Published in final edited form as:

Drug Alcohol Depend. 2017 April 01; 173: 107–116. doi:10.1016/j.drugalcdep.2016.12.023.

Correlates of willingness to initiate pre-exposure prophylaxis and anticipation of practicing safer drug- and sex-related behaviors among high-risk drug users on methadone treatment*

Roman Shrestha^{a,b,*}, Pramila Karki^{b,c}, Frederick L. Altice^{b,d}, Tania B. Huedo-Medina^{b,c}, Jaimie P. Meyer^d, Lynn Madden^f, and Michael Copenhaver^{b,c}

^aDepartment of Community Medicine and Health Care, University of Connecticut Health Center, Farmington, CT, USA

^bThe Institute for Collaboration on Health, Intervention, and Policy, University of Connecticut, Storrs, CT, USA

^cDepartment of Allied Health Sciences, University of Connecticut, Storrs, CT, USA

^dDepartment of Internal Medicine, AIDS Program, Yale University School of Medicine, New Haven, CT, USA

^fAPT Foundation, New Haven, CT, USA

Abstract

Background—Although people who use drugs (PWUD) are key populations recommended to receive pre-exposure prophylaxis (PrEP) to prevent HIV, few data are available to guide PrEP delivery in this underserved group. We therefore examined the willingness to initiate PrEP and the anticipation of HIV risk reduction while on PrEP among high-risk PWUD.

Methods—In a cross-sectional study of 400 HIV-negative, opioid dependent persons enrolled in a methadone program and reporting recent risk behaviors, we examined independent correlates of being willing to initiate PrEP.

Results—While only 72 (18%) were aware of PrEP, after being given a description of it, 251 (62.7%) were willing to initiate PrEP. This outcome was associated with having neurocognitive impairment (aOR=3.184, $p=0.004$) and higher perceived HIV risk (aOR=8.044, $p<0.001$). Among

*Supplementary material can be found by accessing the online version of this paper at <http://dx.doi.org> and by entering doi:...

Correspondence: Roman Shrestha, 263 Farmington Avenue, MC 6325, Farmington, CT USA 06030-6325, USA, TELEPHONE: +1.203.781.4690, FACSIMILE: +1.203.781.4606, Roman.Shrestha@UConn.edu.

Conflict of interest

No conflict declared

Contributors

RS, PK, FA, and MC conceptualized and designed the study; RS and PK analyzed the data; RS and PK prepared the first draft; all authors contributed to the interpretation of the data, critically revised the manuscript for important intellectual content, and approved the final manuscript as submitted.

Publisher's Disclaimer: This is a PDF file of an unedited manuscript that has been accepted for publication. As a service to our customers we are providing this early version of the manuscript. The manuscript will undergo copyediting, typesetting, and review of the resulting proof before it is published in its final citable form. Please note that during the production process errors may be discovered which could affect the content, and all legal disclaimers that apply to the journal pertain.

those willing to initiate PrEP, only 12.5% and 28.2%, respectively, indicated that they would always use condoms and not share injection equipment while on PrEP. Consistent condom use was associated with higher income (aOR=8.315, $p=0.016$), always using condoms with casual partners (aOR=6.597, $p=0.001$), and inversely associated with ongoing drug injection (aOR=0.323, $p=0.027$). Consistent safe injection, however, was inversely associated with age (aOR=0.948, $p=0.035$), ongoing drug injection (aOR=0.342, $p<0.001$), and perceived HIV risk (aOR=0.191, $p=0.019$).

Conclusions—While willingness to initiate PrEP was high and correlated with being at elevated risk for HIV, anticipated higher risk behaviors in this group even while on PrEP suggests that the next generation of HIV prevention approaches may need to combine biomedical and behavioral components to sustain HIV risk reduction over time.

Keywords

Pre-Exposure prophylaxis; people who use drugs (PWUD); substance use; methadone maintenance program; HIV prevention; risk compensation

1. Introduction

From the outset of the HIV epidemic, substance use disorders, including the injection of drugs, has fueled HIV transmission and disease progression (Degenhardt et al., 2013; Kamarulzaman and Altice, 2015). Despite people who use drugs (PWUD) contributing less to HIV incidence in the U.S. recently (Centers for Disease Control and Prevention, 2014), they remain a priority population for HIV prevention because of potential HIV transmission associated with preventable drug-related (e.g., needle-sharing) and sex-related (e.g., condomless sex) risk behaviors (Alipour et al., 2013; Marshall et al., 2014; Nadol et al., 2016; Volkow and Montaner, 2011). PWUD are affected by multi-level barriers to treatment and prevention such as stigma, discrimination, and social marginalization, thus posing a formidable challenge to access HIV services (Calabrese et al., 2016; Van Boekel et al., 2013). Failing to effectively intervene with PWUD has resulted in poor individual outcomes and threatens public health by increasing the likelihood continued HIV transmission by PWUD who remain undiagnosed or off treatment with persistent HIV viremia. High-risk PWUD, and the communities in which they live, would greatly benefit from building on existing evidence-based primary HIV prevention interventions and expanding new approaches for HIV prevention.

The recent availability of pre-exposure prophylaxis (PrEP)—the daily self-administration of antiretroviral medication for primary HIV prevention (CDC, 2014)—provides an unprecedented opportunity to curtail the HIV epidemic. Findings from recent PrEP trials have demonstrated that taking PrEP daily significantly reduces HIV transmission among those at substantial risk of acquiring HIV infection, such as men who have sex with men (MSM), people who inject drugs (PWID), sex workers, and transgender people (Baeten et al., 2012; Choopanya et al., 2013; Grant et al., 2010; Thigpen et al., 2012; Van Damme et al., 2012). Consequently, the Centers for Disease Control and Prevention (CDC) recommends PrEP in PWUD and provides clinical practice guidelines on the use of PrEP for HIV prevention (CDC, 2014).

Despite PrEP's efficacy and coverage by insurance in the U.S., uptake by PWUD has been strikingly low (Kirby and Thornber-Dunwell, 2014). A new PrEP cascade (Liu et al., 2012) suggests that PrEP uptake and optimal protective effect requires a high level of user awareness, willingness to initiate, and ability to remain highly adherent to the medication (Peng et al., 2012). Most recent studies that focus on PrEP uptake factors are concentrated on samples of MSM (Ferrer et al., 2016; Goedel et al., 2016; Gredig et al., 2016; Hoagland et al., 2016; Peng et al., 2012; Young et al., 2013), with limited research among high-risk PWUD (Kuo et al., 2016; Stein et al., 2014). For example, Stein et al. (2014) found that 47% of PWUD reported being willing to use PrEP and that a higher perception of HIV susceptibility was associated with an increased willingness to initiate PrEP (Stein et al., 2014). Among older people who inject drugs (PWID), Kuo et al. (2016) found that only 13.4% had ever heard of PrEP and 71% were likely to take PrEP (Kuo et al., 2016). Furthermore, prior studies have not evaluated how people anticipate their risk-related behaviors will change if they start PrEP. The original PrEP trial affirming its efficacy in PWUD was conducted among PWUD enrolled in a methadone maintenance program (MMP) where high-risk individuals are concentrated and readily available for primary HIV prevention (Choopanya et al., 2013). We therefore sought to better understand factors related to PrEP uptake (e.g., knowledge about and willingness to initiate PrEP) in a sample of PWUD in a MMP. Such findings are necessary to guide future implementation of PrEP among high-risk PWUD in the context of common drug treatment settings.

2. Methods

2.1. Participants

Between June and July 2016, a convenience sample of 400 participants was recruited at Connecticut's largest MMP. Screening eligibility included: i.) being 18 years or older, ii.) reporting HIV-uninfected, iii.) reporting drug- or sex-related HIV risk behaviors in the past 6 months, and iv.) being able to understand, speak, and read English. All patients were stabilized on methadone to treat opioid dependence. Among the 438 MMP clients approached, 28 did not meet eligibility criteria and an additional 10 either did not agree to study participation or chose not to complete the entire survey, leaving 400 individuals for the final analytical sample.

2.2. Study setting and procedures

Participants were recruited at the APT Foundation, which provides methadone maintenance treatment to over 7,000 patients in the greater New Haven, Connecticut community. Convenience sampling was used to recruit participants through flyers, peers, word-of-mouth, and direct referral from counselors. Screening was conducted by trained research assistants in a private room at APT Foundation or by phone. Individuals who met inclusion criteria and expressed interest in participating completed informed consent procedures in person and were administered a 45-minute survey (range: 40 – 60 minutes) using an audio computer-assisted self-interview (ACASI). All participants were reimbursed for the time and effort needed to participate in the survey. The study protocol was approved by the Institutional Review Board at the University of Connecticut and received board approval from APT Foundation, Inc.

2.3. Measures

Covariate measures included were based on prior research. In addition to demographic and social characteristics, we assessed health insurance status, visits to health care providers in the past 12 months and current methadone dose. We assessed whether participants were prescribed any medication (other than methadone) in the past 30 days and, for those who were, we assessed medication adherence using a self-reported, validated three-item scale developed by Wilson et al. (2016). Summary scales were calculated as the mean of the three individual items with higher score indicating better adherence (0–100) (Wilson et al., 2016). Neurocognitive impairment (NCI) was measured using the Brief Inventory of Neurocognitive Impairment (BINI), which is a brief, 54-item self-reported measure of neuropsychological symptoms (Copenhaver et al., 2016). The overall BINI score, which was obtained by summing responses to all items, was converted to age-adjusted standardized scores (i.e., z-scores) based on normative data. Participants with an age-adjusted z-score ≥ 0.5 were classified as moderately to severely neurocognitively “*impaired*”, whereas those with a z-score < 0.5 were classified as “*not impaired*” (Dwan et al., 2015). The overall internal consistency (Cronbach’s alpha) for the BINI scale was 0.97. Depressive symptoms were assessed using the 20-item Center for Epidemiological Studies Depression Scale (CES-D), with ≥ 16 indicative of moderate to severe depression (Radloff, 1977). The overall internal consistency (Cronbach’s alpha) for the scale was 0.92.

Alcohol use disorders were measured using the validated 10-item Alcohol Use Disorders Identification Test (AUDIT), with standard cut-offs ≥ 8 for men and ≥ 4 for women suggestive of an AUD (Babor et al., 2001). The overall internal consistency for the AUDIT was 0.92. Current drug- and sex-related risk was assessed for the past 30 days using an adapted version of the HIV risk-taking behavior scale (HRBS) (Ward et al., 1990). Risk perception for HIV was measured by the question “*What do you think your current risk of getting HIV is?*” with possible options being “*no risk at all*”, “*moderate risk*”, or “*high risk*”. Participants’ satisfaction with previous HIV prevention methods was assessed using the question “*Are you satisfied with your current method of HIV protection (e.g., condom use, clean needle use)?*” Participants were asked about their awareness and previous use of PrEP. Their willingness to initiate PrEP was assessed after providing a brief description of PrEP (Appendix). After reviewing this description, participants were asked to respond to a statement “*I would be interested in taking PrEP to reduce my current risk of HIV infection*” on a five-point Likert scale. Their score was further dichotomized as “*Yes*” (strongly agree and agree) and “*No*” (strongly disagree, disagree, and neutral). Some further hypothetical questions were asked to assess participants’ anticipation of “always using condoms” and “never sharing injection equipment” while on PrEP: “*How confident are you that you would always use condoms while on PrEP?*”, and “*How confident are you that you would stop sharing needles or works completely while on PrEP?*” The 5-point Likert response ranged from “*Not at all confident*” to “*Completely confident*”. This variable was further dichotomized as “*Yes*” (completely confident) and “*No*” (not at all confident, somewhat confident, moderately confident, and very confident).

2.4. Data analysis

All data analyses were performed using SPSS v. 23 (IBM Corp., 2015), and statistical significance was set at $p < 0.05$. We computed descriptive statistics, including frequencies and percentages for categorical variables, and means and standard deviations for continuous variables. After conducting bivariate analyses for significant associations with the two primary outcomes: 1.) willingness to initiate PrEP; and 2.) anticipation of consistent condom use and not sharing injection equipment while on PrEP, we conducted multivariate logistic regression analyses on bivariate associations found to be significant at $p < 0.10$. Stepwise forward entry and backward elimination methods both showed the same results in examining the independent correlates expressed as adjusted odds ratios (aORs) and their 95% confidence intervals (95% CI). The final model was ultimately selected based on goodness-of-fit using the Hosmer and Lemeshow Test (Hosmer et al., 1997).

3. Results

Table 1 shows participant characteristics as stratified by their willingness to initiate PrEP. Participants were mostly in their early 40s ($SD = 11.1$ years). Most participants reported having taken prescribed medication (other than methadone) in the past 30 days, with a mean medication adherence score of 73.3 ($SD = 15.4$) on a scale of 0–100. Approximately one-third of participants were classified as being neurocognitively impaired, and 74.3% and 47.0% met screening criteria for depression and AUDs, respectively. Self-reported HIV risk behaviors were highly prevalent. Over half of participants reported being satisfied with their current method of HIV prevention and two-thirds perceived that they were at risk of acquiring HIV. Only 18% of participants reported having heard of PrEP as a method to prevent HIV transmission and 1.8% had ever used it. Conversations with friends (6.5%) and health care providers (4.8%) were noted as the top sources of PrEP knowledge (Figure 1).

3.1. Willingness to initiate PrEP

Nearly two-thirds of participants (62.7%) reported that they would be willing to initiate PrEP to reduce their risk of HIV infection (Figure 1). While Table 1 shows the bivariate correlates of being willing to initiate PrEP, Table 2 shows the independent correlates associated with this outcome in multivariate modeling. Specifically, being neurocognitively impaired was associated with over a three-fold odds ($aOR = 3.184$, $p = 0.004$) of being willing to initiate PrEP. Additionally, compared to those who did not perceive themselves to be at risk for HIV, those with moderate ($aOR = 4.439$, $p < 0.001$) and high ($aOR = 8.044$, $p < 0.001$) perceived risk were significantly more likely to be willing to initiate PrEP.

3.2. Anticipation of safer drug- and sex-related practices while on PrEP

Participants willing to initiate PrEP were asked about their anticipated sexual and drug-related risk behaviors while on PrEP, and only 12.5% indicated that they would consistently use condoms while on PrEP (Figure 1). Though a number of factors were associated with consistent condom use while on PrEP in bivariate analyses (Table 3), in the multivariate model, earning $> \$20,000$ per year ($aOR = 8.315$, $p = 0.016$) and always using condoms with casual partners ($aOR = 6.597$, $p = 0.001$) were significantly correlated with consistent condom

use, whereas those currently injecting drugs (aOR=0.323, $p=0.027$) were less likely to anticipate consistently using condoms while on PrEP (Table 4).

Regarding drug-related risk, only 28.2% of participants reported that they would not share injection equipment while on PrEP (Figure 1). Again, multiple factors in the bivariate analyses were associated with this outcome, but in the multivariate model (Table 4), participants who were older (aOR=0.948, $p=0.035$), currently injecting drugs (aOR=0.342, $p<0.001$), and reported high perceived risk for HIV (aOR=0.191, $p=0.019$) were less likely to anticipate that they would not share injection equipment while on PrEP.

4. Discussion

Given the dearth of literature examining the interest in or initiation of PrEP among PWUD, we sought to directly assess this risk group for their interest in initiating PrEP and their perceptions about how PrEP might affect their drug and sexual risk behaviors. Several important findings were gleaned from this study that have major implications for PrEP scale-up in MMP settings, where PrEP use among PWUD was originally examined (Choopanya et al., 2013). First, almost none of our participants (<2%) had ever taken PrEP and few (18%) were even aware of PrEP. This is especially concerning given that this is a population at high-risk for HIV, but who have frequent contact with various treatment providers (e.g., through MMPs and elsewhere). This represents missed opportunities to initiate, or at least discuss, PrEP among PWUD. Limited PrEP awareness and use among PWUD here is similar to that reported elsewhere among female sex workers in China (Peng et al., 2012) and among other studies of PWUD in the U.S. (Kuo et al., 2016; Stein et al., 2014), but PrEP awareness was lower than that reported in studies of MSM (Ferrer et al., 2016; Goedel et al., 2016; Hoagland et al., 2016; Young et al., 2013). The higher level of knowledge about PrEP in MSM may stem from a number of PrEP initiatives that have primarily focused on MSM and HIV seronegative partners in sero-discordant couples (Ware et al., 2012). Recent studies have also shown that many addiction treatment providers, with whom MMP patients are in daily contact, have limited awareness of PrEP (Shrestha et al., 2016; Spector et al., 2015). In the context of clinical settings, including MMP patients in this study, treatment providers have great potential to engage their at-risk clients about PrEP through counseling, referrals, research trials, and may also effectively promote adherence to PrEP through counseling and monitoring. Our findings highlight the need for skills training for MMP providers so they can refer clients to PrEP and promote PrEP adherence, as they would for other services (e.g., offer risk reduction items, HIV testing, referral) relevant to HIV prevention. When information deficits about PrEP were corrected by describing its potential benefits, interest in initiating PrEP increased markedly with nearly two-thirds (62.7%) of participants being willing to initiate PrEP. Importantly, those who stand to benefit the most from PrEP (i.e., those at highest risk for HIV) tended to be most interested in it. Specifically, those who accurately perceived themselves as being at higher risk for acquiring HIV were most willing to initiate it, as well as those with neurocognitive impairment, which is associated with higher HIV risk behaviors (Anand et al., 2010; Huedo-Medina et al., 2016; Shrestha and Copenhaver, 2016). Together, these findings support PrEP expansion for PWUD enrolled in MMP.

The combination of high sex- and drug-related risk in MMP patients suggests that PrEP would be ideal for this risk group, just as reported in the original PrEP trial among PWID. In addition to the biomedical prevention benefits of PrEP, the structured nature of MMPs and the requirement for regular counseling suggests that MMP settings could readily support the integration of PrEP into existing evidenced-based behavioral risk reduction strategies.

We found that higher willingness to initiate PrEP was associated with participants having NCI, which is highly prevalent (30%) among this risk group (Shrestha et al., 2016). In prior studies (Anderson et al., 2015; Attonito et al., 2014; Becker et al., 2011), cognitive deficits have been associated with risky behaviors, poor medication adherence, and treatment disengagement (Anand et al., 2010; Shrestha et al., 2015; Verdejo-Garcia and Perez-Garcia, 2007; Vo et al., 2014). Given the relationship between NCI and higher HIV risk behaviors, this is an important group of PWUD who might benefit from PrEP. NCI may also undermine the efficacy of PrEP, however, since high levels of adherence are required for its efficacy (Baeten et al., 2012; Choopanya et al., 2013; Grant et al., 2010; Shrestha et al., 2016; Thigpen et al., 2012; Van Damme et al., 2012). For PWUD with NCI initiating PrEP, it is therefore crucial to couple PrEP with behavioral approaches to support medication adherence, such as cues and reminders or other cognitive remediation strategies (Barlati et al., 2013; Cole-Lewis and Kershaw, 2010; Finitis et al., 2014; Pop-Eleches et al., 2011).

Participants' overall perception of HIV risk was relatively high in this cohort of PWUD. We found that individuals who perceived themselves to be at higher risk of contracting HIV reported greater willingness to initiate PrEP, which is consistent with that reported in prior studies among MSM (Eisingerich et al., 2012; Golub et al., 2013; Wheelock et al., 2013; Young et al., 2013). The results suggest that participants are making rational judgment about their own risk levels when considering whether to initiate PrEP. This may indicate not only a concern about risk of HIV infection but also a self-management response to their HIV risk behaviors (Young et al., 2013). Thus, self-management programs, which have been shown to have positive outcomes in a variety of long-term conditions (e.g., diabetes, hypertension, arthritis) (Martin et al., 2014), may be of specific usefulness to promote self-management aspects of HIV prevention, such as HIV risk reduction strategies and PrEP. Alternatively, PrEP may be seen as an important HIV prevention approach in itself if, as our data suggest found, these individuals are unlikely to start using condoms more consistently (Holt et al., 2012). Overall, our findings suggest the need to consider how at-risk PWUD perceive and respond to their HIV risks as this may have a significant impact on the development and roll-out of PrEP-related programs targeting various risk populations.

Similar to other PrEP studies, findings here suggest that those who start PrEP are unlikely to then modify their risk behaviors. While these data do not support risk compensation as an anticipated behavioral response by PWUD, they do suggest that this population is ideal for PrEP and opens opportunities for integrating biomedical and behavioral interventions to enhance adherence and reduce other sexually transmitted infections (STIs) and blood-borne viral infections. Despite variable findings from other PrEP studies showing no risk compensation in clinical trials (Grant et al., 2010; McCormack et al.; Molina et al., 2015) but elevated risk-taking in other observational studies (Golub et al., 2013; Zhou et al., 2012), such responses should be closely examined in further PrEP studies in PWUD. Additionally,

participants who reported engaging in prior risk behaviors (i.e., active drug injection, condomless sex) were less likely to anticipate using condoms while on PrEP. Those who perceived themselves to be at high risk of contracting HIV and who engaged in current drug injection were more likely to anticipate sharing injection equipment while on PrEP. This suggests that individuals whose current behaviors increase their perceived risk of HIV are more likely to continue to engage in risky behaviors while on PrEP. This could also place these individuals at increased risk of STIs and blood-borne illnesses due to continued involvement in risky activities that are associated with decreased care engagement and medication adherence. Thus, it will be essential to educate PrEP users about the benefits and limitations of PrEP as a singular HIV prevention approach, and to increase self-efficacy by empowering people to make healthy choices. Combination HIV prevention packages that include teaching HIV risk reduction and PrEP adherence skills, routinely testing for HIV and STIs, and monitoring/supporting PrEP adherence over time may be most beneficial.

Our findings are not without limitations. As with all cross-sectional studies, we are only able to assess associations between variables rather than causal relationships. The use of self-reported measures may have resulted in participant underreporting of socially undesirable behaviors (e.g., drug- and sex-related risk behaviors) or inconsistently reporting (e.g., HIV status) because of stigma or fear of judgment. This is unlikely given the high risks reported by this sample and the use of ACASI for data collection. Additionally, the utilization of self-report measure of HIV status during screening process may have resulted in including individuals who were infected with HIV but were unaware of their status, which would make them ineligible for PrEP. Although a brief explanation about PrEP was provided, we do not know the extent to which participants understood every aspect of PrEP (e.g., effectiveness, cost, side-effects, dispensing venue, adherence, etc.) when providing responses regarding their willingness to initiate PrEP. We used participants' "*interest in taking PrEP*" as a proxy measure of their "*willingness to initiate PrEP*." The participants in this study were high-risk PWUD enrolled in MMP; thus, our findings may not be generalizable to PWUD in other settings. Finally, the use of the BINI, although a very user-friendly and convenient screening instrument for difficult-to-reach populations, is not designed to measure as many cognitive domains as a comprehensive battery of tests. Despite these limitations, however, the results support the development and implementation of a PrEP program integrated into existing evidence-based HIV prevention efforts that target high risk PWUD.

5. Conclusions

PWUD in MMPs are a high-risk population who would benefit from both biomedical (PrEP) and behavioral intervention strategies to prevent HIV. There have been limited PrEP data on this group, however, to inform primary HIV prevention efforts. Key findings here suggest that PWUD who would benefit from PrEP most were those most interested in receiving it. Moreover, the structured setting of MMPs provides an ideal clinical context in which to integrate biomedical and behavioral interventions in order to optimize HIV prevention efforts.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

Acknowledgments

Role of funding sources

This work was supported by grants from the National Institute on Drug Abuse for research (R01 DA025943 to FLA) and for career development (K24 DA017072 to FLA; K02 DA033139 to MMC; K23 DA033858 to JPM).

References

- Alipour A, Haghdoost AA, Sajadi L, Zolala F. HIV prevalence and related risk behaviours among female partners of male injecting drugs users in Iran: Results of a bio-behavioural survey, 2010. *Sex Transm Infect.* 2013; 89:iii41–iii44. [PubMed: 24064986]
- Anand P, Springer SA, Copenhaver MM, Altice FL. Neurocognitive impairment and HIV risk factors: A reciprocal relationship. *AIDS Behav.* 2010; 14:1213–1226. [PubMed: 20232242]
- Anderson AM, Higgins MK, Ownby RL, Waldrop-Valverde D. Changes in neurocognition and adherence over six months in HIV-infected individuals with cocaine or heroin dependence. *AIDS Care.* 2015; 27:333–337. [PubMed: 25484035]
- Attonito JM, Devieux JG, Lerner BD, Hospital MM, Rosenberg R. Exploring substance use and HIV treatment factors associated with neurocognitive impairment among people living with HIV/AIDS. *Front Public Health.* 2014; 2:105. [PubMed: 25157345]
- Babor, TF., Higgins-Biddle, JC., Saunders, JB., Monteiro, MG. *The Alcohol Use Disorders Identification Test: Guidelines For Use In Primary Care.* Zeneva, Switzerland: 2001.
- Baeten JM, Donnell D, Ndase P, Mugo NR, Campbell JD, Wangisi J, Tappero JW, Bukusi EA, Cohen CR, Katabira E, Ronald A, Tumwesigye E, Were E, Fife KH, Kiarie J, Farquhar C, John-Stewart G, Kakia A, Odoyo J, Mucunguzi A, Nakku-Joloba E, Twesigye R, Ngure K, Apaka C, Tamoo H, Gabona F, Mujugira A, Panteleeff D, Thomas KK, Kidoguchi L, Krows M, Revall J, Morrison S, Haugen H, Emmanuel-Ogier M, Ondrejcek L, Coombs RW, Frenkel L, Hendrix C, Bumpus NN, Bangsberg D, Haberer JE, Stevens WS, Lingappa JR, Celum C. Antiretroviral prophylaxis for HIV prevention in heterosexual men and women. *N Engl J Med.* 2012; 367:399–410. [PubMed: 22784037]
- Barlatti S, Deste G, De Peri L, Ariu C, Vita A. Cognitive remediation in schizophrenia: Current status and future perspectives. *Schizophr Res Treatment.* 2013; 2013:12.
- Becker BW, Thames AD, Woo E, Castellon SA, Hinkin CH. Longitudinal change in cognitive function and medication adherence in HIV-infected adults. *AIDS Behav.* 2011; 15:1888–1894. [PubMed: 21437726]
- Calabrese SK, Burke SE, Dovidio JF, Levina OS, Uusküla A, Niccolai LM, Heimer R. Internalized HIV and drug stigmas: Interacting forces threatening health status and health service utilization among people with HIV who inject drugs in St. Petersburg, Russia. *AIDS Behav.* 2016; 20:85–97. [PubMed: 26050155]
- CDC. Preexposure prophylaxis for the prevention of HIV infection in the United States—2014: A Clinical Practice Guideline. Department of Health and Human Services USA—Centers for Disease Control and Prevention; Washington, D.C: 2014.
- Centers for Disease Control and Prevention. HIV Surveillance Report, 2014. Vol. 26. Centers for Disease Control and Prevention; Atlanta, GA: 2014.
- Choopanya K, Martin M, Suntharasamai P, Sangkum U, Mock PA, Leethochawalit M, Chiamwongpaet S, Kitisin P, Natrujirote P, Kittimunkong S, Chuachoowong R, Gvetadze RJ, McNicholl JM, Paxton LA, Curlin ME, Hendrix CW, Vanichseni S. 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; 381:2083–2090. [PubMed: 23769234]

- Cole-Lewis H, Kershaw T. Text messaging as a tool for behavior change in disease prevention and management. *Epidemiol Rev.* 2010; 32:56–69. [PubMed: 20354039]
- Copenhaver M, Shrestha R, Wickersham JA, Weikum D, Altice FL. An exploratory factor analysis of a brief self-report scale to detect neurocognitive impairment among participants enrolled in methadone maintenance therapy. *J Subst Abuse Treat.* 2016; 63:61–65. [PubMed: 26879859]
- Degenhardt L, Whiteford HA, Ferrari AJ, Baxter AJ, Charlson FJ, Hall WD, Freedman G, Burstein R, Johns N, Engell RE, Flaxman A, Murray CJL, Vos T. Global burden of disease attributable to illicit drug use and dependence: Findings from the Global Burden of Disease Study 2010. *Lancet.* 2013; 382:1564–1574. [PubMed: 23993281]
- Dwan TM, Ownsworth T, Chambers S, Walker DG, Shum DHK. Neuropsychological assessment of individuals with brain tumor: Comparison of approaches used in the classification of impairment. *Front Oncol.* 2015; 5:56. [PubMed: 25815271]
- 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:e28238. [PubMed: 22247757]
- Ferrer L, Folch C, Fernandez-Davila P, Garcia A, Morales A, Belda J, Susperregui A, 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 Behav.* 2016:1–11. [PubMed: 26370101]
- Finitis DJ, Pellowski JA, Johnson BT. Text Message intervention designs to promote adherence to Antiretroviral Therapy (ART): A meta-analysis of randomized controlled trials. *PLoS ONE.* 2014; 9:e88166. [PubMed: 24505411]
- Goedel WC, Halkitis 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 Behav.* 2016; 20:1435–1442. [PubMed: 26966013]
- Golub SA, Gamarel KE, Rendina HJ, Surace A, Lelutiu-Weinberger CL. From efficacy to effectiveness: Facilitators and barriers to PrEP acceptability and motivations for adherence among MSM and transgender women in New York City. *AIDS Patient Care STDs.* 2013; 27:248–254. [PubMed: 23565928]
- Grant RM, Lama JR, Anderson PL, McMahan V, Liu AY, Vargas L, Goicochea P, Casapía M, Guanira-Carranza JV, Ramirez-Cardich ME, Montoya-Herrera O, Fernández T, Veloso VG, Buchbinder SP, Chariyalertsak S, Schechter M, Bekker LG, Mayer KH, Kallás EG, Amico KR, Mulligan K, Bushman LR, Hance RJ, Ganoza C, Defechereux P, Postle B, Wang F, McConnell JJ, Zheng JH, Lee J, Rooney JF, Jaffe HS, Martinez AI, Burns DN, Glidden DV. Preexposure chemoprophylaxis for HIV prevention in men who have sex with men. *N Engl J Med.* 2010; 363:2587–2599. [PubMed: 21091279]
- Gredig D, Uggowitz F, Hassler B, Weber P, Nideröst S. Acceptability and willingness to use HIV pre-exposure prophylaxis among HIV-negative men who have sex with men in Switzerland. *AIDS Care.* 2016; 28:44–47. [PubMed: 26971540]
- Hoagland B, De Boni RB, Moreira RI, Madruga JV, Kallas EG, Goulart SP, Cerqueira N, Torres TS, Luz PM, Fernandes NM, Liu AY, Grinsztejn B, Veloso VG. Awareness and willingness to Use Pre-exposure Prophylaxis (PrEP) among men who have sex with men and transgender women in Brazil. *AIDS Behav.* 2016. <https://dx.doi.org/10.1007/s10461-016-1516-5>
- Holt M, Murphy DA, Callander D, Ellard J, Rosengarten M, Kippax SC, de Wit JBF. 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. *Sex Transm Infect.* 2012; 88:258–263. [PubMed: 22290327]
- Hosmer DW, Hosmer T, Le Cessie S, Lemeshow S. A comparison of goodness-of-fit tests for the logistic regression model. *Stat Med.* 1997; 16:965–980. [PubMed: 9160492]
- Huedo-Medina TB, Shrestha R, Copenhaver M. Modeling a theory-based approach to examine the influence of neurocognitive impairment on HIV risk reduction behaviors among drug users in treatment. *AIDS Behav.* 2016; 20:1646–1657. [PubMed: 27052845]
- .IBM Corp. IBM SPSS Statistics for Windows, Version 23. IBM Corp; Armonk, NY: 2015.

- Kamarulzaman A, Altice FL. Challenges in managing HIV in people who use drugs. *Curr Opin Infect Dis.* 2015; 28:10–16. [PubMed: 25490106]
- Kirby T, Thornber-Dunwell M. Uptake of PrEP for HIV slow among MSM. *Lancet.* 2014; 383:399–400. [PubMed: 24494225]
- Kuo I, Olsen H, Patrick R, Phillips G II, Magnus M, Opoku J, Rawls A, Peterson J, Hamilton F, Kharfen M, Greenberg A. Willingness to use HIV pre-exposure prophylaxis among community-recruited, older people who inject drugs in Washington, DC. *Drug Alcohol Depend.* 2016; 164:8–13. [PubMed: 27177804]
- Liu, A., Colfax, G., Cohen, S., Bacon, O. The Spectrum Of Engagement In HIV Prevention: Proposal for a Pre-Exposure Prophylaxis (PrEP) Cascade. 7th International Conference on HIV treatment and prevention adherence; Miami, FL. 2012.
- Marshall BDL, Friedman SR, Monteiro JFG, Paczkowski M, Tempalski B, Pouget ER, Lurie MN, Galea S. Prevention and treatment produced large decreases in HIV incidence in a model of people who inject drugs. *Health Aff.* 2014; 33:401–409.
- Martin S, Chinnock P, Perales J, Lee Hy, Lee CY, Wu Yt, Mavrodaris A. Self-management interventions for people living with HIV/AIDS. *Cochrane Database Syst Rev.* 2014; 9:CD008731.
- McCormack S, Dunn DT, Desai M, Dolling DI, Gafos M, Gilson R, Sullivan AK, Clarke A, Reeves I, Schembri G, Mackie N, Bowman C, Lacey CJ, Apea V, Brady M, Fox J, Taylor S, Antonucci S, Khoo SH, Rooney J, Nardone A, Fisher M, McOwan A, Phillips AN, Johnson AM, Gazzard B, Gill ON. Pre-exposure prophylaxis to prevent the acquisition of HIV-1 infection (PROUD): Effectiveness results from the pilot phase of a pragmatic open-label randomised trial. *Lancet.* 387:53–60. [PubMed: 26364263]
- Molina JM, Capitant C, Spire B, Pialoux G, Cotte L, Charreau I, Tremblay C, Le Gall JM, Cua E, Pasquet A, Raffi F, Pintado C, Chidiac C, Chas J, Charbonneau P, Delaugerre C, Suzan-Monti M, Loze B, Fonsart J, Peytavin G, Cheret A, Timsit J, Girard G, Lorente N, Preau M, Rooney JF, Wainberg MA, Thompson D, Rozenbaum W, Dore V, Marchand L, Simon MC, Etien N, Aboulker JP, Meyer L, Delfraissy JF. On-demand preexposure prophylaxis in men at high risk for HIV-1 Infection. *N Engl J Med.* 2015; 373:2237–2246. [PubMed: 26624850]
- Nadol P, Tran H, Hammett T, Phan S, Nguyen D, Kaldor J, Law M. High HIV prevalence and associated risk factors among female sexual partners of male injection drug users (MWID) in Ho chi minh city, Vietnam. *AIDS Behav.* 2016; 20:395–404. [PubMed: 26271814]
- Peng B, Yang X, Zhang Y, Dai J, Liang H, Zou Y, Luo J, Peng H, Zhong X, Huang A. Willingness to use pre-exposure prophylaxis for HIV prevention among female sex workers: A cross-sectional study in China. *HIV AIDS.* 2012; 4:149–158.
- Pop-Eleches C, Thirumurthy H, Habyarimana JP, Zivin JG, Goldstein MP, De Walque D, Mackeen L, Haberer J, Kimaiyo S, Sidle J. Mobile phone technologies improve adherence to antiretroviral treatment in a resource-limited setting: A randomized controlled trial of text message reminders. *AIDS.* 2011; 25:825. [PubMed: 21252632]
- Radloff LS. The CES-D scale: A self-report depression scale for research in the general population. *Appl Psychol Meas.* 1977; 1:385–401.
- Shrestha R, Copenhaver M. The influence of neurocognitive impairment on hiv risk behaviors and intervention outcomes among high-risk substance users: A systematic review. *Front Public Health.* 2016; 4:16. [PubMed: 26904535]
- Shrestha R, Huedo-Medina T, Krishnan A, Altice F, Copenhaver M. Examining the acceptability of mHealth Technology in HIV prevention among high-risk drug users in treatment. *AIDS Behav.* 2016
- Shrestha R, Huedo-Medina TB, Copenhaver MM. Sex-related differences in self-reported neurocognitive impairment among high-risk cocaine users in methadone maintenance treatment program. *Subst Abuse.* 2015; 9:17–24. [PubMed: 25861219]
- Shrestha R, Karki P, Frederick A, Copenhaver M. Developing a bio-behavioral hiv prevention intervention for high-risk drug users in treatment: taking into account the impact of neurocognitive impairment. *AIDS Res Treat.* Unpublished results.

- Shrestha, R., Karki, P., Huedo-Medina, TB., Copenhaver, M. Treatment engagement moderates the effect of neurocognitive impairment on antiretroviral therapy adherence in HIV-infected drug users in treatment. *J Int Assoc Provid AIDS Care*. 2016. <http://dx.doi.org/10.1016/j.jana.2016.09.007>
- Spector AY, Remien RH, Tross S. PrEP in substance abuse treatment: A qualitative study of treatment provider perspectives. *Subst Abuse Treat Prev Policy*. 2015; 10:1–10. [PubMed: 25575428]
- Stein M, Thurmond P, Bailey G. Willingness to use HIV pre-exposure prophylaxis among opiate users. *AIDS Behav*. 2014; 18:1694–1700. [PubMed: 24752703]
- Thigpen MC, Kebaabetswe PM, Paxton LA, Smith DK, Rose CE, Segolodi TM, Henderson FL, Pathak SR, Soud FA, Chillag KL, Mutanhaurwa R, Chirwa LI, Kasonde M, Abebe D, Buliva E, Gvetadze RJ, Johnson S, Sukalac T, Thomas VT, Hart C, Johnson JA, Malotte CK, Hendrix CW, Brooks JT. Antiretroviral preexposure prophylaxis for heterosexual HIV transmission in botswana. *N Engl J Med*. 2012; 367:423–434. [PubMed: 22784038]
- Van Boekel LC, Brouwers EP, Van Weeghel J, Garretsen HF. Stigma among health professionals towards patients with substance use disorders and its consequences for healthcare delivery: systematic review. *Drug Alcohol Depend*. 2013; 131:23–35. [PubMed: 23490450]
- Van Damme L, Corneli A, Ahmed K, Agot K, Lombaard J, Kapiga S, Malahleha M, Owino F, Manongi R, Onyango J, Temu L, Monedi MC, Mak'Oketch P, Makanda M, Reblin I, Makatu SE, Saylor L, Kiernan H, Kirkendale S, Wong C, Grant R, Kashuba A, Nanda K, Mandala J, Fransen K, Deese J, Crucitti T, Mastro TD, Taylor D. Preexposure prophylaxis for HIV infection among African women. *N Engl J Med*. 2012; 367:411–422. [PubMed: 22784040]
- Verdejo-Garcia A, Perez-Garcia M. Profile of executive deficits in cocaine and heroin polysubstance users: common and differential effects on separate executive components. *Psychopharmacology*. 2007; 190:517–530. [PubMed: 17136401]
- Vo HT, Schacht R, Mintzer M, Fishman M. Working memory impairment in cannabis- and opioid-dependent adolescents. *Subst Abuse*. 2014; 35:387–390.
- Volkow ND, Montaner J. The urgency of providing comprehensive and integrated treatment for substance abusers with HIV. *Health Aff*. 2011; 30:1411–1419.
- Ward, J., Darke, S., Hall, W. The HIV Risk-Taking Behaviour Scale (HRBS) Manual. National Drug and Alcohol Research Centre; Sydney, Australia: 1990.
- Ware NC, Wyatt MA, Haberer JE, Baeten JM, Kintu A, Psaros C, Safren S, Tumwesigye E, Celum CL, Bangsberg DR. What's love got to do with it? Explaining adherence to oral antiretroviral pre-exposure prophylaxis (PrEP) for HIV serodiscordant couples. *J Int AIDS Soc*. 2012; 59:463–468.
- Wheelock A, Eisingerich AB, Ananworanich J, Gomez GB, Hallett TB, Dybul MR, Piot P. Are Thai MSM willing to take PrEP for HIV prevention? An analysis of attitudes, preferences and acceptance. *PLoS ONE*. 2013; 8:e54288. [PubMed: 23342121]
- Wilson IB, Lee Y, Michaud J, Fowler FJ, Rogers WH. Validation of a new three-item self-report measure for medication adherence. *AIDS Behav*. 2016; 20:2700–2708. [PubMed: 27098408]
- Young I, Li J, McDaid L. Awareness and willingness to use HIV pre-exposure prophylaxis amongst gay and bisexual men in scotland: Implications for biomedical HIV prevention. *PLoS ONE*. 2013; 8:e64038. [PubMed: 23691143]
- Zhou F, Gao L, Li S, Li D, Zhang L, Fan W, Yang X, Yu M, Xiao D, Yan L, Zhang Z, Shi W, Luo F, Ruan Y, Jin Q. Willingness to accept HIV pre-exposure prophylaxis among Chinese men who have sex with men. *PLoS ONE*. 2012; 7:e32329. [PubMed: 22479320]

Highlights

- We examined the willingness of people who use drugs (PWUDs) to initiate pre-exposure prophylaxis (PrEP).
- We also examined the anticipation of HIV risk reduction among PWUDs.
- 18% reported having heard of PrEP and 62.7% reported being willing to initiate PrEP.
- PrEP willingness was associated with NCI and higher perceived risk for HIV infection.
- We found anticipated higher risk behaviors among this sample while on PrEP.

Figure 1.
Variables of interest related to PrEP among participants (N= 400)

Table 1

Characteristics of participants and HIV transmission risk behaviors, stratified by their willingness to initiate PrEP ($N = 400$)

Variables	Entire sample (N = 400)		Willingness to initiate		OR (95% CI)	p
	Frequency	%	No (n = 149)	Yes (n = 251)		
Characteristics of participants						
Age: Mean (SD)	40.9 (11.1)		39.7 (11.4)	41.8 (10.8)	1.017 (.999, 1.037)	0.070
Gender						
Male	234	58.5	94 (23.5)	140 (35.0)	-	-
Female	166	41.5	55 (13.8)	111 (27.8)	1.355 (.894, 2.053)	0.152
Sexual orientation						
Heterosexual or straight	345	86.3	137 (34.3)	208 (52.0)	-	-
Homosexual, gay, or lesbian	16	4.0	5 (1.3)	11 (2.8)	1.449 (.493, 4.262)	0.500
Bisexual	39	9.7	7 (1.8)	32 (8.0)	3.011 (1.292, 7.015)	0.011
Ethnicity						
Non-white	147	36.8	44 (11.0)	103 (25.8)	-	-
White	253	63.2	105 (26.3)	148 (37.0)	.602 (.391, .928)	0.022
Marital status						
Married	83	20.8	32 (8.0)	51 (12.8)	-	-
Divorced	111	27.8	33 (8.3)	78 (19.5)	1.483 (.813, 2.705)	0.199
Widowed	14	3.5	4 (1.0)	10 (2.5)	1.569 (.454, 5.426)	0.477
Single	192	48.0	80 (20.0)	112 (28.0)	.878 (.519, 1.488)	0.630
High school graduate						
No	107	26.8	32 (8.0)	75 (18.8)	-	-
Yes	293	73.3	117 (29.3)	176 (44.0)	.642 (.399, 1.032)	0.067
Employed						
No	331	82.8	277 (69.3)	54 (13.5)	-	-
Yes	69	17.3	51 (12.8)	18 (4.5)	1.054 (.615, 1.807)	0.848
Income level						
< \$10,000	312	78.0	254 (63.5)	58 (14.5)	-	-
\$10,000 – \$19,999	57	14.2	52 (13.0)	5 (1.3)	.727 (.410, 1.288)	0.274
\$20,000	31	7.8	22 (5.5)	9 (2.3)	1.032 (.478, 2.232)	0.935

Variables	Entire sample (N = 400)		Willingness to initiate		OR (95% CI)	p
	Frequency	%	No (n = 149)	Yes (n = 251)		
Currently have health insurance						
No	19	4.8	15 (3.8)	4 (1.0)	-	-
Yes	381	95.2	313 (78.3)	68 (17.0)	.768 (.286, 2.066)	0.601
Visited healthcare provider (past 12 months)						
No	34	8.5	29 (7.2)	5 (1.3)	-	-
Yes	366	91.5	299 (74.8)	67 (16.8)	1.198 (.586, 2.449)	0.621
Homeless (past 12 months)						
No	198	49.5	172 (43.0)	26 (6.5)	-	-
Yes	202	50.5	156 (39.0)	46 (11.5)	1.252 (.834, 1.879)	0.278
Methadone dose: Mean (SD), mg	81.5 (28.4)		81.3 (29.9)	81.3 (27.4)	1.000 (.993, 1.007)	0.982
Taking medication (past 30 days)						
No	92	23.0	38 (9.5)	54 (13.5)	-	-
Yes	308	77.0	111 (27.8)	197 (49.3)	1.249 (.776, 2.010)	0.360
Medication adherence: Mean (SD)	73.3 (15.4)		75.4 (15.8)	72.2 (15.2)	.986 (.970, 1.002)	0.076
Ever heard of PrEP						
No	328	82.0	120 (30.0)	208 (52.0)	-	-
Yes	72	18.0	29 (7.2)	43 (10.8)	.855 (.508, 1.441)	0.558
Neurocognitive impairment						
No	279	69.8	122 (30.5)	157 (39.3)	-	-
Yes	121	30.3	27 (6.8)	94 (23.5)	2.705 (1.659, 4.411)	<0.001
Moderate to Severe Depression						
No	103	25.8	48 (12.0)	55 (13.8)	-	-
Yes	297	74.3	101 (25.3)	196 (49.0)	1.694 (1.074, 2.671)	0.023
Alcohol use disorders						
No	212	53.0	87 (21.8)	125 (31.3)	-	-
Yes	188	47.0	62 (15.5)	126 (31.5)	1.437 (.940, 2.129)	0.097
HIV transmission risk behaviors						
<i>During the past 30 days...</i>						
Injected drugs						
No	170	42.5	72 (18.0)	98 (24.5)	-	-

Variables	Entire sample (N = 400)		Willingness to initiate		OR (95% CI)	p
	Frequency	%	No (n = 149)	Yes (n = 251)		
Yes	230	57.5	77 (19.3)	153 (38.3)	1.460 (.969, 2.198)	0.070
Shared injection equipment	<i>n</i> = 230					
No	80	34.8	32 (13.9)	48 (20.9)	-	-
Yes	150	65.2	45 (19.6)	105 (45.7)	1.556 (.882, 2.744)	0.127
Had sex						
No	72	18.0	28 (7.0)	44 (11.0)	-	-
Yes	328	82.0	121 (30.3)	207 (51.7)	1.089 (.645, 1.839)	0.751
Number of sexual partners						
1	197	60.1	83 (25.3)	114 (34.8)	-	-
2-5	116	35.3	35 (10.7)	81 (24.7)	1.685 (1.035, 2.742)	0.036
6	15	4.6	3 (0.9)	12 (3.7)	2.912 (.797, 10.647)	0.106
Always used condom with regular partner	<i>n</i> = 308					
No	282	91.6	105 (34.1)	177 (57.5)	-	-
Yes	26	8.4	8 (2.6)	18 (5.8)	1.335 (.561, 3.177)	0.514
Always used condom with casual partner	<i>n</i> = 264					
No	215	81.4	80 (30.3)	135 (51.1)	-	-
Yes	49	18.6	12 (4.5)	37 (14.0)	1.827 (.901, 3.707)	0.095
Diagnosed with STIs (past 12 months)						
No	346	86.5	128 (32.0)	218 (54.5)	-	-
Yes	54	13.5	21 (5.3)	33 (8.3)	.923 (.512, 1.663)	0.789
Perceived risk for HIV infection						
No risk at all	129	32.3	65 (16.3)	64 (16.0)	-	-
Moderate	145	36.3	57 (14.2)	88 (22.0)	1.568 (.970, 2.533)	0.065
High	126	31.5	27 (6.8)	99 (24.8)	3.724 (2.153, 6.441)	<0.001
Satisfied with current method of HIV prevention						
No	162	40.5	56 (14.0)	106 (26.5)	-	-
Yes	238	59.5	93 (23.3)	145 (36.3)	.824 (.544, 1.248)	0.360

PrEP: Pre-exposure prophylaxis; SD: Standard deviation; OD: Odds ratio; STIs: Sexually transmitted infections; OR: Odds ratio

Note: STIs in the past 12 months

Table 2Multivariate logistic regression models of factors associated with willingness to initiate PrEP ($N = 400$)

Variables	Willingness to initiate PrEP		
	aOR	95% CI	<i>p</i>
Age	1.017	.986, 1.049	0.280
Sexual orientation			
Heterosexual or straight	-	-	-
Homosexual, gay, or lesbian	1.378	.279, 6.814	0.694
Bisexual	2.920	.930, 9.171	0.067
Ethnicity			
Non-white	-	-	-
White	1.188	.566, 2.496	0.648
High school graduate			
No	-	-	-
Yes	1.040	.482, 2.240	0.920
Neurocognitive impairment			
No	-	-	-
Yes	3.184	1.459, 6.949	0.004
Moderate to Severe Depression			
No	-	-	-
Yes	1.219	.535, 2.779	0.638
Alcohol use disorders			
No	-	-	-
Yes	1.023	.526, 1.986	0.948
Injected drugs			
No	-	-	-
Yes	.986	.483, 2.012	0.968
Number of sexual partners			
1	-	-	-
2–5	.714	.350, 1.455	0.353
6	.629	.126, 3.139	0.572
Always used condom with casual partner			
No	-	-	-
Yes	3.401	.940, 6.307	0.062
Perceived risk for getting HIV			
No risk at all	-	-	-
Moderate	4.439	1.959, 7.060	<0.001
High	8.044	3.012, 13.481	<0.001
Hosmer and Lemeshow Test: Chi-square = 5.439; $p = 0.710$			

aOR: Adjusted odds ratio

Table 3
Anticipation of consistent condom use and not sharing of injection equipment while on PrEP ($N = 400$)

Variables	Consistent condom use		OR (95% CI)	p	Not sharing injection equipment		OR (95% CI)	p
	No (n = 350)	Yes (n = 50)			No (n = 287)	Yes (n = 113)		
Characteristics of participants								
Age: Mean (SD)	41.1 (11.3)	39.9 (9.7)	.990 (.964, 1.018)	0.490	41.7 (11.5)	39.1 (9.7)	.978 (.959, .998)	0.035
Gender								
Male	206 (51.5)	28 (7.0)	-	-	172 (43.0)	62 (15.5)	-	-
Female	144 (36.0)	22 (5.5)	1.124 (.618, 2.043)	0.701	115 (28.7)	51 (12.8)	1.230 (.793, 1.909)	0.355
Sexual orientation								
Heterosexual or straight	298 (74.5)	47 (11.8)	-	-	245 (61.3)	100 (25.0)	-	-
Homosexual, gay, or lesbian	15 (3.8)	1 (0.3)	.423 (.055, 3.275)	0.410	13 (3.3)	3 (0.8)	.565 (.158, 2.027)	0.381
Bisexual	37 (9.3)	2 (0.5)	.343 (.080, 1.469)	0.149	29 (7.2)	10 (3.5)	.845 (.397, 1.798)	0.662
Ethnicity								
Non-white	127 (31.8)	20 (5.0)	-	-	108 (27.0)	39 (9.8)	-	-
White	223 (55.8)	30 (7.5)	.854 (.466, 1.566)	0.611	179 (44.8)	74 (18.5)	1.145 (.726, 1.805)	0.561
Marital status								
Married	71 (17.8)	12 (3.0)	-	-	57 (14.2)	26 (6.5)	-	-
Divorced	96 (24.0)	15 (3.8)	.924 (.408, 2.096)	0.851	84 (21.0)	27 (6.8)	.705 (.373, 1.330)	0.280
Widowed	14 (3.5)	0 (0.0)	1 (.999, 1.010)	0.999	12 (3.0)	2 (0.5)	.365 (.076, 1.751)	0.208
Single	169 (42.3)	23 (5.8)	.805 (.380, 1.706)	0.572	134 (33.5)	58 (14.5)	.949 (.544, 1.656)	0.854
High school graduate								
No	97 (24.3)	10 (2.5)	-	-	81 (20.3)	26 (6.5)	-	-
Yes	253 (63.2)	40 (10.0)	1.534 (.738, 3.187)	0.252	206 (51.5)	87 (21.8)	1.316 (.792, 2.186)	0.290
Employed								
No	277 (69.3)	54 (13.5)	-	-	235 (58.8)	96 (24.0)	-	-
Yes	51 (12.8)	18 (4.5)	1.054 (.615, 1.807)	0.848	52 (13.0)	17 (4.3)	.800 (.441, 1.454)	0.464
Income								
< \$10,000	280 (70.0)	32 (8.0)	-	-	231 (57.8)	81 (20.3)	-	-
\$10,000 – \$19,999	50 (12.5)	7 (1.8)	1.225 (.512, 2.928)	0.648	38 (9.5)	19 (4.8)	1.426 (.778, 2.614)	0.251
\$20,000	20 (5.0)	11 (2.8)	4.812 (2.116, 6.945)	<0.001	18 (4.5)	13 (3.3)	2.060 (.966, 4.391)	0.061

Variables	Consistent condom use		OR (95% CI)	p	Not sharing injection equipment		OR (95% CI)	p
	No (n = 350)	Yes (n = 50)			No (n = 287)	Yes (n = 113)		
Currently have health insurance								
No	17 (4.3)	2 (0.5)	-	-	15 (3.8)	4 (1.0)	-	-
Yes	333 (83.3)	48 (12.0)	1.225 (.274, 5.470)	0.790	272 (68.0)	109 (27.3)	1.503 (.488, 4.629)	0.478
Visited healthcare provider (past 12 months)								
No	31 (7.8)	3 (0.8)	-	-	26 (6.5)	8 (2.0)	-	-
Yes	319 (79.8)	47 (11.8)	1.522 (.448, 5.178)	0.501	261 (65.3)	105 (26.3)	1.307 (.573, 2.981)	0.524
Homeless (past 12 months)								
No	170 (42.5)	28 (7.0)	-	-	140 (35.0)	58 (14.5)	-	-
Yes	180 (45.0)	22 (5.5)	.742 (.409, 1.347)	0.327	147 (36.8)	55 (13.8)	.903 (.584, 1.396)	0.647
Methadone dose: Mean (SD), mg	81.2 (28.1)	82.1 (30.4)	1.001 (.991, 1.012)	0.839	80.5 (28.0)	83.3 (29.3)	1.003 (.996, 1.011)	0.382
Taking medication (past 30 days)								
No	87 (21.8)	5 (1.3)	-	-	68 (17.0)	24 (6.0)	-	-
Yes	263 (65.8)	45 (11.3)	2.977 (1.145, 7.738)	0.025	219 (54.8)	89 (22.3)	1.151 (.680, 1.949)	0.600
Medication adherence: Mean (SD)	72.1 (15.5)	80.4 (13.3)	1.053 (1.021, 1.086)	0.001	71.9 (14.9)	76.8 (16.2)	1.024 (1.005, 1.043)	0.013
Heard about PrEP								
No	287 (71.8)	41 (10.3)	-	-	234 (58.5)	94 (23.5)	-	-
Yes	63 (15.8)	9 (2.3)	1.000 (.462, 2.163)	0.990	53 (13.3)	19 (4.8)	.892 (.502, 1.588)	0.699
Neurocognitive impairment								
No	245 (61.3)	34 (8.5)	-	-	201 (50.2)	78 (19.5)	-	-
Yes	105 (26.3)	16 (4.0)	1.098 (.581, 2.075)	0.773	86 (21.5)	35 (8.8)	1.049 (.654, 1.681)	0.843
Moderate to Severe Depression								
No	85 (21.3)	18 (4.5)	-	-	69 (17.3)	34 (8.5)	-	-
Yes	265 (66.3)	32 (8.0)	.570 (.305, 1.067)	0.079	218 (54.5)	79 (19.8)	.735 (.453, 1.194)	0.214
Alcohol use disorders								
No	181 (45.3)	31 (7.8)	-	-	143 (35.8)	69 (17.3)	-	-
Yes	169 (42.3)	19 (4.8)	.656 (.357, 1.206)	0.175	144 (36.0)	44 (11.0)	.633 (.406, .987)	0.043
HIV transmission risk behaviors								
During the past 30 days...								

Variables	Consistent condom use		OR (95% CI)	p	Not sharing injection equipment		OR (95% CI)	p
	No (n = 350)	Yes (n = 50)			No (n = 287)	Yes (n = 113)		
Injected drugs								
No	138 (34.5)	32 (8.0)	-	-	100 (25.0)	70 (17.5)	-	-
Yes	212 (53.0)	18 (4.5)	.366 (.198, .678)	0.001	187 (46.8)	43 (10.8)	.328 (.209, .516)	<0.001
Shared injection equipment								
No	70 (30.4)	10 (4.3)	-	-	54 (23.5)	26 (11.3)	-	-
Yes	142 (61.7)	8 (3.5)	.394 (.149, 1.043)	0.061	133 (57.8)	17 (7.4)	.265 (.133, .528)	<0.001
Had sex								
No	60 (15.0)	12 (3.0)	-	-	49 (12.3)	23 (5.8)	-	-
Yes	290 (72.5)	38 (9.5)	.655 (.323, 1.327)	0.240	238 (59.5)	90 (22.5)	.806 (.464, 1.399)	0.442
Number of sexual partners								
1	173 (52.7)	24 (7.3)	-	-	134 (40.9)	63 (19.2)	-	-
2-5	103 (31.4)	13 (4.0)	.910 (.444, 1.865)	0.796	90 (27.4)	26 (7.9)	.614 (.362, 1.043)	0.071
6	14 (4.3)	1 (0.3)	.515 (.065, 4.093)	0.530	14 (4.3)	1 (0.3)	.152 (.020, 1.181)	0.072
Always used condom with regular partner								
No	250 (81.2)	32 (10.4)	-	-	206 (66.9)	76 (24.7)	-	-
Yes	20 (6.5)	6 (1.9)	2.344 (.876, 6.268)	0.090	15 (4.9)	11 (3.6)	1.988 (.874, 4.519)	0.101
Always used condom with casual partner								
No	199 (75.4)	16 (6.1)	-	-	169 (64.0)	46 (17.4)	-	-
Yes	38 (14.4)	11 (4.2)	3.600 (1.551, 8.360)	0.003	30 (11.4)	19 (7.2)	2.327 (1.202, 4.505)	0.012
Diagnosed with STIs (past 12 months)								
No	304 (76.0)	42 (10.5)	-	-	245 (61.3)	101 (25.3)	-	-
Yes	46 (11.5)	8 (2.0)	1.259 (.556, 2.850)	0.581	42 (10.5)	12 (3.0)	.693 (.350, 1.371)	0.292
Perceived risk for HIV infection								
No risk at all	107 (26.8)	22 (5.5)	-	-	78 (19.5)	51 (12.8)	-	-
Moderate	132 (33.0)	13 (3.3)	.479 (.230, .995)	0.049	105 (26.3)	40 (10.0)	.583 (.351, .967)	0.037
High	111 (27.8)	15 (3.8)	.657 (.324, 1.334)	0.245	104 (26.0)	22 (5.5)	.324 (.181, .578)	<0.001
Satisfied with current method of HIV prevention								
No	150 (37.5)	12 (3.0)	-	-	123 (30.8)	39 (9.8)	-	-
Yes	200 (50.0)	38 (9.5)	2.375 (1.200, 4.700)	0.013	164 (41.0)	74 (18.5)	1.423 (.905, 2.238)	0.127

PrEP: Pre-exposure prophylaxis; SD: Standard deviation; OD: Odds ratio

Note: STIs: Sexually transmitted infections; STIs in the past 12 months; OR: Odds ratio

Author Manuscript

Author Manuscript

Author Manuscript

Author Manuscript

Table 4

Multivariate logistic regression models of factors associated with anticipation of consistent condom use and not sharing of injection equipment while on PrEP ($N = 400$)

Variables	Consistent condom use			Variables			Not sharing injection equipment		
	aOR	95% CI	p				aOR	95% CI	p
Income				Age, years			.948	.902, .996	0.035
< \$10,000	-	-	-	Income					
\$10,000 – \$19,999	6.409	.925, 12.414	0.060	< \$10,000			-	-	-
\$20,000	8.315	1.719, 15.162	0.016	\$10,000 – \$19,999			2.243	.489, 10.285	0.299
Taking medication (past 30 days)				\$20,000			3.012	.560, 16.207	0.199
No	-	-	-	Medication adherence			1.004	.970, 1.0388	0.837
Yes	1.035	.993, 1.078	0.103	Alcohol use disorders					
Medication adherence				No			-	-	-
Moderate to Severe Depression	1.016	.967, 1.067	0.527	Yes			.856	.287, 2.550	0.780
No	-	-	-	Injected drugs					
Yes	.943	.446, 1.997	0.879	No			-	-	-
Injected drugs				Yes			.342	.217, .539	<0.001
No	-	-	-	Shared injection equipment			-	-	-
Yes	.323	.097, .890	0.027	No			-	-	-
Shared injection equipment				Yes			.544	.162, 1.831	0.326
No	-	-	-	Number of sexual partners					
Yes	.424	.054, 3.325	0.439	1			-	-	-
Always uses condom with regular partner				2–5			.476	.153, 1.474	0.198
No	-	-	-	6			.343	.030, 3.876	0.387
Yes	.436	.023, 8.393	0.583	Always uses condom with casual partner					
Always uses condom with casual partner				No			-	-	-
No	-	-	-	Yes			1.435	.321, 6.411	0.637
Yes	6.726	2.290, 10.754	0.001	Perceived risk for HIV infection					
Perceived risk for HIV infection				No risk at all			-	-	-
No risk at all	-	-	-	Moderate			.760	.442, 1.308	0.322
Moderate	.144	.005, 4.212	0.261	High			.488	.261, .911	0.024

Variables	Consistent condom use			Variables	Not sharing injection equipment		
	aOR	95% CI	p		aOR	95% CI	p
High	1.391	.083, 5.210	0.818				
Satisfied with current method of HIV prevention					Hosmer and Lemeshow Test: Chi-square = 7.095; p = 0.526		
No	-	-	-				
Yes	.797	.154, 4.131	0.787				
Hosmer and Lemeshow Test: Chi-square = 4.869; p = 0.771							
aOR: Adjusted odds ratio							