



Published in final edited form as:

Arch Sex Behav. 2018 October ; 47(7): 2123–2133. doi:10.1007/s10508-017-1083-5.

Are Anal Sex Roles Associated with Preferences for Pre-Exposure Prophylaxis Administration Modalities Among Men Who Have Sex with Men

William C. Goedel¹, John A. Schneider, MD, MPH², H. Rhodes Hambrick, BS¹, Noah T. Kreski, BA¹, Jace G. Morganstern, MS¹, Su Hyun Park, PhD, MPH¹, Ofole Mgbako, MD^{1,3}, and Dustin T. Duncan, ScD¹

¹Spatial Epidemiology Lab, Department of Population Health, School of Medicine, New York University, New York, New York

²Departments of Medicine and Public Health Sciences, School of Medicine, University of Chicago, Chicago, Illinois

³Residency Program in Internal Medicine, Department of Medicine, School of Medicine, New York University, New York, New York

Abstract

The current study sought to examine awareness of, willingness to use, and preferences for available and theoretical administration modalities for HIV pre-exposure prophylaxis (PrEP) and the association of anal sex roles with these concepts among a sample of men who have sex with men (MSM) in Paris, France. Broadcast advertisements were placed on a popular geosocial-networking smartphone application for MSM to direct users to complete a web-based survey. MSM answered questions on their recent engagement in condomless anal intercourse and awareness of and willingness to use PrEP in the form of once daily and event-driven pill regimens, long-acting injections, and penile and rectal microbicides as well as sexual roles. Multinomial regression models were fit to assess the association between behaviorally-classified anal sexual role and preferences for one of these biomedical prevention modalities. A total of 482 HIV-uninfected MSM completed the survey, 48.1% of whom engaged in some form of condomless anal intercourse (CAI) in the preceding three months. Most respondents (85.3%) had heard of once daily PrEP, but fewer respondents had heard of other prevention strategies. Assuming equal effectiveness, long-acting injections were the most commonly preferred (21.8%). Behaviorally-defined “bottom” and “versatile” MSM more frequently preferred long-acting injections (32.9% of “bottoms” and 25.3% of “versatiles”). The development of long-acting injections to deliver antiretroviral drugs and topical microbicides may offer more convenient and acceptable options for

Address Correspondence to: William C. Goedel (william.goedel@nyu.edu), New York University School of Medicine, Department of Population Health, Spatial Epidemiology Lab, 227 East 30th Street, 6th Floor, New York, New York 10016. Phone: (646) 501-2715.
Compliance with Ethical Standards

Ethical Approval: All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards.

Informed Consent: Informed Consent was obtained from all individuals included in the study.

HIV prevention among MSM, as MSM in this sample were willing to use them and would prefer to use them over currently available pill regimens.

Keywords

Men Who Have Sex with Men; Pre-Exposure Prophylaxis; Gay Men's Health

INTRODUCTION

The HIV epidemic remains a pressing public health crisis among gay, bisexual, and other men who have sex with men (MSM) internationally (Beyrer et al., 2012). Male-to-male sexual contact remains the predominant mode of HIV transmission across numerous regions, including Western Europe, with reported HIV prevalence among MSM ranging from 0.5% to 17.7% among Western European nations (European Centre for Disease Prevention and Control, 2015). The highest prevalence estimates have been reported in France (17.7%), Spain (13.1%), Greece (12.7%), and Germany (11.5%) (European Centre for Disease Prevention and Control, 2015). These countries have seen a gradual rise in HIV incidence among MSM (Beyrer et al., 2012). In France, for example, MSM are estimated to represent only 3.9% of the male population (Marcus, Hickson, Weatherburn, & Schmidt, 2013), but accounted for 36.3% of all new infections among men in 2015 (European Centre for Disease Prevention and Control, 2016). Between 2003 and 2014, the number of new infections in France declined in nearly all transmission risk groups except for MSM (J.M. Molina, 2016).

The development of HIV pre-exposure prophylaxis (PrEP), comprised of emtricitabine and tenofovir disoproxil fumarate (FTC-TDF) as a daily pill, represents a breakthrough in biomedical prevention of HIV infection (Grant et al., 2010; McCormack et al., 2016; J. M. Molina et al., 2015). The efficacy of PrEP in preventing HIV infection among MSM was shown in the global iPrEx trials (Grant et al., 2010) and in the PROUD trial based in the United Kingdom (McCormack et al., 2016). More specifically, the iPrEx trials showed that, when taken daily, PrEP is efficacious in reducing the risk of HIV acquisition by 92% compared to a placebo (Grant et al., 2010), and the PROUD trial confirmed these findings, showing a relative risk reduction of 86% among those who were provided daily PrEP immediately compared to those in a waitlist control group (McCormack et al., 2016). In addition, the French-based IPERGAY trial demonstrated efficacy for an intermittent dosing regimen, where individuals took a loading dose of two pills anywhere from 2 to 24 hours before a sexual encounter, one pill 24 hours after the loading dose, and a fourth pill 24 hours after that (J. M. Molina et al., 2015). This dosing regimen reduced the risk of HIV acquisition by 86% compared to a placebo (J. M. Molina et al., 2015). PrEP became widely available for use in France in January 2016 and is available in both daily and so-called "on-demand" or "event-driven" dosing regimens (J.-M. Molina, 2016). In the first six months of implementation, 1,077 persons began receiving PrEP; most of whom (96.4%) were MSM and most of whom (65.2%) took PrEP in the on-demand dosing regimen (J.M. Molina, 2016). This number is expected to rise with increased capacity of sites to deliver PrEP and increased awareness of its availability among at-risk populations.

However, concerns regarding short- and long-term side effects (Okwundu & Okoromah, 2012), high costs associated with engagement in PrEP-related medical care (Gomez et al., 2013), potential stigma surrounding PrEP use (Calabrese & Underhill, 2015), and difficulties with adherence (Grant et al., 2014) remain significant barriers to the uptake of PrEP. Given these barriers, it may be beneficial to develop new strategies to deliver antiretroviral drugs, including long-acting injectable formulations and topical microbicides, as these administration modalities may confer protection for longer periods of time that is not dependent on an individual's ability to take a pill (in the case of injectable formulations) or could be incorporated into products already used for anal intercourse (in the case of topical microbicides). Many of these prevention strategies are currently being developed and their efficacy is being tested. Currently, the HIV Prevention Trial Network (HPTN) Protocol #83 is enrolling at-risk MSM and transgender women in eight countries in a Phase 2B/3 trial to test the efficacy of a long-acting cabotegravir-containing injection (McGowan, 2015) and Microbicide Trial Network (MTN) Protocol #035 is being developed as a Phase 2A trial to evaluate the safety and pharmacokinetics of rectal dapivirine gel among MSM and transgender women (McGowan, 2014).

Many studies have shown that many MSM across contexts are aware that PrEP is available as an option for HIV prevention, with estimates ranging from 23% (Eaton, Driffin, Bauermeister, Smith, & Conway-Washington, 2015) to 85% (Goedel, Halkits, Greene, & Duncan, 2016), and many are willing to use PrEP, with estimates from many studies ranging from 28% (Holt et al., 2012) to 80% (Brooks, Landovitz, Kaplan, Lee, & Barkley, 2012). However, high levels of awareness and willingness to use PrEP have not translated into high levels of adoption (Rendina, Whitfield, Grov, Starks, & Parsons, 2017). Few studies have examined willingness to use and preferences among these other biomedical strategies in MSM in the United States and Western Europe and no studies have been conducted in France. Among a convenience sample of MSM in Spain ($n = 866$), 76.8% were willing to use PrEP if it were a monthly injection and 70.1% were willing to use PrEP if it were a pill taken before sex, compared to 41.2% who were willing to use PrEP if it were a daily pill (Ferrer et al., 2016). Among a sample of MSM recruited from Facebook and Twitter in the Netherlands ($n = 108$), 60.8% preferred a topical rectal microbicide used before and after anal intercourse compared to only 20.3% who preferred to use PrEP as a daily pill taken orally (Marra & Hankins, 2015).

Sociological, psychological, and public health studies have documented that many MSM may self-identify by their penetrative or receptive role in anal intercourse (Moskowitz & Hart, 2011; Wegesin & Meyer-Bahlburg, 2000; Wei & Raymond, 2011). These self-identifications are hereby referred to as anal sex roles, where men who prefer to be exclusively receptive during anal intercourse self-identify as 'bottoms,' men who prefer to be exclusively penetrative during anal intercourse self-identify as 'tops,' and men without preference for either role during anal intercourse self-identify as 'versatiles' (Moskowitz & Hart, 2011). It has been suggested that dominance and submissiveness are potential correlates of these self-identifications, where some research has found that "tops" report being more dominant and "bottoms" report being more submissive (Gil, 2007; Moskowitz, Rieger, & Roloff, 2008), but other studies have suggested that these assertions may be inconsistent and rely almost entirely on the dynamics between sexual partners (Kippax &

Smith, 2001). Nonetheless, previous research has documented high levels of concordance between these self-identifications and enacted behaviors (Moskowitz & Hart, 2011). Few studies have examined differences in acceptability of various HIV prevention strategies by these roles, with one study among a sample of 206 MSM in New York City finding no association between anal sex role and willingness to use PrEP (Groves, Whitfield, Rendina, Ventuneac, & Parsons, 2015). However, given that some MSM engage in anal intercourse with and without condoms in specific roles depending on their HIV status and the HIV status of their partner to reduce their risk of acquiring or transmitting HIV (Parsons et al., 2005), it is likely that MSM may expressed different preferences and levels of willingness to use PrEP and other biomedical prevention strategies based on these anal sex roles.

As such, the objective of the current study was to examine awareness of and willingness to use these various prevention strategies among a sample of MSM in Paris, France. Given that the HIV epidemic continues to disproportionately affect MSM in France and in many other countries, understanding preferences for biomedical HIV prevention strategies and the sexual behaviors and preferences contributing to ongoing sexual transmission of the virus is essential in developing effective strategies to prevent transmission. As a secondary aim, we explore associations between behaviorally-defined anal sex role and preferences for these prevention strategies, as these may reflect differences in perceived risk for HIV infection and perceived appropriateness of biomedical HIV prevention strategies. Understanding this association may inform the creation of customized prevention packages that can be used to empower individuals to choose risk reduction strategies that fit their behaviors and needs.

METHODS

Sample Recruitment

Potential participants were recruited utilizing broadcast advertisements placed on a popular geosocial-networking smartphone application for MSM in Paris, France. These advertisements, written in both French and English, were presented to users of this application over the course of three consecutive 24-hour periods in October 2016. Users were presented with the advertisement at their first login during each of the three periods. It is possible that users viewed this advertisement three times, so precautions were taken to prevent duplicate responses. As done in previous research with online surveys of MSM who use geosocial-networking smartphone applications (Goedel, Halkits, Greene, Hickson, & Duncan, 2016), the 'Prevent Ballot Box Stuffing' feature on Qualtrics was utilized to prevent users from responding to the survey more than one time on the same device. In addition, all responses were reviewed at the completion of the advertising period to identify responses with duplicate IP addresses. Responses with duplicated IP addresses were to be removed, but not were apparent. In English, the advertisement read, "Looking to improve your health and the health of those in your community? Share your thoughts with us on gay and bisexual men's health and have a chance to win €5! Click more to get started!" After clicking the advertisement, users were directed to landing page where they provided informed consent and began an online survey with 52 items.

Respondents were given the option of completing the survey in either French or English. The survey was first composed in English and translated into French using the translate,

review, adjudicate, pretest, and document (TRAPD) model (Harkness, 2005). First, three native French speakers completed individual forward translations of the initial English version of the survey and these translations were then compared and integrated into a single version by a fourth French speaker. A fifth French speaker then back-translated the survey into English to test it for accuracy. Most users (93.4%) took the survey in French. In the 72-hour recruitment, 5,206 users clicked through the advertisement and reached the survey's landing page, 935 users began the survey, and 580 users completed the survey, representing a response rate of 11.1%. The survey took, on average, 11.4 minutes (Standard Deviation [SD]: 4.0) to complete. All protocols were approved by the [Blinded for Review] Institutional Review Board prior to data collection.

Measures

Recent Condomless Anal Intercourse—Participants were asked, “In the past three months, with how many partners have you engaged in anal intercourse without a condom as the insertive partner?” and “In the past three months, with how many partners have you engaged in anal intercourse with a condom as the receptive partner?” The responses to these two items were then used to first create a binary variable to reflect any engagement in condomless anal intercourse and no condomless anal intercourse and then create a categorical variable to reflect a behaviorally-defined anal sex role: engagement in condomless anal intercourse as the insertive (“top”) partner only; engagement in condomless anal intercourse as the receptive (“bottom”) partner only; and engagement in condomless anal intercourse as both the insertive and receptive partner (“versatile”). The value of the second variable was set to missing for individuals who did not engage in condomless anal intercourse during the recall period.

Use of Daily Oral Pre-Exposure Prophylaxis—Respondents were given the following description of once daily PrEP, previously used among a sample of MSM in the United States (Goedel, Halkits, Greene, Hickson, et al., 2016), “Pre-exposure prophylaxis (PrEP) is a new prescription medication that can be taken by an HIV-negative person to protect against HIV. It is sometimes referred to by the brand name Truvada. Currently, it is available in the form of a pill taken once every day.” Participants were asked if they had ever heard of once daily PrEP to prevent HIV infection before taking the survey. Participants were also then asked if they had ever taken PrEP and if they were currently taking PrEP. Those who reported never taking PrEP were given the following statement, “Once daily PrEP has been shown to be at least 90% effective in preventing HIV when taken daily,” and then asked, “How likely would you be to take this form of PrEP in the future?” Respondents answered this item on a five point Likert scale ranging from “Very unlikely” (1) to “Very likely” (5).

Use of Event-Driven Pre-Exposure Prophylaxis—Respondents were given the following description of event-driven PrEP, adapted from a description used among MSM in the United States (Parsons, Rendina, Whitfield, & Grov, 2016), “Scientists are testing the effectiveness of taking PrEP based on when someone has sex. Users of this type of PrEP would not need to take it when they are not having sex. It would involve taking four pills – two pills taken within 24 hours before sexual activity and two separate one-pill doses within two days after sex. Scientists believe that this can work similarly to daily PrEP to prevent

HIV. This is called ‘event-driven PrEP.’ It currently available only in France.” Participants were asked if they had ever heard of event-driven PrEP before taking the survey. Participants were then given the following statement, “Suppose that event-driven PrEP is at least 90% effective in preventing HIV when used as described previously” and then asked, “How likely would you be to take this form of PrEP in the future?” Respondents answered this item on a Likert scale ranging from “Very unlikely” (1) to “Very likely” (5).

Use of Long-Acting Injectable Pre-Exposure Prophylaxis—Respondents were given the following description of long-acting injectable PrEP, used previously among a sample of MSM in the United States (Parsons et al., 2016), “Scientists are also working to make a different kind of PrEP that would not require taking a pill every day. Instead, it would involve getting an injecting once a month and would not require a daily pill. Scientists believe that this new injection could work similarly to daily oral PrEP to prevent HIV, but conclusive results have not yet been obtained. This is called ‘long-acting injectable PrEP.’” Participants were asked if they had ever heard of long-acting injectable PrEP before taking the survey. Participants were then given the following statement, “Suppose that long-acting injectable PrEP is at least 90% effective in preventing HIV when injected every month, and then asked, “How likely would you be to take this form of PrEP in the future?” Respondents answered this item on a Likert scale ranging from “Very unlikely” (1) to “Very likely” (5).

Use of Topical Microbicides—Respondents were given the following description of topical microbicides, adapted from a description used among a sample of MSM in the United States (Parsons et al., 2016), “Microbicides are products that are applied directly to the penis or the rectum prior to sex to prevent the transmission of HIV. They come in the form of a gel, cream, or suppository. A number of these products are currently being tested around the world to see if they are effective.” Participants were asked if they had ever heard of microbicides before taking the survey. Participants were then given the following statements “Suppose a microbicide was at least 90% effective in preventing HIV as a gel applied to the penis,” and “Suppose a microbicide was at least 90% effective in preventing HIV as a gel applied to the rectum,” and then asked, “How likely would you be to use it the future?” for both rectal and penile microbicides respectively. Respondents answered these items on a Likert scales ranging from “Very unlikely” (1) to “Very likely” (5).

Preferences for Pre-Exposure Prophylaxis Administration Modalities—

Respondents were then asked, “Given the choice between these different forms of prevention, which would you prefer to use?” with the following answer choices: once daily PrEP, event-driven PrEP, long-acting injectable PrEP, microbicide applied to the penis, microbicide applied to the rectum, whichever form is most effective, I have no preference, and none of these prevention strategies.” In multinomial logistic regression models, “None of these prevention strategies” was used as the reference category.

Demographic Characteristics—Participants were asked to report their age (in years) and was considered a continuous variable in all analyses. Participants also reported whether they were born in France (yes, no), their sexual orientation (gay, bisexual, straight, other), employment status (employed, unemployed, student, retired), and their current relationship

status (single, relationship with a man, relationship with a woman). A dichotomous variable for sexual orientation was created to indicate gay identity and non-gay-identity (created by combining “bisexual,” “straight,” and “other”). A dichotomous variable for employed status was created to indicate current employment or enrollment in school (created by combining the “employed” and “student” response options) or current unemployment or retirement (created by combining the “unemployed” and “retired response options). A dichotomous variable for relationship was created to indicate single status or a current relationship (created by combining with “relationship with a man” and “relationship with a woman” response options).

Data Analysis

All analyses were conducted in Stata Version 13.0 (StataCorp, College Station, Texas). First, descriptive statistics were calculated for all study variables. Next, binary logistic regression models were fit to assess the association between engagement in condomless anal intercourse and awareness of each of the administration modalities, adjusted for all demographics. Third, multinomial logistic regression models were fit to assess the association between engagement in condomless anal intercourse and willingness to use each of the administration modalities. For each model related to willingness to use each of the administration modalities, response options were collapsed into three categories – willing (created by combining the “willing” and “very willing” responses), undecided, and unwilling (created by combining the “unwilling” and “very unwilling” responses). Last, a single multinomial logistic regression model was fit to assess the association between engagement in condomless anal intercourse and preferences for the administration modalities. These models were used to estimate relative risk ratios (RRRs) and 95% confidence intervals (CI). All demographic variables were included in these models as covariates. Any analyses were followed-up with a chi-square test of independence assessing the association between the anal sex role variable and the outcome to assess differences between “top” MSM, “bottom” MSM, and “versatile” MSM.

RESULTS

Sample Demographics

A total of $n = 580$ respondents completed the survey. The analytical sample was restricted to $n = 482$ participants after removing $n = 58$ participants who self-reported their HIV status as positive, given the focus of the current analyses on HIV prevention, and $n = 19$ participants who were missing responses to either item assessing condomless insertive or receptive anal intercourse, as these participants could not be classified with a behaviorally-defined anal sex role. In addition, participants were also excluded if they were missing any data on their preference for any of the biomedical prevention strategies ($n = 2$), their awareness of any of the modalities ($n = 7$), their willingness to use any of the modalities ($n = 6$), or any of the demographic covariates ($n = 7$).

The demographics of the analytical sample are reported in Table 1. The average age in the sample was 34.9 years (SD: 9.9), where 64.9% of respondents were 30 years or older. Most respondents (85.9%) identified as gay; 12.2% identified as bisexual. Most respondents

(80.1%) were born in France. Most participants were either employed (69.3%) or enrolled as a student (14.9%). About two-thirds of respondents (69.1%) reported being single.

Recent Condomless Anal Intercourse

Approximately one-half of the sample (51.9%) did not engage in any form of condomless anal intercourse in the preceding three months. Among those who engaged in condomless anal intercourse in the preceding three months ($n = 232$), 39.2% reported being both the insertive and receptive partner, 24.1% reported being the insertive partner only, and 36.6% reported being the receptive partner only. Among those who engaged in condomless insertive anal intercourse ($n = 147$), the median number of partners was 2.00 (Interquartile Range [IQR]: 2.00). Among those who engaged in condomless receptive anal intercourse ($n = 176$), the median number of partners was 1.00 (IQR: 2.00).

Awareness of Pre-Exposure Prophylaxis Administration Modalities

The results of multivariate analyses of awareness of four antiretroviral medication administration modalities are displayed in Table 2. Most participants (85.3%) had heard of once daily PrEP. Non-gay-identified participants were less likely to have ever heard of once daily PrEP (Odds Ratio [OR]: 0.520; 95% Confidence Interval [CI]: 0.272, 0.994). About one-half of the sample (47.1%) had heard of event-driven PrEP. Few participants had heard of long-acting injectable PrEP (7.0%). Few participants had heard of topical microbicides (8.9%). Participants born outside of France were less likely to be aware of topical microbicides (OR: 0.275; 95% CI: 0.083, 0.915). Participants who engaged in condomless anal intercourse were no more likely to have ever heard of once daily PrEP, event-driven PrEP, long-acting injectable PrEP, or topical microbicides.

Lifetime and Current Use of Pre-Exposure Prophylaxis

A small percentage of respondents reported ever using PrEP (9.5%) or currently using PrEP (6.4%). The results of logistic regression models assessing the association between anal sexual role and lifetime and current PrEP use are not displayed. “Tops” (OR: 6.740; 95% CI: 2.494, 18.209) and “versatile” participants (OR: 8.458; 95% CI: 3.560, 20.093) were more likely to have ever used PrEP. In addition, “tops” (OR: 10.560; 95% CI: 2.488, 44.821) and “versatile” participants (OR: 1.917; 95% CI: 5.388, 68.237) were more likely to be current PrEP users.

Willingness to Use Pre-Exposure Prophylaxis Administration Modalities

The results of multinomial logistic regression models assessing the association between anal sexual role and willingness to use each of the five antiretroviral medication administration modalities. Among those who had never used PrEP ($n = 436$), 32.1% rated themselves as willing or very willing to take a once daily pill as PrEP. About one-half of respondents (46.1%) rated themselves as willing or very willing to use event-driven PrEP. Overall, 44.4% rated themselves as willing or very willing to use a long-acting injection as PrEP. One-half of respondents (50.8%) rated themselves as willing or very willing to use a microbicide applied to the penis. More than one-half of respondents (55.0%) rated themselves as willing or very willing to use a microbicide applied to the rectum.

Participants who engaged in condomless anal intercourse were more likely to report being willing or very willing to use once daily PrEP (OR: 4.098, 95% CI: 2.567, 6.542), event-driven PrEP (OR: 1.820, 95% CI: 1.185, 2.793), long-acting injectable PrEP (OR: 2.291, 95% CI: 1.462, 3.589), penile microbicides (OR: 1.750, 95% CI: 1.115, 2.745), and rectal microbicides (OR: 2.170, 95% CI: 1.383, 3.402). There were significant differences in willingness to use long-acting injectable PrEP ($p = .031$), where “bottoms” (60.0%) and “versatile” MSM (60.4%) more commonly reported being willing or very willing to use long-acting injectable PrEP compared to “tops” (35.7%).

Preferences for Pre-Exposure Prophylaxis Administration Methods

The results of the multinomial logistic regression assessing the association of anal sex role with preferences for antiretroviral medication administration modalities are displayed in Table 4. Overall, 4.8% expressed a preference for a once daily pill over all other prevention strategies. Overall, 11.0% expressed a preference for event-driven pills over all other prevention strategies. Overall, 21.8% expressed a preference for a long-acting injection over all other strategies. Overall, 8.3% expressed a preference for a penile microbicide over all other strategies and 6.6% expressed a preference for a rectal microbicide over all other strategies. About one-third (31.7%) expressed a preference for whichever form is most effective; 4.2% had no preference; and 11.6% preferred none of these prevention strategies.

There were no significant differences in preferences based on engagement in condomless anal intercourse. However, there were significant differences in preferences for each of the prevention modalities ($p = .004$), where “tops” were more likely to have selected a penile microbicide (19.6% of “tops”); “bottoms” were more likely to select long-acting injectable PrEP (32.9% of “bottoms”); and “versatile” MSM were more likely to select long-acting injectable PrEP (25.3% of “versatile” MSM).

DISCUSSION

Respondents in this sample of MSM in Paris, France recruited from a popular geosocial-networking smartphone application are willing to use a wide range of PrEP administration modalities, including once daily and event-driven pill regimens, long-acting injections, and topical microbicides. The most commonly preferred of the five prevention modalities was a long-acting injection administered once every month. The preference for long-acting injections over other forms of prevention may be related to lower burden placed on the user for adherence (Landovitz, Kofron, & McCauley, 2016), as pill regimens can require a user to remember to take a pill every day (in the case of once daily dosing) or require an individual to accurately predict when they will have sex and take pills before and after sex (in the case of event-driven dosing) (Lorente et al., 2012; Volk et al., 2012). While long-acting injectable forms of PrEP may overcome some of these barriers related to adherence, issues related to retention in care and adherence to injection schedules may arise and will require further study (Landovitz et al., 2016). If long-acting injectable PrEP formulation prove efficacious, future studies are warranted to understand potential barriers to their uptake and to develop appropriate models of service delivery. The findings regarding likelihood of use of these hypothetical prevention strategies should be interpreted with caution. In the cause of daily

oral PrEP, high levels of willingness to use PrEP have not translated into high rates of adoption and adherence (Rendina et al., 2017). In addition, as these new formulations are developed and found to be efficacious, patterns of willingness to use them may change depending on cost and availability of these prevention modalities (GroV, Rendina, Whitfield, Ventuneac, & Parsons, 2016). For example, individuals may be less willing to use a long-acting injectable formulation if the initial cost of the injection and the associated office visit is high or to use a topical microbicide if it is made available with a prescription rather than over-the-counter.

Levels of awareness and willingness to use daily oral PrEP were comparable to those observed among other samples of MSM recruited from geosocial-networking smartphone applications in the United States (Goedel, Halkits, Greene, & Duncan, 2016; Goedel, Halkits, Greene, Hickson, et al., 2016). Levels of awareness of long-acting injectable PrEP were comparable to those observed among an online sample of MSM in the United States (GroV et al., 2016). Levels of willingness to use PrEP in an event-driven regimen and as a long-acting injection were lower in this sample compared to those observed in a convenience sample of MSM in Spain (Ferrer et al., 2016). A preference for rectal microbicides over other forms of PrEP was less common in this sample than was observed among a convenience sample of MSM in the Netherlands (Marra & Hankins, 2015), but similar to findings among an online sample of MSM in the United States (Hall, Heneine, Sanchez, Sineath, & Sullivan, 2016), the highest levels of willingness to use any of the prevention strategies was observed for penile and rectal microbicides compared to other options.

With regards to awareness of these biomedical prevention strategies, non-gay-identified MSM were less likely to have ever heard of daily oral PrEP. Although both populations are sexually active with male partners, gay- and non-gay-identified MSM may differ in their exposure to media targeting MSM (French, Bonell, Weillings, & Weatherburn, 2014). As such, non-gay-identifying MSM may be exposed less frequently to media campaigns promoting PrEP as an HIV prevention option among gay men. Future campaigns should emphasize that PrEP is an effective HIV prevention strategy for all individuals at-risk for HIV infection, regardless of their identity. “Versatile” participants were more likely to have ever heard of daily and event-driven PrEP, the two forms of PrEP available in France, because they were more likely to be current PrEP users at the time of survey administration.

With regard to willingness to use these biomedical prevention strategies, older MSM were less likely to be willing to use daily oral PrEP and less likely to prefer daily oral PrEP, event-driven PrEP, and long-acting injectable PrEP. Previous research has documented generational differences in attitudes towards PrEP among MSM (Calabrese & Underhill, 2015) and it has been suggested that these differences stem from each generation’s experience of the HIV epidemic – older MSM came of age during the height of the HIV epidemic when treatment was unavailable while younger MSM have come of age in times where effective treatment options are available. MSM born outside of France were more likely to be willing to use all of these prevention strategies. This group of respondents may represent individuals who immigrated or traveled to France from countries with high prevalence of HIV infection or where biomedical prevention strategies are unavailable who wish to utilize new prevention strategies. All participants who engaged in condomless anal

intercourse (regardless of anal sex role) were more likely to be willing to use once daily PrEP, suggesting a willingness to use PrEP among all individuals who engage in condomless anal intercourse. “Versatile” participants were more likely to be willing to use all of these prevention strategies. This may be due to an awareness that individuals who engage in both insertive and receptive anal intercourse are at higher risk for HIV infection rather than those who engage in insertive or receptive intercourse only (Varghese, Maher, Peterman, Branson, & Steketee, 2002). “Bottoms” were more likely to be willing to use long-acting injectable and rectal microbicides. In addition, participants in relationships were more likely to prefer event-driven PrEP. For individuals with relation agreements allowing for partners outside of the primary relationship (John, Starks, Rendina, Grov, & Parsons, 2017), event-driven PrEP may provide additional protection in periods of increased risk for HIV infection within the partnership.

Recent sexual behavior patterns were also associated with preferences for specific forms of PrEP administration, demonstrating the need for various forms of biomedical prevention to allow patients and providers to work together to decide which strategies are most suitable for an individual’s risk behaviors and sexual practices. The differences in preferences for specific PrEP administration modalities by behaviorally-defined anal sexual role may reflect differences in the perceived risk of certain sexual behaviors. For example, an individual who engages exclusively in condomless receptive anal intercourse may be aware that their risk of acquiring HIV infection is higher than that of an individual who engages in condomless insertive anal intercourse (Varghese et al., 2002) and therefore, may prefer a prevention strategy that lasts for a longer period of time, like a long-acting injectable formulation, that is less dependent on the user’s behaviors (e.g., pill taking). Qualitative research has suggested that MSM who identify as “bottoms” or engage exclusively in receptive anal intercourse may be less assertive in negotiating safer sex practices (Johns, Pingel, Eisenberg, Santana, & Bauermeister, 2012). While “bottoms” and “versatile” individuals both practice receptive anal intercourse, it is possible that “bottoms” may prefer a discrete long-acting prevention strategy as they may feel less comfortable negotiating other safer sex practices. In contrast, given their flexibility in sexual role, “versatile” individuals may feel more comfortable negotiating the use of other safer sex practices with their sexual partners.

There are several limitations to these findings. First, these data were collected from a convenience of MSM in a single Western European metropolitan area from a single geosocial-networking smartphone application for MSM. As such, these findings may not be generalizable to MSM outside of Western Europe or MSM who do not use these geosocial-networking smartphone applications. The measure of anal sexual role is behaviorally defined based on self-reported engagement in condomless receptive and insertive anal intercourse. It is possible that more individuals would be categorized as behavioral top, bottom, and versatile partners if behaviors with condoms were assessed, which was not assessed in the current survey. However, MSM frequently self-identify with these anal sexual role labels (Hemmige et al., 2011; Wegesin & Meyer-Bahlburg, 2000; Wei & Raymond, 2011). Future research should assess the congruence of self-identification and behavioral classification as a top, bottom, or versatile partner and compare the associations of these identities and behavioral categories with these outcomes (Kapur et al., 2014). In addition, these behavioral classifications are based on reported engagement in condomless insertive and receptive anal

intercourse and there may be some misclassification. Individuals may have also been misclassified as a “top,” “bottom,” or “versatile” if their sexual positioning differs across whether or not condoms are used. In addition, the period used to classify anal sexual roles (3 months) may not reflect broader sexual behavior over longer time periods. In addition, our measures of lifetime and current PrEP use did not distinguish between the two regimens (once daily doses and event-driven doses) that are currently available in France. The survey used in this study assessed awareness of, willingness to use, and preferences for these various biomedical prevention strategies, but does not assess potential concerns related to their uptake. Future research should utilize both qualitative and quantitative methods to understand motivations for using specific prevention strategies over others and begin to examine potential barriers to the adoption of these strategies.

Until a highly effective vaccine against HIV infection is available, novel HIV prevention strategies are needed to stem the ongoing HIV epidemic. The inability to universalize treatment access and viral suppression of HIV-infected individuals worldwide with antiretroviral treatment to minimize their infectivity leave a prevention need for those at risk for acquiring HIV infection (Kilmarx & Mutasa-Apollo, 2013). The use of tenofovir-containing compounds as PrEP has been demonstrated as effective in preventing HIV infection (Grant et al., 2010; McCormack et al., 2016; J. M. Molina et al., 2015), but required levels of adherence to daily or near-daily oral pill regimens is challenging for many populations, including MSM (Liu et al., 2014; Mansergh, Koblin, & Sullivan, 2012). The development of long-acting injections to deliver antiretroviral drugs and topical microbicides may offer greater choices for preventing HIV infection among MSM, as they are willing to use them and would prefer to use these modes of antiretroviral drug delivery over currently available daily and event-driven pill regimens. Strong adherence is needed so that the full benefits of these biomedical prevention strategies can be realized.

Acknowledgments

Funding: This study was funded by [Author’s Name, blinded for peer review] [Author’s Institution, blinded for peer review] start-up research fund.

References

- Beyrer C, Baral SD, Van Griensven F, Goodreau SM, Chariyalertsak S, Wirtz AL, Brookmeyer R. Global epidemiology of HIV infection in men who have sex with me. *The Lancet*. 2012; 380(9839): 367–377. DOI: 10.1016/S0140-6736(12)60821-6
- Brooks RA, Landovitz RJ, Kaplan RL, Lee SJ, Barkley TW. Sexual risk behaviors and acceptability of HIV pre-exposure prophylaxis among HIV-negative gay and bisexual men in serodiscordant relationships: A mixed methods stud. *AIDS Patient Care & STDs*. 2012; 26(2):87–94. DOI: 10.1089/apc.2011.0283 [PubMed: 22149764]
- Calabrese SK, Underhill K. How stigma surrounding the use of HIV preexposure prophylaxis undermines prevention and pleasure: A call to destigmatize “Truvada whores”. *American Journal of Public Health*. 2015; 105(10):1960–1964. DOI: 10.2105/ajph.2015.302816 [PubMed: 26270298]
- Eaton LA, Driffin DD, Bauermeister J, Smith H, Conway-Washington C. Minimal awareness and stalled uptake of pre-exposure prophylaxis (PrEP) among at-risk, HIV-negative, Black men who have sex with me. *AIDS & Behavior*. 2015; 29(8):423–429. DOI: 10.1089/apc.2014.0303
- European Centre for Disease Prevention and Control. Men Who Have Sex with Men: Monitoring Implementation of the Dublin Declaration on Partnership to Fight HIV/AIDS in Europe and Central

- Asia: 2014 Progress Report. Stockholm: European Centre for Disease Prevention and Control; 2015.
- European Centre for Disease Prevention and Control. HIV/AIDS Surveillance in Europe, 2015. Stockholm: European Centre for Disease Prevention and Control; 2016.
- Ferrer L, Folch C, Fernandez-Davila P, Garcia A, Morales A, Belda J, Casabona J. Awareness of pre-exposure prophylaxis for HIV, willingness to use it and potential barriers or facilitators to uptake among men who have sex with men in Spain. *AIDS & Behavior*. 2016; 20(7):1423–1433. DOI: 10.1007/s10461-016-1379-9 [PubMed: 27022938]
- French RS, Bonell C, Weillings K, Weatherburn P. An exploratory review of HIV prevention mass media campaigns targeting men who have sex with men. *BMC Public Health*. 2014; 14(1):616. doi: 10.1186/1471-2458-14-616 [PubMed: 24939013]
- Gil S. A narrative exploration of gay men's sexual practices as a dialectical dialogu. *Sexual and Relationship Therapy*. 2007; 22(1):63–75. DOI: 10.1080/14681990600861057
- Goedel WC, Halkits PN, Greene RE, Duncan DT. Correlates of awareness of and willingness to use pre-exposure prophylaxis (PrEP) in gay, bisexual, and other men who have sex with men who use geosocial-networking smartphone applications in New York City. *AIDS & Behavior*. 2016; 20(7): 1435–1442. DOI: 10.1007/s10461-016-1353-6 [PubMed: 26966013]
- Goedel WC, Halkits PN, Greene RE, Hickson DA, Duncan DT. HIV risk behaviors, perceptions, and testing and preexposure prophylaxis (PrEP) awareness/use in Grindr-using men who have sex with men in Atlanta, Georgia. *Journal of the Association of Nurses in AIDS Care*. 2016; 27(2):133–142. DOI: 10.1016/j.jana.2015.11.005 [PubMed: 26708834]
- Gomez GB, Borquez A, Case KK, Wheelock A, Vassall A, Hankins C. The cost and impact of scaling up pre-exposure prophylaxis for HIV prevention: A systematic review of cost-effectiveness modelling studies. *PLoS Medicine*. 2013; 10(3):e1001401. doi: 10.1371/journal.pmed.1001401 [PubMed: 23554579]
- Grant RM, Anderson PL, McMahan V, Liu A, Amico KR, Mehrotra M, Team, i.S. 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(9):820–829. DOI: 10.1016/S1473-3099(14)70847-3 [PubMed: 25065857]
- Grant RM, Lama JR, Anderson PL, McMahan V, Liu AY, Vargas L, iPrEx Study Team. Preexposure chemoprophylaxis for HIV prevention in men who have sex with men. *New England Journal of Medicine*. 2010; 2010(363):2587–2599. DOI: 10.1056/NEJMoa1011205
- Grov C, Rendina HJ, Whitfield TH, Ventuneac A, Parsons JT. Changes in familiarity with and willingness to take preexposure prophylaxis in a longitudinal study of highly sexually active gay and bisexual men. *LGBT Health*. 2016; 3(4):252–257. DOI: 10.1089/lgbt.2015.0123 [PubMed: 27183232]
- Grov C, Whitfield TH, Rendina HJ, Ventuneac A, Parsons JT. Willingness to take PrEP and potential for risk compensation among highly sexually active gay and bisexual men. *AIDS & Behavior*. 2015; 19(12):2234–2244. DOI: 10.1007/s10461-015-1030-1 [PubMed: 25735243]
- Hall EW, Heneine W, Sanchez T, Sineath RC, Sullivan PS. Preexposure prophylaxis modality preferences among men who have sex with men and use social media in the United States. *Journal of Medical Internet Research*. 2016; 18(5):e111. doi: 10.2196/jmir.5713 [PubMed: 27199100]
- Harkness J. SHARE Translation Procedures and Translation Assessment. In: Börsch-Supan A, Jürges H, editors *The Survey of Health, Aging, and Retirement in Europe – Methodology*. Mannheim: Mannheim Research Institute for the Economics of Aging; 2005. 24
- Hemmige V, Snyder H, Liao C, Mayer K, Lakshmi V, Gandham SR, Schneider J. Sex position, marital status, and HIV risk among Indian men who have sex with men: Clues to optimizing prevention approaches. *AIDS Patient Care & STDs*. 2011; 25(12):725–734. DOI: 10.1089/apc.2011.0079 [PubMed: 21682588]
- Holt M, Murphy DA, Callander D, Ellard J, Rosengarten M, Kippax SC, De Wit JB. Willingness to use HIV pre-exposure prophylaxis and the likelihood of decreased condom use are both associated with unprotected anal intercourse and the perceived likelihood of becoming HIV-positive among Australian gay and bisexual men. *Sexually Transmitted Infections*. 2012; 88(4):258–263. DOI: 10.1136/sextrans-2011-050312 [PubMed: 22290327]

- John SA, Starks TJ, Rendina HJ, Grov C, Parsons JT. Should I convince my partner to go on pre-exposure prophylaxis (PrEP)? The role of personal and relationship factors on PrEP-related social control among gay and bisexual men. *AIDS & Behavior*, In Press. 2017; doi: 10.1007/s10461-017-1835-1
- Johns MM, Pingel E, Eisenberg A, Santana ML, Bauermeister J. Butch tops and femme bottoms? Sexual positioning, sexual decision making, and gender roles among young gay me. *American Journal of Men's Health*. 2012; 6(6):505–518. DOI: 10.1177/1557988312455214
- Kapur A, Schneider JA, Heard D, Mukherjee S, Schumm P, Oruganti G, Laumann EO. A digital network approach to infer sex behavior in emerging HIV epidemic. *PLoS One*. 2014; 9(7):e101416. doi: 10.1371/journal.pone.0101416 [PubMed: 24992340]
- Kilmarx PH, Mutasa-Apollo T. Patching a leaky pipe: The cascade of HIV care. *Current Opinions in HIV/AIDS*. 2013; 8(1):59–64. DOI: 10.1097/COH.0b013e32835b806e
- Kippax SC, Smith G. Anal intercourse and power in sex between me. *Sexualities*. 2001; 4(4):413–434. DOI: 10.1177/136346001004004002
- Landovitz RJ, Kofron R, McCauley M. The promise and pitfalls of long-acting injectable agents for HIV prevention. *Current Opinions in HIV/AIDS*. 2016; 11(1):122–128. DOI: 10.1097/COH.0000000000000219
- Liu A, Cohen S, Follansbee S, Cohan D, Weber S, Sachdev D, Buchbinder S. Early experiences implementing pre-exposure prophylaxis (PrEP) for HIV prevention in San Francisco. *PLoS Medicine*. 2014; 11(3):e1001613. doi: 10.1371/journal.pmed.1001613 [PubMed: 24595035]
- Lorente N, Fugon L, Carrieri MP, Andreo C, Le Gall JM, Cook E, Spire B. Acceptability of an “on-demand” pre-exposure HIV prophylaxis trial among men who have sex with men living in France. *AIDS Care*. 2012; 24(4):468–477. DOI: 10.1080/09540121.2011.626394 [PubMed: 22085083]
- Mansergh G, Koblin BA, Sullivan PS. Challenges for HIV pre-exposure prophylaxis among men who have sex with men in the United States. *PLoS Medicine*. 2012; 9(8):e1001286. doi: 10.1371/journal.pmed.1001286 [PubMed: 22927797]
- Marcus U, Hickson F, Weatherburn P, Schmidt AJ. Estimating the size of the MSM populations for 38 European countries by calculating the survey-surveillance discrepancies (SSD) between self-reported new HIV diagnoses from the European MSM internet survey (EMIS) and surveillance-reported HIV diagnoses among MSM in 200. *BMC Public Health*. 2013; 13(1):919. doi: 10.1186/1471-2458-13-919 [PubMed: 24088198]
- Marra E, Hankins CA. Perceptions among Dutch men who have sex with men and their willingness to use rectal microbicides and oral pre-exposure prophylaxis to reduce HIV risk—a preliminary study. *AIDS Care*. 2015; 27(12):1493–1500. DOI: 10.1080/09540121.2015.1069785 [PubMed: 26695133]
- McCormack S, Dunn DT, Desai M, Dolling DI, Gafos M, Gilson R, Schembri G. Pre-exposure prophylaxis to prevent the acquisition of HIV-1 infection (PROUD): effectiveness results from the pilot phase of a pragmatic open-label randomised trial. *The Lancet*. 2016; 387(10013):53–60. DOI: 10.1016/S0140-6736(15)00056-2
- McGowan I. The development of rectal microbicides for HIV prevention. *Expert Opinions in Drug Delivery*. 2014; 11(1):69–82. DOI: 10.1517/17425247.2013.860132
- McGowan I. Injectable and implantable antiretroviral strategies for HIV prevention. *Future Virology*. 2015; 10(10):1163–1176. DOI: 10.2217/fvl.15.83
- Molina JM. PrEP Roll-Out in France. Paper presented at the World AIDS Conference; Durban, South Africa: 2016.
- Molina JM, Capitant C, Spire B, Pialoux G, Cotte L, Charreau I, ANRS IPERGAY Study Group. On-demand preexposure prophylaxis in men at high risk for HIV-1 infection. *New England Journal of Medicine*. 2015; 373(23):2237–2246. DOI: 10.1056/NEJMoa1506273 [PubMed: 26624850]
- Moskowitz DA, Hart TA. The influence of physical body traits and masculinity on anal sex roles in gay and bisexual men. *Archives of Sexual Behavior*. 2011; 40(4):835–841. DOI: 10.1007/s10508-011-9754-0 [PubMed: 21465269]
- Moskowitz DA, Rieger G, Roloff ME. Tops, bottoms, and versatile. *Sexual and Relationship Therapy*. 2008; 23(3):191–202. DOI: 10.1080/14681990802027259

- Okwundu CI, Okoromah CA. Antiretroviral pre-exposure prophylaxis (PrEP) for preventing HIV in high-risk individuals. *Cochrane Database of Systematic Reviews*. 2012; 11(7):CD007189.doi: 10.1002/14651858.CD007189.pub3
- Parsons JT, Rendina HJ, Whitfield TH, Grov C. Familiarity with and preferences for oral and long-acting injectable HIV pre-exposure prophylaxis (PrEP) in a national sample of gay and bisexual men in the U. *AIDS & Behavior*. 2016; 20(7):1390–1399. DOI: 10.1007/s10461-016-1370-5 [PubMed: 27000145]
- Parsons JT, Schrimshaw EW, Wolitski RJ, Halkits PN, Purcell DW, Hoff CC, Gomez CA. Sexual harm reduction practices of HIV-seropositive gay and bisexual men: Serosorting, strategic positioning, and withdrawal before ejaculatio. *AIDS & Behavior*. 2005; 19(S1):S13–S25. DOI: 10.1097/01.aids.0000167348.15750.9a
- Rendina HJ, Whitfield TH, Grov C, Starks TJ, Parsons JT. Distinguishing hypothetical willingness from behavioral intentions to initiate HIV pre-exposure prophylaxis (PrEP): Findings from a large cohort of gay and bisexual men in the US. *Social Science & Medicine*. 2017; 172(115-123)doi: 10.1016/j.socscimed.2016.10.030
- Varghese B, Maher JE, Peterman TA, Branson BM, Steketee RW. Reducing the risk of sexual HIV transmission: Quantifying the per-act risk for HIV on the basis of choice of partner, sex act, and condom use. *Sexually Transmitted Diseases*. 2002; 29(1):38–43. DOI: 10.1097/00007435-200201000-00007 [PubMed: 11773877]
- Volk JE, Liu A, Vittinghoff E, Irvin R, Krobot E, Krakower D, Buchbinder S. Sexual frequency and planning among at-risk men who have sex with men (MSM) in the US: Implications for event-based intermittent pre-exposure prophylaxis (iPrEP). *Journal of Acquired Immune Deficiency Syndromes*. 2012; 61(1):112.doi: 10.1097/qai.0b013e31825bd87d [PubMed: 22592590]
- Wegesin DJ, Meyer-Bahlburg HF. Top/bottom self-label, anal sex practices, HIV risk and gender role identity in gay men in New York City. *Journal of Psychology & Human Sexuality*. 2000; 12(3):43–62. DOI: 10.1300/j056v12n03_03
- Wei C, Raymond HF. Preference for and maintenance of anal sex roles among men who have sex with men: Sociodemographic and behavioral correlate. *Archives of Sexual Behavior*. 2011; 40(4):829–834. DOI: 10.1007/s10508-010-9623-2 [PubMed: 20464471]

Table 1Sample Demographics, Sample of Men Who Have Sex with Men (MSM) in Paris, France ($n = 482$)

	% (n)
Age	
18 to 24 years old	15.8 (76)
25 to 29 years old	19.3 (93)
30 to 39 years old	31.7 (153)
40 to 49 years old	23.86 (115)
50 years old or older	9.3 (45)
Sexual Orientation	
Gay	85.9 (414)
Bisexual	12.2 (59)
Other	1.9 (9)
Born in France	
Yes	80.1 (386)
No	19.9 (96)
Employment Status	
Employed	69.3 (334)
Unemployed	14.9 (72)
Student	14.9 (72)
Retired	0.8 (4)
Relationship Status	
Single	69.1 (333)
Relationship with Man	29.1 (140)
Relationship with Woman	1.9 (9)

Table 2

Associations of Anal Sex Role with Awareness of Antiretroviral Drug Administration Modalities

	Daily Pre-Exposure Prophylaxis (OR [95% CI])	Event-Driven Pre-Exposure Prophylaxis (OR [95% CI])	Long-Acting Injectable Pre- Exposure Prophylaxis (OR [95% CI])	Topical Microbicides (OR [95% CI])
Age	1.012 (0.986, 1.039)	1.001 (0.983, 1.020)	1.013 (0.978, 1.050)	1.003 (0.971, 1.036)
Sexual Orientation				
Gay-Identified	Reference Category	Reference Category	Reference Category	Reference Category
Non-Gay-Identified	0.495* (0.258, 0.953)	0.645 (0.374, 1.110)	1.531 (0.592, 3.960)	0.540 (0.182, 1.605)
National Origin				
Born in France	Reference Category	Reference Category	Reference Category	Reference Category
Born Outside France	0.697 (0.383, 1.269)	0.709 (0.447, 1.126)	1.310 (0.567, 3.026)	0.277* (0.083, 0.920)
Employment Status				
Employed/Student	Reference Category	Reference Category	Reference Category	Reference Category
Unemployed/Retired	1.244 (0.636, 2.433)	0.877 (0.528, 1.458)	1.591 (0.530, 4.773)	0.741 (0.322, 1.711)
Relationship Status				
Single	Reference Category	Reference Category	Reference Category	Reference Category
In a Relationship	0.804 (0.462, 1.399)	1.126 (0.754, 1.680)	1.337 (0.640, 2.794)	1.231 (0.624, 2.428)
Anal Sexual Role				
No Condomless Sex	Reference Category	Reference Category	Reference Category	Reference Category
“Top”	2.032 (0.755, 5.466)	1.070 (0.593, 1.929)	0.753 (0.211, 2.690)	0.964 (0.345, 2.695)
“Bottom”	1.111 (0.558, 2.215)	1.122 (0.680, 1.852)	1.078 (0.406, 2.864)	0.574 (0.208, 1.589)
“Versatile”	5.490* (1.336, 22.555)	1.940** (1.183, 3.180)	1.363 (0.560, 3.315)	1.259 (0.578, 2.741)

Note:

* $p < .05$;** $p < .01$;*** $p < .001$

Table 3
Associations of Anal Sex Role with Willingness to Use Antiretroviral Drug Administration Modalities

	Daily PrEP (RRR [95% CI])	Event-Driven PrEP (RRR [95% CI])	Long-Acting Injectable PrEP (RRR [95% CI])	Penile Microbicides (RRR [95% CI])	Rectal Microbicides (RRR [95% CI])
Age	0.972* (0.949, 0.996)	0.985 (0.964, 1.007)	0.995 (0.973, 1.018)	1.005 (0.983, 1.028)	0.999 (0.977, 1.021)
Sexual Orientation					
Gay-Identified	Reference Category	Reference Category	Reference Category	Reference Category	Reference Category
Non-Gay-Identified	0.799 (0.406, 1.574)	0.929 (0.495, 1.743)	1.002 (0.516, 1.945)	0.816 (0.436, 1.530)	0.908 (0.484, 1.706)
National Origin					
Born in France	Reference Category	Reference Category	Reference Category	Reference Category	Reference Category
Born Outside France	1.880* (1.056, 3.047)	2.227** (1.261, 3.932)	1.910* (1.086, 3.357)	2.027* (1.139, 3.609)	2.162** (1.220, 3.829)
Employment Status					
Employed/Student	Reference Category	Reference Category	Reference Category	Reference Category	Reference Category
Unemployed/Retired	1.012 (0.513, 1.997)	0.796 (0.421, 1.503)	0.726 (0.374, 1.411)	0.472* (0.238, 0.938)	0.559 (0.291, 1.074)
Relationship Status					
Single	Reference Category	Reference Category	Reference Category	Reference Category	Reference Category
In a Relationship	0.642 (0.381, 1.082)	0.943 (0.591, 1.505)	0.853 (0.522, 1.394)	0.601* (0.374, 0.967)	0.797 (0.496, 1.283)
Current PrEP Use					
No	Reference Category	Reference Category	Reference Category	Reference Category	Reference Category
Yes	Omitted	Omitted	8.268** (1.847, 37.008)	3.624 (0.791, 16.597)	2.494 (0.685, 9.080)
Anal Sexual Role					
No Condomless Sex	Reference Category	Reference Category	Reference Category	Reference Category	Reference Category
“Top”	3.064** (1.396, 6.725)	1.379 (0.691, 2.755)	1.003 (0.488, 2.064)	1.415 (0.697, 2.870)	1.074 (0.552, 2.091)
“Bottom”	3.310*** (1.740, 6.297)	1.325 (0.746, 2.354)	3.496*** (1.834, 6.654)	1.291 (0.713, 2.338)	2.363** (1.262, 4.426)

	Daily PrEP (RRR [95% CI])	Event-Driven PrEP (RRR [95% CI])	Long-Acting Injectable PrEP (RRR [95% CI])	Penile Microbicides (RRR [95% CI])	Rectal Microbicides (RRR [95% CI])
“Versatile”	3.476 *** (1.778, 6.795)	2.023 * (1.076, 3.805)	2.582 ** (1.380, 4.833)	3.045 ** (1.522, 6.090)	3.690 *** (1.829, 7.447)

Note:

* $p < .05$;

** $p < .01$;

*** $p < .001$

Table 4
Associations of Anal Sex Role with Preferences for Antiretroviral Drug Administration Modalities

	Daily PrEP (RRR [95% CI])	Event-Driven PrEP (RRR [95% CI])	Long-Acting Injectable PrEP (RRR [95% CI])	Penile Microbicides (RRR [95% CI])	Rectal Microbicides (RRR [95% CI])
Age	0.944* (0.894, 0.998)	0.951* (0.914, 0.990)	0.953** (0.921, 0.986)	0.980 (0.939, 1.022)	0.987 (0.944, 1.031)
Sexual Orientation	Reference Category	Reference Category	Reference Category	Reference Category	Reference Category
Gay-Identified	Reference Category	Reference Category	Reference Category	Reference Category	Reference Category
Non-Gay-Identified	0.153 (0.017, 1.350)	0.240* (0.061, 0.951)	0.574 (0.222, 1.486)	1.721 (0.644, 4.595)	0.906 (0.272, 3.010)
National Origin	Reference Category	Reference Category	Reference Category	Reference Category	Reference Category
Born in France	Reference Category	Reference Category	Reference Category	Reference Category	Reference Category
Born Outside France	2.419 (0.749, 7.809)	0.867 (0.306, 2.455)	0.900 (0.370, 2.189)	1.055 (0.354, 3.150)	1.079 (0.34, 3.371)
Employment Status	Reference Category	Reference Category	Reference Category	Reference Category	Reference Category
Employed/Student	Reference Category	Reference Category	Reference Category	Reference Category	Reference Category
Unemployed/Retired	0.407 (0.106, 1.562)	0.650 (0.207, 2.043)	1.277 (0.436, 3.736)	0.286* (0.098, 0.834)	0.990 (0.257, 3.808)
Relationship Status	Reference Category	Reference Category	Reference Category	Reference Category	Reference Category
Single	Reference Category	Reference Category	Reference Category	Reference Category	Reference Category
In a Relationship	0.833 (0.251, 2.772)	2.433* (1.051, 5.635)	1.191 (0.553, 2.565)	0.964 (0.363, 2.557)	1.976 (0.762, 5.125)
Current PrEP Use	Reference Category	Reference Category	Reference Category	Reference Category	Reference Category
No	Reference Category	Reference Category	Reference Category	Reference Category	Reference Category
Yes	Reference Category	Reference Category	Reference Category	Reference Category	Reference Category
Anal Sexual Role	Reference Category	Reference Category	Reference Category	Reference Category	Reference Category
No Condomless Sex	Reference Category	Reference Category	Reference Category	Reference Category	Reference Category
“Top”	2.775 (0.681, 11.312)	1.071 (0.327, 3.505)	0.626 (0.207, 1.895)	2.154 (0.716, 6.488)	0.373 (0.068, 2.026)
“Bottom”	1.284 (0.212, 7.769)	1.485 (0.446, 4.944)	3.020* (1.109, 8.224)	1.200 (0.294, 4.892)	2.519 (0.762, 8.322)
“Versatile”	3.674 (0.984, 13.710)	1.830 (0.634, 5.278)	1.578 (0.605, 4.114)	0.880 (0.242, 3.197)	0.516 (0.115, 2.313)

Author Manuscript

Author Manuscript

Author Manuscript

Author Manuscript

Note:
 * $p < .05$;
 ** $p < .01$;
 *** $p < .001$

Due to space limitations, the results for “Whichever is most effective” and “I have no preference” are no displayed. However, we note that there are no significant associations between the abovementioned factors and selecting either of these options.