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Exploring Patterns of Awareness and Use of HIV Pre-Exposure Prophylaxis among Young Men Who Have Sex with Men

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Abstract

Pre-exposure prophylaxis (PrEP) has shown promise as a safe and effective HIV prevention strategy, but there is limited research on awareness and use among young men who have sex with men (YMSM). Using baseline data from the “Keep It Up! 2.0” randomized control trial, we examined differences in PrEP awareness and use among racially diverse YMSM (N = 759; mean age = 24.2 years). Participants were recruited from study sites in Atlanta, Chicago, and New York City, as well as through national advertising on social media applications. While 67.5% of participants reported awareness of PrEP, 8.7% indicated using the medication. Awareness, but not use, varied by demographic variables. PrEP-users had twice as many condomless anal sex partners (ERR = 2.05) and more condomless anal sex acts (ERR = 1.60) than non-users. Future research should aim to improve PrEP awareness and uptake among YMSM and address condom use.

Keywords

Homosexuality, Male; Pre-Exposure Prophylaxis; Primary Health Care; Risk Reduction Behavior; Sexual Behavior

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COMPLIANCE WITH ETHICAL STANDARDS

Ethical approval: All procedures performed in studies involving human participants were in accordance with the ethical standards of the Northwestern University Institutional Review Board and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards.

Informed consent: Informed consent was obtained from all individual participants included in the study.

INTRODUCTION

In the U.S., the burden of new HIV infections falls disproportionately on young men who have sex with men (YMSM), making HIV prevention among this population a high priority research area (1, 2). Among all U.S. youth, YMSM aged 13 to 24 years accounted for greater than 70% of new HIV diagnoses between 2010 and 2014(3); further 13 to 24 year old MSM and 25 to 34 year old MSM were two of the few age and risk groups to show increases in new diagnoses. African Americans represented 45% of new HIV diagnoses among YMSM, compared to 16% and 28% for Whites and Latinos, respectively (4). Despite these alarming epidemiological trends among YMSM, there has not been a commensurate HIV prevention response (1).

Conferring both individual- and population-level benefits, HIV pre-exposure prophylaxis (PrEP) can enhance HIV prevention in communities most at risk for infection. In addition to HIV prevention, PrEP provides an opportunity to link high-risk YMSM to healthcare services they otherwise might not access, including sexually transmitted infection (STI) testing and risk reduction counseling. At the population level, PrEP may curb the spread of HIV in high-risk sexual networks by decreasing the incidence of new infections (5).

PrEP as a Biomedical Intervention: Awareness, Acceptability, and Uptake

In 2012, the U.S. Food and Drug Administration (FDA) approved daily oral co-formulated tenofovir (TDF) plus emtricitabine (FTC), under the brand name Truvada®, for use as PrEP. Both the Centers for Disease Control and Prevention (CDC) and the World Health Organization (WHO) have since released guidelines for the use of daily PrEP for those at high risk for HIV infection based on evidence from a number of landmark international randomized controlled trials (RCTs) (6–8). For example, in a large, multi-nation placebo-controlled RCT involving nearly 2,500 MSM, the *Pre-Exposure Prophylaxis Initiative* (iPrEx) found that daily PrEP use conferred 44% additional protection versus placebo in MSM who also received a comprehensive package of monthly prevention services (6).

Despite high efficacy, many barriers remain to PrEP implementation at the individual and population levels, from awareness and acceptability, to access and provider factors. A major impediment to non-research-based PrEP use in the real world is a lack of awareness of the drug. One study found that as few as 13% of MSM in the U.S. were aware of PrEP before the iPrEx trial, and 19% were aware of the medication after the 2010 trial (9). With FDA approval in 2012, pervasive media coverage, and the CDC and WHO clinical practice guidelines issued in 2014, PrEP awareness has become more widespread (10). For instance, the *U.S. PrEP Demonstration Project* conducted in San Francisco, Miami, and Washington, D.C. found that of 922 eligible MSM and transgender women who were offered PrEP from 2012 to 2014, 59% were aware of PrEP prior to engagement (11). Among highly sexually active MSM in New York City, awareness of PrEP increased from 53% to 72% for participants enrolled in the *Pillow Talk* study from 2011 to 2013 (10).

Linked with awareness of PrEP, research has also examined acceptability and willingness to use the drug as an approach for HIV prevention. The *PrEPARE* study identified barriers to uptake in a population that largely declined to initiate PrEP after presenting to an HIV

testing facility (12). Those declining enrollment revealed deterrents such as cost (48%), apprehension about long-term side effects (41%), low perceived risk of HIV infection (33%) and concerns about daily medication use (30%). Similar concerns were reported in the iPrEx open-label extension (iPrEx OLE; 13), *U.S. PrEP Demonstration Project* (11), and the recent *One Thousand Strong* national panel study of gay and bisexual men in the U.S. (14). In research with YMSM in Chicago examining the acceptability of PrEP under various hypothetical conditions of side-effects, dosing, and effectiveness, the sample was on average "somewhat likely" to be interested in using PrEP (15). There were no significant differences across racial or ethnic groups in PrEP interest, but higher interest was associated with increased level of education. Other research with highly sexually active, adult MSM found greater willingness to use PrEP if it were provided at no cost, with no significant age, income, racial or ethnic differences in acceptability (10). However, in contrast with previous research with YMSM (15), more educated adult MSM in this study were less likely to consider taking PrEP than less educated men.

In addition to variability in willingness to take PrEP across diverse samples, there are also healthcare-related barriers that impact uptake of the drug. Lack of access to a healthcare provider and insurance or funds to pay for the medication, in addition to discomfort discussing PrEP use with a provider, have been identified as barriers among potential MSM users (11–13, 16). In addition, barriers to PrEP endorsement by providers remain, potentially driven by a lack of knowledge about the drug and concerns about its safety (17, 18) despite the CDC's release of the PrEP *Clinical Practice Guideline* in 2014 (19). For example, a study of HIV and non-HIV internists and family practice providers revealed concerns about PrEP, including drug toxicity, adherence, and development of resistance (17).

Given that many barriers remain to PrEP implementation, particularly at the individual and healthcare levels, it is not surprising that there is low uptake (<7% in many studies) (14, 16, 20–23), despite high acceptability of PrEP among MSM (11, 16, 20, 24). However, recent research may serve to address concerns about PrEP safety and efficacy in real-world applications. A recent study demonstrated high efficacy of PrEP in a large clinical practice setting, with no new HIV infections occurring among MSM using PrEP over 388 person-years of follow up, despite high rates of STI acquisition (25). The recently published *PROUD* study found an 86% higher infection rate in the deferred treatment group compared to the group taking PrEP, dispelling the notion that the drug might only be efficacious in tightly controlled trials (26). In addition, the *Ipergay* study examined interval PrEP use only around the time of intercourse, and found an 86% reduction of HIV incidence in the "on-demand" PrEP arm versus placebo, suggesting the effectiveness of a non-daily PrEP regimen which may confer cost, side effect, and adherence benefits (27). However, it also been shown that MSM are not very accurate in predicting when they are going to have sex, leading to concerns regarding intermittent PrEP use with this population (28).

Risk Compensation

Concern about increased risk-taking in response to a perceived decrease in susceptibility to HIV infection while on PrEP (i.e., risk compensation) may be an important barrier to PrEP utilization at a healthcare provider level (17). However, this concern has not been completely

substantiated in the research literature. The iPrEx, iPrEx OLE, *U.S. MSM Safety Study*, and *PROUD* studies found no significant change in sexual risk behaviors among participants (13, 26, 29, 30) with each observing declines in risk behaviors (e.g., number of sex partners, frequency of condomless sex), potentially due to the risk reduction services and regular follow-up provided in the research context (29, 30). Despite these findings, recent PrEP implementation research has reported high rates of STIs in PrEP initiators (25), and other research with MSM has indicated intentions for condomless anal sex while taking PrEP (10, 31).

The Current Study

Though there is a robust and growing body of research supporting PrEP use, most of these studies do not specifically target populations for whom effective HIV prevention efforts are most critically needed, namely YMSM. For example, in clinical research, the *PROUD* (26) and *Ipergay* (27) trials both reported a mean age of 35 years for study participants. Further, there is limited implementation research with YMSM on access to information about PrEP, barriers to use, perceived effectiveness, and linkages with the healthcare system, which are important determinants to accessing, initiating, and staying on PrEP. The following questions will be addressed in the current study: (a) How are 18 to 29 year old YMSM receiving information about PrEP?; (b) Among PrEP non-users, are there demographic differences between those who are aware of PrEP as an HIV prevention strategy and those who are unaware?; (c) Are there demographic differences between PrEP users and non-users?; (d) What are the barriers for accessing and using PrEP?; and (e) How are PrEP awareness and use related to engagement in sexual risk behaviors?

METHODS

Study Design

This study was conducted in the context of baseline data collection for “Keep It Up! 2.0” (KIU!2.0), an ongoing, multisite, two-arm RCT. Keep It Up! is an interactive online HIV prevention program tailored to racially/ethnically diverse YMSM (32). The aim of KIU!2.0 is to establish the efficacy of the intervention by using a multisite RCT with follow-up assessments through 12 months post-intervention. For these analyses, baseline assessments collected between June 2013 and March 2015 were utilized.

Study Population

A sample of racially/ethnically diverse YMSM (N = 759) between the ages of 18 and 29 years participated in this study. Individuals were screened for eligibility based on established inclusion and exclusion criteria. Participants were required to be MSM, defined as a birth male who identifies as male and who reports having sexual contact with another male over the past 6 months. They also had to report condomless anal sex with another male in the previous 6 months. Exclusion criteria included having an HIV diagnosis and being in a behaviorally monogamous relationship lasting longer than 6 months.

Recruitment

Participants were recruited across diverse sources, including: (a) HIV testing clinics and mobile testing units of partner community-based organizations (CBOs) in Atlanta, Chicago, and New York; (b) local health department clinics in Chicago; (c) university-based HIV testing at research sites in Atlanta and New York; (d) street outreach in Atlanta, Chicago, and New York; (e) local and national print, online, and telephone recorded ads; (f) research participant registries at the university locations; and (g) nationwide online advertisements on social media applications linked with at-home HIV testing. Participants were screened upon a negative HIV test result at any of the recruitment sites or after uploading a photograph of a negative result from the at-home HIV test kit. Eligible participants were offered the option to visit the university research sites to complete the baseline assessment and to self-administer their first set of urine and rectal STI test kits. Participants were compensated $30 in the form of gift card for completing the baseline assessment and HIV/STI screen (or up to $50 cash if completed on-location at an academic site) and there were monetary incentives for retention including monthly raffles.

Data Collection

At study baseline, enrolled participants completed a battery of psychosocial measures including assessments of mental, physical, and sexual health domains using an online survey.

Measures

Demographics—The study team developed an instrument to collect standard measures of age, race and ethnicity, education, socioeconomic status, birth sex, gender identity, and sexual orientation identity.

Date of baseline—Baseline data collection took place between June 2013 and March 2015. Month and year of baseline completion were used to assess changes in PrEP awareness and use over time, as this could be due to increased publicity around PrEP in the media.

PrEP awareness and use—The *PREP Intentions and Impact on Condom Use* measure is a 21-item scale designed to assess participants' intention to use PrEP (10, 33). The measure was extensively adapted based on the literature and the study team's experience with the population and PrEP. Items were also modified to pertain to the past 3 months. Participants were given a short description of PrEP and asked if they had taken PrEP. Participants who responded that they had used PrEP were asked follow-up questions to assess patterns of use, as well as patterns of condom use. A sample question includes, "*Since you began taking the medication, how has it affected your condom use?*". Participants who had not used PrEP were asked about their awareness of the medication and given the option to choose multiple sources of PrEP information.

HIV risk behaviors—The *HIV-Risk Assessment for Sexual Partnerships* (H-RASP) (34), is a structured computerized interview designed to assess sexual behaviors and associated situational variables. The H-RASP assesses characteristics of and behaviors with up to three

sexual partners during the 3-month period prior to the assessment. For this study, sexual risk variables included number of condomless vaginal and anal sex partners, and number of condomless anal sex acts (CASA).

Statistical Analysis

Univariable and bivariable analyses were conducted to assess characteristics of individuals who were aware of PrEP. The variable used to assess PrEP awareness was dichotomized to facilitate comparisons: Not Aware = "*Never heard of it before today*" and "*Heard about it, but didn't really know what it was*;" Aware = "*Know a little bit about it*," "*Know a fair amount about it*," and "*Know a lot about it*." Significant differences were assessed using χ^2 tests and Student's t-tests. Additional analyses were conducted to assess demographic characteristics associated with barriers to PrEP use among those who had never taken the medication. Time of baseline survey administration was assessed as a predictor of PrEP awareness, and then as a confounder in adjusted models. Date of administration was coded as a continuous variable with months as the unit of analysis.

In parallel, univariable and bivariable analyses were conducted to assess characteristics of individuals who had taken PrEP, and to compare them with those who had never taken PrEP. For categorical variables, χ^2 tests were used to assess significant differences; Student's t-tests were used to assess significant differences for continuous variables.

Poisson regression analysis was used to assess the associations between PrEP usage and awareness and number of condomless sex partners. Logistic regression analysis was used to identify potential associations among PrEP awareness and use. All analyses were conducted in SAS v9.4.

RESULTS

Demographics

Participants (N = 759) were recruited and enrolled locally in Chicago (22.8%), New York City (30.1%), Atlanta (12.2%), and through nationwide recruitment campaigns (35.0%). See Table 1 for participant demographic information.

PrEP Awareness

Among participants who had not used PrEP (n = 693), 16.9% never heard of it, 15.6% heard about it but did not know what it was, 32.3% knew a little bit about it, 25.8% knew a fair amount about it, and 9.4% knew a lot about it. Participants were categorized as being aware of PrEP (n = 468) if they endorsed knowing a little bit, a fair amount, or a lot about the medication. The remaining participants were categorized as being unaware (n = 225).

There was an association between PrEP awareness and time of interview administration – for each subsequent month of baseline data collection starting June 2013, participants were 10% more likely to be aware of PrEP (odds ratio [OR] = 1.10; 95% confidence interval [CI]: 1.05, 1.14).

The majority of respondents reported hearing about PrEP from friends or acquaintances (59.1%), followed by HIV service agencies (36.4%), healthcare professionals (33.8%), newspapers and magazines (31.0%), and TV and radio (12.5%). More than one-quarter (28.9%) had heard about PrEP from other sources; of those who provided open-ended responses, 63.9% found out about PrEP from the Internet. Further, with adjustment for time of survey, participants who heard about PrEP from a healthcare professional were significantly more likely to report knowing "*a lot about it*" (adjusted OR [aOR] = 6.20; 95% CI: 3.40, 11.3) or "*a fair amount about it*" (aOR = 3.05; 95% CI: 1.99, 4.68) than knowing "*a little bit about it*" when compared with those who did not learn about it from healthcare professionals. The same relationship was found for those who heard about it from an HIV service agency (aOR = 2.16; 95% CI: 1.23, 3.80 and aOR = 1.55; 95% CI: 1.03, 2.33, respectively).

Demographic differences—Significant differences in PrEP awareness were observed for a number of demographic variables, including age, race, education and employment. These data are presented in Table II. With regard to geographic differences, participants in Atlanta and nationwide participants were significantly less likely to be aware of PrEP compared with New York City and Chicago respondents ($\chi^2 = 24.3$, $p<0.001$). After controlling for time of survey administration, those who were from Atlanta (aOR = 0.36; 95% CI: 0.20, 0.63) and from the nationwide group (aOR = 0.46; 95% CI: 0.28, 0.75) had significantly lower odds of being aware of PrEP compared with those from Chicago; there was no significant difference between New York City and Chicago (p = 0.79). The associations also persisted after controlling for both time and race (Atlanta [aOR = 0.40; 95% CI: 0.22, 0.74] and nationwide [aOR = 0.43; 95% CI: 0.26, 0.71]).

Sexual risk—Participants who were aware of PrEP had 10% fewer condomless vaginal and anal sex partners than those who were unaware (event rate ratio [ERR] = 0.90, 95% CI: 0.82, 0.99). They also engaged in significantly fewer CASA than unaware participants (ERR = 0.93, 95% CI: 0.88, 0.98). When controlling for time, the association between PrEP awareness and partner number was no longer significant (ERR = 0.92, 95% CI: 0.83, 1.01), but the association with CASA persisted (ERR = 0.94, 95% CI: 0.89, 0.99). With regard to PrEP use intentions (if the medication was at least 80% effective and free), those who said they would "*probably not take it*" had significantly more CASA compared to participants who said they would "*definitely take it*", both in unadjusted analysis (ERR = 1.87; 95% CI: 1.68, 2.07) and in adjusted analysis (ERR = 1.86; 95% CI: 1.68, 2.06).

Barriers to PrEP Use

The most commonly cited barrier to PrEP use was uncertainty about how to obtain the medication, cited by 46.8% of respondents. Participants also stated that they did not know PrEP was available (34.9%), that the medication was too expensive (33.2%), that they did not have healthcare insurance (22.8%), and that there were too many side effects from taking PrEP (16.6%). Additionally, 21.7% provided open-ended response on other reasons for not taking PrEP, with common responses being no engagement in high-risk sexual behaviors and a preference for condoms over PrEP. Participants also stated that there was "no long term study of side effects like cancer" and that their doctor did not recommend the medication

"because taking PrEP could cause me to become resistant to the drug Truvada". Only two barriers were significantly associated with changes over time. Being unaware of the availability of PrEP decreased over time (OR = 0.89; 95% CI: 0.85, 0.92). Conversely, believing the medication to be too expensive increased with each subsequent month (OR = 1.05; 95% CI: 1.01, 1.10).

Demographic differences—Participants who did not know the medication was available and those who did not know how to obtain the medication were significantly younger than those who did not cite these as barriers (aOR = 0.84; 95% CI: 0.79, 0.89 and aOR = 0.93; 95% CI: 0.88, 0.98, respectively). Those reporting that the medication was too expensive and those reporting concern over too many adverse side effects were significantly older than those who did not endorse these barriers (aOR = 1.09; 95% CI: 1.03, 1.15 and aOR = 1.20; 95% CI: 1.11, 1.30, respectively). African-American and other race individuals were found to be significantly more likely to say that not knowing PrEP was available was a barrier to taking it than White participants, after controlling for time of interview (aOR = 1.75; 95% CI: 1.14, 2.68 and aOR = 2.05; 95% CI: 1.30, 3.25, respectively). Conversely, African-American and other race respondents were significantly less likely to report concerns about side effects as a barrier than White YMSM (aOR = 0.40; 95% CI: 0.22, 0.75 and aOR = 0.33; 95% CI: 0.16, 0.69, respectively). Compared with White participants, African Americans were significantly more likely to report lack of healthcare insurance as a barrier to obtaining PrEP (aOR = 1.66; 95% CI: 1.04, 2.65), but less likely to cite concerns of their partner learning about the medication (aOR = 0.16; 95% CI: 0.04, 0.67). Latino participants were significantly less likely to say the medication was not effective enough (aOR = 0.44; 95% CI: 0.23, 0.86) and that their partner would react badly to finding out they were using PrEP (aOR = 0.28; 95% CI: 0.10, 0.79) than non-Latino individuals.

Demographic differences were also observed for education and employment. Participants with a college degree or graduate degree were less likely to say they did not know the medication was available compared with participants who had a high school education or less (aOR = 0.32; 95% CI: 0.19, 0.52 and aOR = 0.31; 95% CI: 0.16, 0.60, respectively). However, individuals with a college or graduate degree were more likely to report worry about the side effects of PrEP than those with a high school degree or less (aOR = 3.27; 95% CI: 1.36, 7.89 and aOR = 7.76; 95% CI: 3.01, 20.0, respectively). Those who were unemployed or were employed part time were significantly more likely to say that having no insurance was a barrier than those with full-time jobs (aOR = 1.85; 95% CI: 1.18, 2.89 and aOR = 1.73; 95% CI: 1.13, 2.64, respectively). Unemployed individuals were also significantly less likely to report the medication not being effective enough as a barrier to PrEP use when compared to those who were employed (aOR = 0.37; 95% CI: 0.16, 0.85).

PrEP Use

Sixty-six (8.7%) participants reported using PrEP in the past 3 months. Use of PrEP within this sample was not significantly associated with age, ethnicity, race, sexual orientation, education, or employment (Table III). However, there were significant differences in PrEP use by study site ($\chi^2 = 9.70$, p = 0.021); 13.4% of New York City participants had used PrEP compared to 6.7% of Chicago participants, 3.4% of Atlanta participants, and 8.3% of

nationwide participants. There were no significant differences in PrEP use based on month of baseline administration (p = 0.46).

When asked why they decided to take PrEP, 83.3% of respondents said it was part of their current risk reduction strategy and 50.0% said they wanted to try the medication. Some individuals said the reason was to have sex with multiple partners (37.9%), have "unprotected sex" (33.3%), or have sex with partners who had an unknown (27.3%) or positive (21.2%) HIV status. With regard to condom use while taking PrEP, 40.0% said their condom use had not changed, 35.4% said they had been less likely to use condoms, and 24.6% said they had been more likely to use condoms.

Sexual risk—Participants who reported using PrEP had twice as many condomless vaginal and anal sex partners than those who did not (ERR = 2.05, 95% CI: 1.83, 2.29). Similarly, those who used PrEP engaged in significantly more CASA than those who did not use PrEP, with an ERR of 1.60 (95% CI: 1.49, 1.73).

DISCUSSION

In this study, we are the first to report on real world PrEP awareness and use in a national sample of diverse YMSM. We found that 67.5% of PrEP non-users indicated awareness of PrEP, and only 8.7% of overall participants reported use of PrEP. Awareness was higher among older respondents and those with higher education, full-time employment, and residence in New York City and Chicago compared to Atlanta. The leading barrier to use was not knowing how to obtain the medication. Among participants who used PrEP, there was heterogeneity in condom use: while 35.4% reported decreasing use, the majority of the sample reported no change or an increase in condom use.

PrEP Awareness

Of the participants who had not used PrEP in the current sample, over two-thirds were aware of the medication and knowledge increased over time. This can be compared to awareness rates of 13% and 19% among adult MSM pre-iPrEx (September to October, 2010) and post-iPrEx (December to January, 2011), respectively (9), in addition to an awareness rate of 58.6% among MSM and a small number of transgender women in the *U.S. PrEP Demonstration Project* (September 2012 to January 2014) (11). The higher rate of awareness in this sample likely reflects the finding of increased knowledge of PrEP over time. Burgeoning PrEP awareness may be due to widespread media coverage of new studies, clinical guidelines, and even sources of controversy (35), as they arise, alongside an expanding population of PrEP users. Wide-ranging differences in PrEP awareness highlight potential socioeconomic and structural barriers faced by YMSM in the healthcare system. That is, awareness of PrEP was higher among White or multiracial respondents, older participants, and those with higher education and full-time employment. Increasing awareness with age may be partially explained by the fact that FDA labeling information specifies PrEP indications for "adults" and persons under the age of 18 were not included in the completed PrEP trials informing the PrEP clinical practice guideline (19). As such, adolescents are not targeted by drug companies or healthcare providers for PrEP education,

while older MSM have had longer cumulative healthcare exposure as potential PrEP candidates.

Although PrEP awareness increases over time, particularly among YMSM, knowledge deficits persist with regard to perceptions of medication efficacy, availability of and access to the medication, and proper use of PrEP. Our data showed that 34.9% of the non-PrEP users in our sample did not know the medication was available, 46.8% did not know how to obtain it, 31.9% did not know an estimated effectiveness, and over 30% would decrease condom use if they were to start the drug. While increasing awareness of PrEP in the public consciousness is important for wider implementation of the drug, there is an even greater need for adequate education, access to healthcare resources, and linkage to PrEP-related care among YMSM.

PrEP Use

The CDC estimates that around 10,000 people are using PrEP (36); however closer to 500,000 are considered high-risk candidates, indicating that PrEP is currently at only 2% of its maximal implementation in the U.S. (37). The paucity of data on PrEP use among YMSM makes it difficult to gauge whether use among participants in this study was low at 8.7%, but this percentage is consistent with the low uptake rates among MSM and all high-risk individuals in the U.S. For example, the most comprehensive uptake study to date used electronic prescription data from approximately 55% of all retail pharmacies across the U.S. and determined that 3,253 individuals initiated PrEP between January 2012 and April 2014, with 58% being men and only 7.4% being men under 25 years of age (22). Taking into consideration that this study did not capture those accessing PrEP through Medicaid, demonstration projects, or open-label extensions, these data far undershoot the CDC's projected figure for high-risk candidates and indicate areas for improvement for PrEP uptake, particularly among YMSM.

Risk Compensation

While the majority of PrEP users reported no change or an increase in condom use, those using PrEP were found to have twice as many condomless sex partners and found to engage in 1.6 times as many CASA compared to non-users. Because PrEP users may be engaging in higher HIV risk behaviors at PrEP initiation, direct causality cannot be inferred. Rather, this pattern may reflect that those engaging in more condomless sex were more likely to opt for PrEP as a prevention strategy. However, risk compensation may be another explanation among this sample of YMSM given that participants cited the desire to have condomless sex, wanting to have sex with multiple partners, and going beyond their usual sexual risk-taking limits as motivations for PrEP use. Additionally, 31.2% of non-users indicated an increased likelihood of not using condoms if they were to adopt PrEP. These findings are inconsistent with prior research with MSM (10, 13, 26, 30), primarily from PrEP clinical trials conducted when PrEP efficacy was unknown, which found no risk compensation. Further research is needed with PrEP users outside the context of clinical trials to allow for a richer understanding of how decision-making occurs in the context of multiple effective prevention options (38). When effectiveness is better understood and disseminated, some individuals may opt to replace condom use with PrEP as their prevention choice (31).

Racial and Geographic Considerations

In this study, African-American and other race participants were less likely than White respondents to report awareness of PrEP, which was consistent with the findings in a study of New York City MSM surveying PrEP awareness on online dating sites in 2011 (21). However, a study of awareness and uptake of PrEP pre- and post-iPrEx among older MSM around the same time (September 2010 to January 2011) found no significant difference in awareness among racial or ethnic groups (9). African-American YMSM in this study were also more likely to cite structural barriers of lack of insurance and lack of knowledge of availability of PrEP; these prevention barriers may be a direct result of disparities in the socioeconomic determinants of health experienced by African Americans in the U.S. (39).

Because African-American YMSM are at highest risk for HIV acquisition (4), further research is needed to examine willingness to use PrEP among this population. One such effort of note is the HIV Prevention Trials Network 073 demonstration study that assesses the initiation and correlates of daily PrEP use among African-American MSM, including age, education, and risk behaviors, as well as PrEP adherence (40). Although medical distrust has been cited as a barrier to PrEP use among African-American MSM in the U.S. (16), there is promise for uptake among African-American YMSM given limited concerns regarding medication effectiveness, side effects, and relationship issues (e.g., "*My partner would react badly to finding out I was using the medication*") among participants in this study. Interestingly, the *One Thousand Strong* study found higher intentions to use PrEP among gay and bisexual men who were younger, African American, and who reported less education (41).

Closely linked with the racial differences in PrEP awareness and barriers to use, this study found geographic differences with respect to PrEP. Study participants in Atlanta, and those recruited nationally, were less aware of PrEP than those from Chicago and New York City and participants from New York City had higher PrEP use rates compared to all other participants. A number of factors by geographic region could be contributing to these findings. Atlanta has the highest poverty rate of the three cities (42), potentially suggesting that socioeconomic status may be affecting access to care and ability to cover costs of the medication. Related, 21.1% of Georgia's population lacks health insurance, while Illinois and New York had uninsured rates of 14.6% and 12.4%, respectively (43). Also, according to a survey of PrEP resources across the U.S., Atlanta currently has a limited number of private clinics offering the medication, while Chicago offers a number of dedicated PrEP clinics and PrEP-friendly healthcare providers, and the New York Metropolitan area has more than 40 clinics offering PrEP. These data, coupled with findings demonstrating that seven of the 10 states, and eight of the 10 metropolitan areas with the highest HIV prevalence rates were in the South (44), demand that this geographic area should represent a national priority for PrEP outreach efforts.

The Role of Healthcare Providers in PrEP Awareness and Uptake

Our findings emphasize that healthcare providers must play a major role in improving PrEP awareness and uptake in YMSM. Study participants who learned about PrEP from HIV service agencies and healthcare professionals were more likely to know a lot about the

medication, while those who heard about PrEP from friends and acquaintances were more likely to anticipate infrequent condom use while taking PrEP. Providers should be knowledgeable about the disproportionate risk of HIV in ethnic and racial minority YMSM, and particularly more extensively informed about PrEP efficacy, side effects, and proper use. They should also develop patient-education strategies for new users that reinforce concurrent condom use and stress the continued risk of STIs, which may decrease the potential for sexual risk compensation while on PrEP. Community organizations and HIV service agencies also play an important role in mitigating PrEP uptake barriers to allow more widespread access, especially for those without insurance. And finally, service agencies and healthcare providers must continue to deliver culturally competent care as research has shown that gay and bisexual men who disclosed their sexual orientation to their healthcare provider were more likely to report intentions for PrEP initiation (41).

Limitations

The results of this study should be considered in light of several limitations. The research was cross-sectional and does not allow inferences about causality. Additional study sites would have enabled a comprehensive geographic comparison of PrEP awareness and use among broader samples of YMSM. Because individuals in long-term, monogamous relationships were excluded from participation in this trial, these findings may not be generalizable to all MSM, particularly those in HIV serodiscordant relationships for whom PrEP may be a viable prevention option. The self-reported sexual risk data may suffer from social desirability bias; however, the surveys were administered by computer, thus minimizing bias associated with reporting sexual risk behaviors to a person. The wording of the question to assess the impact of PrEP use on sexual behaviors was framed in a way that required awareness of the influences of PrEP on condom use. For this reason, the item wording (“*Since you began taking the medication, how has it affected your condom use?”)* may have resulted in an underestimation of behavioral changes following PrEP initiation. That is, participants may have decreased condomless anal sex after starting PrEP but may not have attributed their sexual behavior change to PrEP use directly. Future longitudinal research should examine the frequency of condom use before and after PrEP initiation, and then probe for reasons for any changes in condom use patterns. This study only assessed PrEP use over the past 3 months, potentially excluding past users who may have discontinued the medication for various reasons. Given the low number of PrEP users in this research, the study may have been underpowered to detect significant differences between PrEP users and non-users, though differences in ethnic and sexual orientation identities approached significance.

Despite these limitations, this was the first study to rigorously examine real world PrEP knowledge and use in a diverse sample of YMSM in multiple U.S. cities and contributes to the small body of literature examining PrEP in this population. Future studies should continue to examine disparities in PrEP awareness and use patterns over time, as new research and historical events (e.g., iPrEx in 2011, FDA approval in 2012, widespread media campaigns in 2013) continue to influence the course of PrEP implementation in the U.S. In addition, the suggestion of condom discontinuation among YMSM who use PrEP in this research underscores the need for further exploration.

CONCLUSIONS

Given that recent studies are reporting 86% effectiveness rates in reducing the risk of new HIV infections (26, 27), and the fact that Medicaid and private companies are currently covering the cost of PrEP, a large gap exists between acceptability and use. In line with previous research (10), there were no demographic differences in PrEP acceptability, suggesting that those disproportionately affected by HIV would be equally likely to consider PrEP if they had access to the same resources. The demographic characteristics that put YMSM at higher risk for acquiring HIV, including younger age, limited education, and underemployment, are also characteristics that render YMSM less likely to be adequately informed about PrEP, despite being the best candidates for its use. Special targeting of these YMSM is warranted to increase awareness, knowledge, and uptake of PrEP. In practice, primary care specialists and other healthcare providers may be the ideal point of access and education for PrEP candidates and stronger efforts should be made to connect YMSM to routine general and sexual healthcare services.

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Table I

Demographic characteristics.

	Total (N = 759)
	n (%)
Race	
African American	146 (19.6)
White	393 (52.8)
Multiracial	90 (12.1)
Other	116 (15.6)
Hispanic Ethnicity	212 (28.0)
Sexual Orientation	
Gay	652 (86.0)
Bisexual	79 (10.4)
Other	27 (3.6)
Education	
≤ High school	92 (12.1)
Some college	211 (27.8)
College degree	360 (47.5)
Graduate degree	95 (12.5)
Employment	
Unemployed	166 (21.9)
Full time	388 (51.3)
Part time	203 (26.8)
Age	
Mean years (SD)	24.2 (2.9)

Table II

Demographic differences in PrEP awareness.

	Total[a] (N = 693)	Not aware of PrEP[b] (N = 225)	Aware of PrEP[c] (N = 468)	X^2 (p-value)
	Col %	Row %	Row %	
	n (%)			
Race				
African American	132 (19.4)	55 (41.7)	77 (58.3)	**17.6 (0.001)**
White	362 (53.2)	93 (25.7)	269 (74.3)	
Multiracial	81 (11.9)	26 (32.1)	55 (67.9)	
Other	106 (15.6)	45 (42.5)	61 (57.5)	
Hispanic Ethnicity	200 (28.9)	75 (37.5)	125 (62.5)	3.25 (0.07)
Sexual Orientation				
Gay	593 (85.6)	184 (31.0)	409 (69.0)	4.41 (0.11)
Bisexual	77 (11.1)	33 (42.9)	44 (57.1)	
Other	23 (3.3)	8 (34.8)	15 (65.2)	
Education				
≤High	87 (12.6)	46 (52.9)	41 (47.1)	**45.3 (<0.001)**
Some college	199 (28.7)	86 (43.2)	113 (56.8)	
College degree	324 (46.8)	78 (24.1)	246 (75.9)	
Graduate degree	83 (12.0)	15 (18.1)	68 (81.9)	
Employment				
Unemployed	154 (22.3)	56 (36.4)	98 (63.6)	**9.81 (0.007)**
Full time	349 (50.4)	94 (26.9)	255 (73.1)	
Part time	189 (27.3)	74 (39.2)	115 (60.8)	
Age Mean years (SD)	24.2 (2.9)	23.1 (3.0)	24.7 (2.8)	**t = −7.10 (<0.001)**

[a] Of the total sample of 759, this number represents the total number of participants who reported no PrEP use.

[b] Not aware: *"Never heard of it before today"* and *"Heard about it, but didn't really know what it was."*

[c] Aware: *"Know a little bit about it," "Know a fair amount about it,"* and *"Know a lot about it."*

Table III

Demographic differences in PrEP use.

	Used PrEP (N = 66)	Not Used PrEP (N = 693)	X^2 (p-value)
	N (%)		
Race			
African American	15 (23.1)	131 (19.3)	0.97 (0.81)
White	31 (47.7)	362 (53.2)	
Multiracial	9 (13.9)	81 (11.9)	
Other	10 (15.4)	106 (15.6)	
Hispanic Ethnicity	12 (18.2)	200 (28.9)	3.44 (0.06)
Sexual Orientation			
Gay	60 (90.9)	592 (85.6)	5.26 (0.07)
Bisexual	2 (3.0)	77 (11.1)	
Other	4 (6.1)	23 (3.3)	
Education			
≤ High school	5 (7.6)	87 (12.6)	5.56 (0.14)
Some college	13 (19.7)	198 (28.6)	
College degree	36 (54.6)	324 (46.8)	
Graduate degree	12 (18.2)	83 (12.0)	
Employment			
Unemployed	12 (18.2)	154 (22.3)	2.54 (0.28)
Full time	40 (60.6)	348 (50.4)	
Part time	14 (21.2)	189 (27.4)	
Age **Mean years (SD)**	24.7 (2.8)	24.2 (2.9)	t = −1.44 (0.15)