contents are solely the responsibility of the authors and do not necessarily represent the official view of NIH.

AUTHORS CONTRIBUTIONS. JG, AD, and FA analyzed and interpreted the preference data regarding PrEP delivery program preferences, as well as demographical descriptive statistics. JG and DV were major contributors in writing the manuscript. All authors read and approved the final manuscript.

ACKNOWLEDGEMENTS. The authors would like to acknowledge Carmen Portillo and Nancy R. Reynolds for their contributions to this manuscript.

REFERENCES

1. Armed Forces Health Surveillance B. Update: Routine screening for antibodies to human immunodeficiency virus, civilian applicants for U.S. military service and U.S. Armed Forces, active and reserve components, January 2013-June 2018. MSMR. 2018;25(9):2-8.
2. Blaylock JM, Hakre S, Okulicz JF, Garges E, Wilson K, Lay J, et al. HIV Preexposure Prophylaxis in the U.S. Military Services - 2014-2016. MMWR Morb Mortal Wkly Rep. 2018;67(20):569-74.
3. Hakre S, Scoville SL, Pacha LA, Peel SA, Kim JH, Michael NL, et al. Brief Report: Sexual Risk Behaviors of HIV Seroconverters in the US Army, 2012-2014. J Acquir Immune Defic Syndr. 2015;70(4):456-61.
4. Patterson SB, Rivera D, Sunil TS, Okulicz JF. Evaluation of extragenital screening for gonorrhea and chlamydia in HIV-infected active duty Air Force members. MSMR. 2014;21(11):7-9.
5. Hakre S, Mydlarz DG, Dawson P, Danaher PJ, Gould PL, Witkop CT, et al. Epidemiology of HIV among US Air Force Military Personnel, 1996-2011. PLoS One. 2015;10(5):e0126700.
6. Thigpen MC, Kebaabetswe PM, Paxton LA, Smith DK, Rose CE, Segolodi TM, et al. Antiretroviral preexposure prophylaxis for heterosexual HIV transmission in Botswana. N Engl J Med. 2012;367(5):423-34.
7. 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.
8. Choopanya K, Martin M, Suntharasamai P, Sangkum U, Mock PA, Leethochawalit M, 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. Lancet. 2013;381(9883):2083-90.
9. Baeten JM, Donnell D, Ndase P, Mugo NR, Campbell JD, Wangisi J, et al. Antiretroviral prophylaxis for HIV prevention in heterosexual men and women. N Engl J Med. 2012;367(5):399-410.
10. Lykins WR, Luecke E, Johengen D, van der Straten A, Desai TA. Long acting systemic HIV pre-exposure prophylaxis: an examination of the field. Drug Deliv Transl Res. 2017;7(6):805-16.
11. Molina JM, Charreau I, Spire B, Cotte L, Chas J, Capitant C, et al. Efficacy, safety, and effect on sexual behaviour of on-demand pre-exposure prophylaxis for HIV in men who have sex with men: an observational cohort study. Lancet HIV. 2017;4(9):e402-e10.
12. Antoni G, Tremblay C, Delaugerre C, Charreau I, Cua E, Rojas Castro D, et al. On-demand pre-exposure prophylaxis with tenofovir disoproxil fumarate plus emtricitabine among men who have sex with men with less frequent sexual intercourse: a post-hoc analysis of the ANRS IPERGAY trial. Lancet HIV. 2020;7(2):e113-e20.
13. Pines HA, Gorbach PM, Weiss RE, Hess K, Murphy R, Saunders T, et al. Acceptability of potential rectal microbicide delivery systems for HIV prevention: a randomized crossover trial. AIDS Behav. 2013;17(3):1002-15.

14. Hendrix CW. HIV Antiretroviral Pre-Exposure Prophylaxis: Development Challenges and Pipeline Promise. Clin Pharmacol Ther. 2018;104(6):1082-97.
15. Dubov A, Fraenkel L, Yorick R, Ogunbajo A, Altice FL. Strategies to Implement Pre-exposure Prophylaxis with Men Who Have Sex with Men in Ukraine. AIDS Behav. 2018;22(4):1100-12.
16. Dubov A, Ogunbajo A, Altice FL, Fraenkel L. Optimizing access to PrEP based on MSM preferences: results of a discrete choice experiment. AIDS Care. 2018:1-9.
17. Touger R, Wood BR. A Review of Telehealth Innovations for HIV Pre-Exposure Prophylaxis (PrEP). Current HIV/AIDS Reports. 2019;16(1):113-9.
18. Swift JK, Callahan JL. The Impact of Client Treatment Preferences on Outcome: A Meta-Analysis. J Clin Psychol. 2009;65(4):368-81.
19. Adamson SJ, Bland JM, Hay EM, Johnson RE, Jones GT, Kitchener H, et al. Patients' preferences within randomised trials: systematic review and patient level meta-analysis. Bmj-Brit Med J. 2008;337.
20. Graff FS, Morgan TJ, Epstein EE, McCrady BS, Cook SM, Jensen NK, et al. Engagement and Retention in Outpatient Alcoholism Treatment for Women. Am J Addiction. 2009;18(4):277-88.
21. Ryan M, Farrar S. Using conjoint analysis to elicit preferences for health care. BMJ. 2000;320(7248):1530-3.
22. Phillips KA, Maddala T, Johnson FR. Measuring preferences for health care interventions using conjoint analysis: an application to HIV testing. Health Serv Res. 2002;37(6):1681-705.
23. Viney R, Lancsar E, Louviere J. Discrete choice experiments to measure consumer preferences for health and healthcare. Expert Rev Pharmacoecon Outcomes Res. 2002;2(4):319-26.
24. Lancsar E, Louviere J. Conducting discrete choice experiments to inform healthcare decision making: a user's guide. Pharmacoeconomics. 2008;26(8):661-77.
25. Opuni M, Bishai D, Gray GE, McIntyre JA, Martinson NA. Preferences for characteristics of antiretroviral therapy provision in Johannesburg, South Africa: results of a conjoint analysis. AIDS Behav. 2010;14(4):807-15.
26. Anderson CW, Smith HR. Stigma and honor: Gay, lesbian, and bisexual people in the US military. Homosexual issues in the workplace. 1993:65-89.
27. Biddix JM, Fogel CI, Perry Black B. Comfort levels of active duty gay/bisexual male service members in the military healthcare system. Mil Med. 2013;178(12):1335-40.
28. Russell TG. An examination of stigma in the military. 2013.
29. Lloyd J, Papworth E, Grant L, Beyrer C, Baral S. Systematic review and meta-analysis of HIV prevalence among men in militaries in low income and middle income countries. Sex Transm Infect. 2014;90(5):382-7.
30. Hakre S, Blaylock JM, Dawson P, Beckett C, Garges EC, Michael NL, et al. Knowledge, attitudes, and beliefs about HIV pre-exposure prophylaxis among US Air Force Health Care Providers. Medicine (Baltimore). 2016;95(32):e4511.
31. Galea JT, Kinsler JJ, Salazar X, Lee SJ, Giron M, Sayles JN, et al. Acceptability of pre-exposure prophylaxis as an HIV prevention strategy: barriers and

facilitators to pre-exposure prophylaxis uptake among at-risk Peruvian populations. Int J STD AIDS. 2011;22(5):256-62.
32. Eisingerich AB, Wheelock A, Gomez GB, Garnett GP, Dybul MR, Piot PK. Attitudes and acceptance of oral and parenteral HIV preexposure prophylaxis among potential user groups: a multinational study. PLoS One. 2012;7(1):e28238.
33. 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.
34. Shrestha R, Karki P, Altice FL, Dubov O, Fraenkel L, Huedo-Medina T, et al. Measuring Acceptability and Preferences for Implementation of Pre-Exposure Prophylaxis (PrEP) Using Conjoint Analysis: An Application to Primary HIV Prevention Among High Risk Drug Users. AIDS and behavior. 2018;22(4):1228-38.
35. Shrestha R, Altice F, Karki P, Copenhaver M. Developing an Integrated, Brief Biobehavioral HIV Prevention Intervention for High-Risk Drug Users in Treatment: The Process and Outcome of Formative Research. Front Immunol. 2017;8:561.
36. Toubia O, Hauser J, Garcia R. Probabilistic Polyhedral Methods for Adaptive Choice-Based Conjoint Analysis: Theory and Application. Marketing Science. 2007;26(5):596-610.
37. Chapman C, Alford J, Johnson C, Weidemann R, Lahav M. CBC vs. ACBC: comparing results with real product selection. Sawtooth Software Conference Proceedings, Sequim, WA. 2009.
38. Cunningham CE, Deal K, Chen Y. Adaptive choice-based conjoint analysis: a new patient-centered approach to the assessment of health service preferences. Patient. 2010;3(4):257-73.
39. Lowe B, Kroenke K, Grafe K. Detecting and monitoring depression with a two-item questionnaire (PHQ-2). J Psychosom Res. 2005;58(2):163-71.
40. Wilton J, Kain T, Fowler S, Hart TA, Grennan T, Maxwell J, et al. Use of an HIV-risk screening tool to identify optimal candidates for PrEP scale-up among men who have sex with men in Toronto, Canada: disconnect between objective and subjective HIV risk. J Int AIDS Soc. 2016;19(1):20777.
41. Software S. Lighthouse Studio v9.0 (Formerly SSIWeb). Orem, UT: Sawtooth Software; 2016.
42. Software S. Hosting Security Information 2018 [Available from: https://www.sawtoothsoftware.com/88-services/hosting/1457-hosting-security-information.
43. Orme B. Consistency Cutoffs to Identify "Bad" Respondents in CBC, ACBC, and MaxDiff. Sawtooth Software Research Paper Series. 2019.
44. Lenk P, Desarbo W, Green P, Young M. Hierarchical Bayes Conjoint Analysis: Recovery of Partworth Heterogeneity from Reduced Experimental Designs. Marketing Science. 1996;15:173-91.
45. Rao V. Applied Conjoint Analysis2013. 1-389 p.
46. Herrmann A, Gustafsson A, Huber F. Conjoint Measurement: Methods and Applications. University of StGallen. 2007.

47. Orme B. Getting Started with Conjoint Analysis: Strategies for Product Design and Pricing Research. Second Edition ed. Madison, Wis.: Research Publishers LLC; 2010.
48. Millar BM, Starks TJ, Grov C, Parsons JT. Sexual Risk-Taking in HIV-Negative Gay and Bisexual Men Increases with Depression: Results from a U.S. National Study. AIDS Behav. 2017;21(6):1665-75.
49. Fendrich M, Avci O, Johnson TP, Mackesy-Amiti ME. Depression, substance use and HIV risk in a probability sample of men who have sex with men. Addictive Behaviors. 2013;38(3):1715-8.
50. Parsons JT, Grov C, Golub SA. Sexual Compulsivity, Co-Occurring Psychosocial Health Problems, and HIV Risk Among Gay and Bisexual Men: Further Evidence of a Syndemic. American Journal of Public Health. 2012;102(1):156-62.
51. Gleason JL, Beck KH. Examining Associations Between Relocation, Continuity of Care, and Patient Satisfaction in Military Spouses. Military Medicine. 2017;182(5-6):e1657-e64.
52. Brown RA, Marshall GN, Breslau J, Farris C, Osilla KC, Pincus HA, et al. Access to Behavioral Health Care for Geographically Remote Service Members and Dependents in the U.S. Rand Health Q. 2015;5(1):21-.
53. Blumenthal J, Jain S, Krakower D, Sun X, Young J, Mayer K, et al. Knowledge is Power! Increased Provider Knowledge Scores Regarding Pre-exposure Prophylaxis (PrEP) are Associated with Higher Rates of PrEP Prescription and Future Intent to Prescribe PrEP. AIDS and behavior. 2015;19(5):802-10.
54. Hernandez-Romieu AC, Sullivan PS, Sanchez TH, Kelley CF, Peterson JL, Del Rio C, et al. The comparability of men who have sex with men recruited from venue-time-space sampling and facebook: a cohort study. JMIR Res Protoc. 2014;3(3):e37.
55. Grov C, Westmoreland D, Rendina HJ, Nash D. Seeing Is Believing? Unique Capabilities of Internet-Only Studies as a Tool for Implementation Research on HIV Prevention for Men Who Have Sex With Men: A Review of Studies and Methodological Considerations. J Acquir Immune Defic Syndr. 2019;82 Suppl 3:S253-S60.
56. Whooley MA, Avins AL, Miranda J, Browner WS. Case-finding instruments for depression. Two questions are as good as many. J Gen Intern Med. 1997;12(7):439-45.

APPENDIX

Table 1. Consort diagram for participant enrollment and exclusion, and part-worth utility scores (PWUS) of total sample with omitted responses due to RLH included.

Enrollment

1238 completed survey responses

Exclusion

Demographics Ineligibility (*n*=351)[1]
- Cis-gendered women (*n*=139)
- HIV-positive (*n*=66)
- No MSM activity (*n*=72)
- Service impossibility[2] (*n*=74)

Data Quality Parameters (*n*=458)
- Below 95th percentile RLH (*n*=432)
- Below 10-minute survey time completion (*n*=26)

429 total completed responses included

Total Sample PWUS with omitted responses due to RLH[3]

Attribute/Levels	PWUS
Dosing Method	
Daily pill	10.2
PrEP injection	11.2
PrEP implant	-3.6
On-demand	9.1
Rectal douche	-26.9
Provider Type	
Military	3.8
Civilian	-3.8
PrEP Visit Location	
Smartphone	3.2
On-base	4.5
Off-base	-7.8
Lab Evaluation	
On-base	15.0
Off-base	-5.9
Mail-in kit	-9.1
Dispensing Venue	
On-base	11.2
Off-base	-2.0
By mail	-9.2
NONE[4]	-25.2

Notes:
1: Inclusion criteria demographics were assessed twice; at consent screen for eligibility, and again after conjoint experiment.
2: Omitted responses indicated a service impossibility, such as self-identifying as an Air Force warrant officer (does not exist)
3: PWUS calculated using omitted respondents due to RLH cut-off to examine differences in scores.
4: Increase in *NONE* utility score (up from -57.7), indicating that including the omitted responses with low RLH scores into the final sample affects the computation of PrEP participation rates calculated using the *NONE* utility score.

Table 2. Characteristics of the participants in the aggregate sample (N=429)

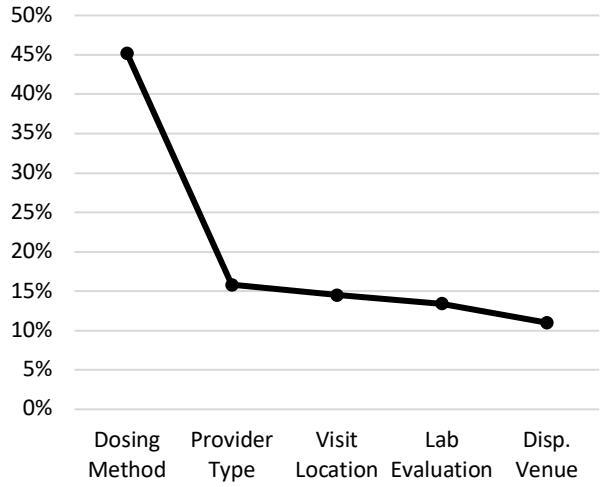
Variable	*Frequency*	*%*	*Variable*	*Frequency*	*%*
Age: Mean (±SD)	29.9 (4.7)		*Condom Use with Casual Male Partner*		
Gender			Every time	46	10.7
Male	415	96.7	Often	156	36.4
Trans Female	11	2.6	Sometimes	127	29.6
Trans Male	3	0.7	Rarely	66	15.4
Sexual Identity: Mean (±SD)[a]	7.0 (2.7)		Never	10	2.3
Race			No regular partner	24	5.6
White	309	72.0	*# of Condom-less Receptive Anal Sex the Past 6 Months*		
Black	78	18.2	None	69	16.1
All Other Race	42	9.8	About once/month or less	249	58.0
Ethnicity			About once/week or more	111	25.9
Hispanic	118	27.5	*Comfort Level Discussing Sex with PCP*		
Non-Hispanic	311	72.5	Extremely Uncomfortable	37	8.6
Rank			Somewhat Uncomfortable	121	28.2
Enlisted	161	37.5	Mostly Comfortable	209	48.7
Officer	199	46.4	Extremely Comfortable	62	14.5
Warrant	69	16.1	*How Fearful of PCP Judging You for being MSM?*		
Education			Very Fearful	62	14.5
High School	28	6.5	Somewhat Fearful	144	33.6
AD or Some College	169	39.4	Slightly Fearful	148	34.5
Bachelor's Degree	188	43.8	Not At All Fearful	75	17.5
Graduate/Prof Degree	44	10.3	*How Fearful of PCP Mistreating You for being MSM?*		
Military Branch			Very Fearful	79	18.4
Air Force	65	15.2	Somewhat Fearful	115	26.8
Army	209	48.7	Slightly Fearful	160	37.3
Coast Guard	49	11.4	Not At All Fearful	75	17.5
Marine Corps	48	11.2	*Decision Support Autonomy by PCP*		
Navy	58	13.5	Not Important	4	0.9
Region of Station[b]			Slightly Important	89	20.7
Midwest	55	12.8	Somewhat Important	183	42.7
Northeast	79	18.4	Very Important	153	35.7
Southeast	121	28.2	*Sexual Identity Affirmation by PCP*		
Southwest	40	9.3	Not Important	24	5.6
West	129	30.1	Slightly Important	130	30.3
Other/OCONUS	5	1.2	Somewhat Important	199	46.4
Location Type of Station			Very Important	76	17.7
Remote	33	7.7	*Depression PHQ Screening*[c]		
Rural	77	17.9	>=1	269	62.7
Suburban	150	35.0	=0	160	37.3
Urban/City	169	39.4	*HIRI-MSM Risk Score*[d]		
Condom Use with Regular Male Partner			>=10	383	89.3
Every time	51	11.9	<10	46	10.7
Often	144	33.6			
Sometimes	111	25.9			
Rarely	68	15.9			

Table 2. Characteristics of the participants in the aggregate sample (N=429)					
Variable	*Frequency*	*%*	*Variable*	*Frequency*	*%*
Never	35	8.2			
No regular male partner	20	4.7			

Notes:
a: 1-10 range (1=straight/heterosexual, 5=bisexual, 10=gay/homosexual)
b: States within the U.S. Midwest (IA, IL, IN, KS, MI, MN, MO, ND, NE, OH, SD, WI), Northeast (CT, DC, DE, MA, MD, ME, NH, NJ, NY, PA, RI, VT), Southeast (AL, AR, FL, GA, KY, LA, MS, NC, SC, TN, VA, WV), Southwest (AZ, NM, OK, TX), West (AK, CA, CO, HI, ID, MT, NV, OR, UT, WA, WY), Other/OCONUS (overseas, out of country)
c: Yes/No PHQ2 Version. Scores >=1 positive screen(56)
d: 1-47 range. Scores >=10 defined as high risk for HIV(40)

Table 3. Relative importance scores (RIS) of PrEP attributes for the total sample (*N*=429) in decreasing order of preference

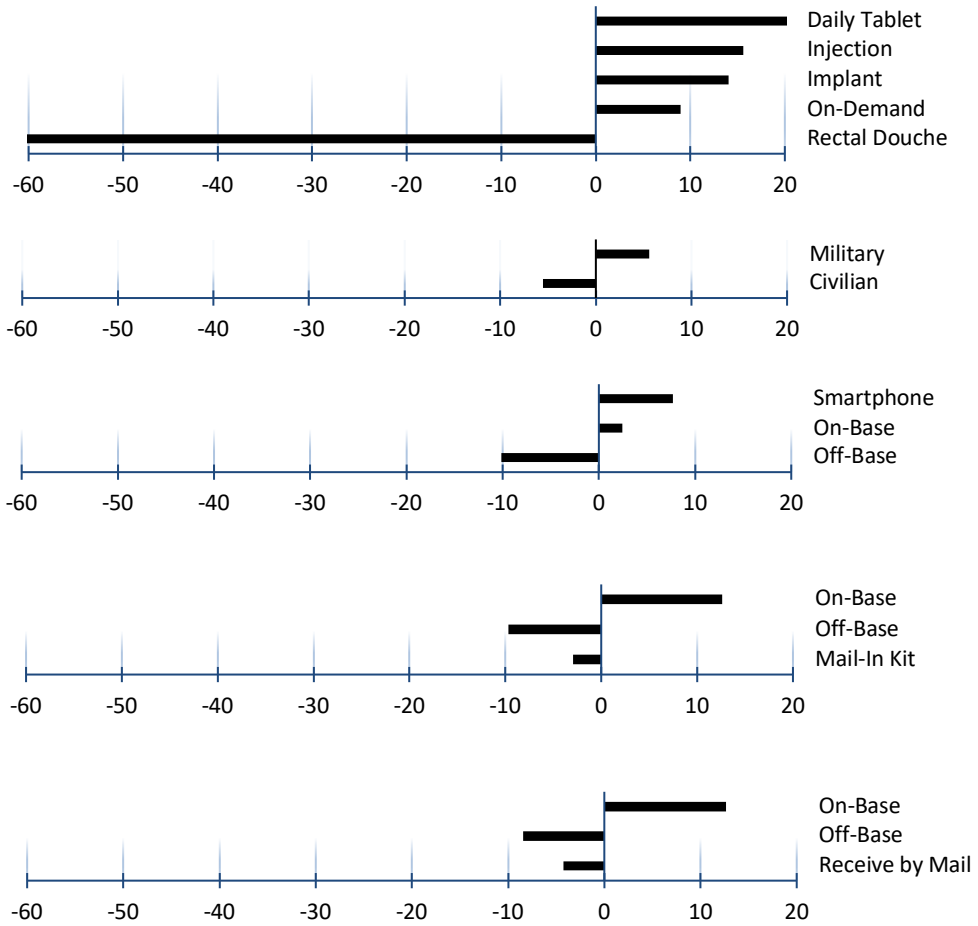
Attributes	Attribute RIS (%)	Standard Deviations
Dosing Method	45.2%	16.5
Provider Type	15.8%	11.5
PrEP Visit Location	14.5%	7.7
Lab Evaluation Location	13.4%	7.6
PrEP Dispensing Venue	11.0%	6.2



Notes: Relative importance scores reflect the influence that each attribute has on a participant's decision-making (standardized to sum 100%).

Table 4. Part-worth utilities (zero-centered values) of PrEP program level choices of participants in the aggregate sample (*N*=429)

Attributes and Levels	Part-Worth Utilities (zero-centered)[e]
Dosing Method	
Daily pill	21.75
PrEP injection	15.58
PrEP implant	14.05
On-demand regimen	8.99
PrEP rectal douche	-60.37
Provider Type	
Military	5.55
Civilian	-5.55
PrEP Visit Location	
Smartphone	7.69
On-Base	2.45
Off-Base	-10.13
Lab Evaluation Location	
Provide labs on-base	12.65
Provide labs off-base	-9.68
Home-based mail-in kit	-2.97
PrEP Dispensing Venue	
Receive PrEP on-base	12.66
Receive PrEP off-base	-8.42
Receive PrEP by mail	-4.23
NONE[f]	*-54.7*



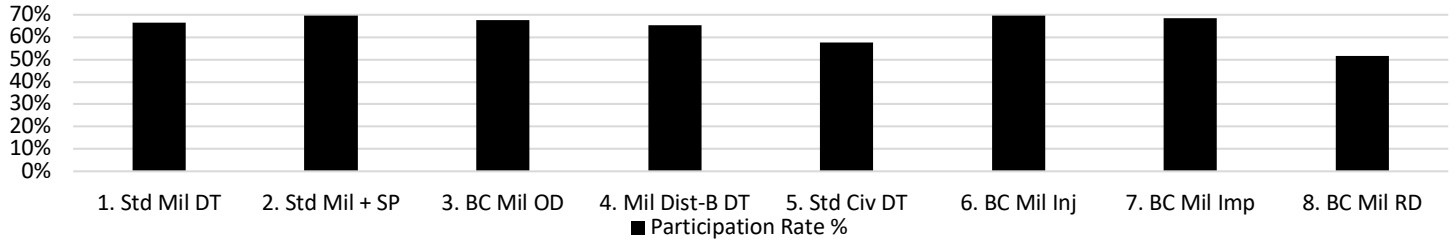
Notes:

e: Zero-centered part-worth utility scores imply the positive or negative magnitude of the participant's preference for the level choice in relation to the other level options within the same attribute.

f: The "None" parameter represents the positive or negative magnitude in which a respondent is likely to select "None" (not willing to take PrEP in any scenario despite program configuration)

Table 5. Individual Program Preferences. Acceptability (mean) of individual PrEP scenarios with different attributes among participants (*N*=429).*

		PrEP Attributes & Levels				
PrEP Scenario	Participation Interest %	*Dosing Method*	*Provider Type*	*Visit Location*	*Lab Evaluation*	*Dispensing Venue*
1: Standard Military Daily Pill	**66.4%**	Daily Pill	Military	On-base	On-base	On-base
2: Standard Military + Smartphone	**69.6%**	Daily Pill	Military	Smartphone	On-base	On-base
3: Best Case Military On-Demand	**67.6%**	On-Demand	Military	Smartphone	On-base	On-base
4: Military Home-Based PrEP	**65.2%**	Daily Pill	Military	Smartphone	Home kit	Mail Delivery
5: Standard Civilian Daily Pill	**57.7%**	Daily Pill	Civilian	Off-base	Off-base	Off-base
6: Best Case Military Injection	**69.6%**	Injection	Military	Smartphone	On-base	On-base
7: Best Case Military Implant	**68.5%**	PrEP Implant	Military	Smartphone	On-base	On-base
8: Best Case Military Rectal Douche	**51.6%**	Rectal Douche	Military	Smartphone	On-base	On-base



Notes:
***1**: Standard (Std) Military (Mil) Daily Pill (DP), **2**: Standard Military + Smartphone (SP), **3**: Standard Civilian (Civ) Daily Pill, **4**: Best Case (BC) Military On-Demand (OD), **5**: Military Home-Based (Home B) PrEP, **6**: Best Case Military Injection (Inj), **7**: Best Case Military Implant (Imp), **8**: Best Case Military Rectal Douche (RD)