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## Factors associated with awareness and use of pre-exposure prophylaxis (PrEP) among Black men who have sex with men with a recent STI diagnosis

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### ABSTRACT

Black men who have sex with men (BMSM) with a recent STI diagnosis are at particularly high risk for HIV infection and, as such, are a population for whom we must focus our anti-retroviral pre-exposure prophylaxis (PrEP) implementation efforts. Understanding the factors that are associated with awareness and use of PrEP among BMSM with a recent STI diagnosis is a critical component of meeting our HIV prevention goals. For the current study, BMSM ( $N=209$ ) diagnosed with a STI in the past year residing in the Atlanta, Georgia metropolitan and surrounding areas were assessed on PrEP awareness and use, HIV risk behaviors (e.g., condomless anal intercourse) HIV risk perceptions, HIV treatment optimism, and HIV status communication self-efficacy. BMSM aware of PrEP ( $n=152$ , 72.7%) were younger in age (OR = 0.96, 95% CI: 0.93-0.98,  $p=0.030$ ) and had significantly higher educational attainment (OR = 1.96, 95% CI: 1.28-3.02,  $p=0.027$ ) than PrEP unaware participants. In addition, participants who were aware of PrEP had significantly higher levels of HIV risk perceptions (OR = 1.27, 95% CI: 1.04-1.56,  $p=0.019$ ) than PrEP unaware participants. Finally, participants who had ever used PrEP ( $n=15$ , 7.1%) had significantly higher HIV treatment optimism (OR = 1.55, 95% CI: 1.05-2.96,  $p=0.034$ ) than PrEP non-users. The present study showed that, while nearly three-fourths of the sample were PrEP aware, PrEP use among BMSM with STI diagnoses was limited and that PrEP is utilized *less* often by individuals who have less HIV treatment optimism. These findings call attention to the need to better understand how to effectively target PrEP uptake strategies for key populations.

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Black men who have sex with men; pre-exposure prophylaxis; PrEP; STI

### Introduction

Despite the fact that HIV transmission has declined overall in the United States, HIV infection rates among gay, bisexual, and other men who have sex with men (MSM) have remained stable or have *increased* among some subpopulations of MSM, including young adult MSM and racial/ethnic minority MSM.<sup>1</sup> African-American or Black MSM (BMSM) are disproportionately affected by HIV, as this population accounts for 30% of all MSM living with HIV and 40% of new HIV diagnoses among MSM.<sup>2</sup> Further, a recent study by Matthews et al.<sup>3</sup> found that, if current transmission rates continue, approximately 60% of BMSM could be HIV infected by the time they are 40 years of age. While there is consensus around the critical importance of targeting BMSM for HIV prevention, treatment, and care services,<sup>4</sup> high transmission rates continue to persist among BMSM, and we are failing to both adequately and comprehensively address their needs.

STI transmission is a robust predictor of HIV seroconversion, and therefore, timely treatment of STIs and access to HIV prevention options among BMSM with STI diagnoses are critical strategies for slowing the HIV epidemic. In studies by Millett et al.,<sup>5,6</sup> BMSM, despite similar levels of engagement in sexual risk taking, have been found to be significantly more likely than MSM of other races/ethnicities to be diagnosed with STIs. This finding suggests that the elevated rate of HIV among BMSM may at least in part be explained by higher rates of STIs. Overall, the link between STIs and subsequent HIV infection is well-documented. (Ward & Rönn<sup>7</sup>; i.e., STIs cause direct mucosal disruption, the presence of HIV susceptible cells in the genital compartment, and increased HIV viral load in plasma and genital secretions) Previous studies have found that rectal STIs, in particular, strongly increase the risk of HIV.<sup>8,9</sup> Furthermore, other studies have confirmed a relationship between

STI diagnoses and higher rates of perceived discrimination and socioeconomic disadvantage that may discourage adequate engagement in healthcare and HIV prevention services.<sup>10,11</sup> To date, however, there is little known about the extent to which BMSM with STI diagnoses, in particular, are aware of, and able to access, HIV prevention options.

Oral HIV pre-exposure prophylaxis (PrEP) through a once-daily tablet containing a fixed dose combination of tenofovir disoproxil fumarate and emtricitabine (FTC-TDF) has been shown to be highly effective in reducing the risk of HIV infection.<sup>12–14</sup> Despite this advancement, adequate inclusion of BMSM in PrEP clinical efficacy trials has been of concern since the beginning of PrEP-focused work.<sup>13</sup> Along similar lines, there is growing evidence that the gap between BMSM and other MSM that exists for multiple HIV prevention and healthcare services is being mirrored with PrEP.<sup>15</sup> Perhaps as a result, Eaton and her colleagues<sup>16</sup> have found that PrEP awareness among BMSM has remained minimal in the years following its approval by the U.S. Food and Drug Administration (FDA) in July of 2012. Most recently, Gupta, Lounsbury, and Patel<sup>17</sup> found that approximately one-third of MSM know about PrEP, with trends suggesting less awareness of PrEP among BMSM compared with other MSM.

Of BMSM who are aware of PrEP, there is evidence from multiple studies that their interest in and willingness to take PrEP is growing.<sup>18,19</sup> However, despite high levels of interest in PrEP among those who are aware of it, relatively few BMSM have utilized the drug. A study published by Arrington-Sanders et al.<sup>18</sup> found that a small minority of BMSM were taking PrEP (8%) despite the fact that the majority reported condomless anal intercourse (CAI; 66%), a recent healthcare visit (54%), and willingness to take PrEP (62%). Moreover, in their study, Rolle et al.<sup>19</sup> found that 35% of BMSM who were offered PrEP actually initiated PrEP; however, 16% of individuals who initiated PrEP subsequently discontinued the medication. The authors found that persons who used PrEP were significantly older in age, more educated, had higher incomes, were more likely to identify as gay as opposed to bisexual or other, and had not tested positive for an STI in the prior 12 months. The fact that BMSM diagnosed with STIs were *less* likely to be taking PrEP is concerning given the strong link between STIs and HIV infection, as well as the high likelihood of them having engaged in sexual risk taking behaviors.<sup>5</sup>

In 2015, Kelley and her colleagues theorized a PrEP care continuum, a model to be used to elucidate factors that are relevant to PrEP uptake. The four sequential steps in this continuum included: awareness and willingness to use PrEP, access to healthcare, receiving a PrEP prescription, and adherence to PrEP. Given preliminary evidence from Rolle et al.<sup>19</sup> that BMSM with a STI diagnosis are less likely to use PrEP despite need, it is important to examine factors that are associated with the first steps along the PrEP care continuum that lead into PrEP awareness and use for BMSM with a STI diagnosis. According to Kelley et al.,<sup>20</sup> as well as Golub et al.,<sup>15</sup> these factors may include HIV risk perceptions, HIV treatment optimism, HIV status communication self-efficacy, and HIV risk behaviors. Understanding whether and how these variables are associated with PrEP awareness and use for BMSM with a STI diagnosis will allow researchers and practitioners to enhance PrEP implementation and delivery for a population that may benefit greatly from this HIV prevention tool.

### **Study aims**

Given the high rates of HIV and other STIs that have been observed among BMSM and the high prevention efficacy of PrEP, as well as the robustness with which STIs operate as a risk factor for subsequent HIV infection,<sup>21</sup> the primary aims of the current study were to assess the factors that are associated with PrEP awareness and use among BMSM, specifically, BMSM with a laboratory confirmed STI diagnosis in the past 12 months (including chlamydia, gonorrhea, and/or syphilis). Factors that were explored included (1) HIV risk behaviors, (2) HIV risk perceptions, (3) HIV treatment optimism, and (4) HIV status communication self-efficacy.

### **Methods**

#### **Sampling, recruitment, and enrollment**

The present study, which was approved by *<blinded for peer review>* Institutional Review Board, is a part of a larger behavioral HIV prevention intervention trial.<sup>22</sup> Participants for the trial were BMSM recruited from gay-identified bars, clubs, bathhouses, parks, and street locations in the Atlanta, Georgia metropolitan and surrounding areas, as well as from online classifieds, and on social media (e.g., Facebook, Black Gay Chat, Jack'd). BMSM were screened in-person using electronic handheld devices and over the phone using screening software. For in-person screening

procedures, recruiters approached BMSM as they entered the abovementioned target venues. BMSM were eligible to participate if they reported CAI in the past year with a man, were HIV negative, and were at least 18 years of age. Study participants provided written informed consent for the study procedures. Participants attended up to four in-person appointments at the study research site over a 12-month period and were tested for gonorrhea, chlamydia, and syphilis at each appointment. At the baseline appointment, individuals were screened for HIV using the OraQuick ADVANCE Rapid HIV-1/2 Antibody Test, and individuals who tested HIV negative were eligible for study enrollment. Persons who tested HIV positive were linked to care and eligible for other study opportunities.

At the final, 12-month follow-up appointment, participants completed an assessment using Audio Computer Assisted Interviewing (ACASI) software. After their ACASI assessments were complete, participants were tested for HIV. Participants ACASI responses and HIV test results were used in the present study's analyses, which are described in the Data Analysis sub-section below.

Between December of 2012 and October of 2015,  $N=209$  study participants out of a total sample of  $N=549$  (38%) tested positive for one or more STIs during at least one of their study appointments. For the present study, only the participants who tested positive for at least one STI at their study appointment were included in our analyses. In addition, participants' 12-month follow-up assessment date was included as a variable in all of the bivariate and multivariable analyses (described below) to control for when during the data collection period each participant completed their 12-month follow-up assessment.

## Measures

### Socio-demographic characteristics

Participants were asked to report on their age, race, sexual orientation, education, and income.

### PrEP awareness and use

Participants were provided with written and verbal descriptions of PrEP that described both its use and timing (adapted from Eaton et al.<sup>16</sup>) Participants were then asked the following questions about PrEP: "Have you ever heard of PrEP?", "Have you ever used PrEP?", and "Are you currently taking PrEP?" Response set included *yes* (coded 1) or *no* (coded 0). Participants who reported being aware of PrEP were

then asked (a) whether they had ever used PrEP and (b) if they were currently on PrEP. Due to the small number of participants who used or were currently using PrEP, and because the participants who were currently taking PrEP also endorsed ever having used PrEP, those two variables were collapsed into one ever-use of PrEP variable.

### HIV risk behavior

Items regarding sex behaviors included number of male and female sex partners in the last three months, as well as the total number of CAI and condomless vaginal intercourse (CVI) acts in the past three months. In addition, participants were asked to report on the number of CAI acts they had engaged in the past three months that were (a) under the influence of alcohol or (b) under the influence of drugs.

### HIV risk perceptions

Participants were asked five questions<sup>23</sup> at the 12-month appointment regarding how much risk for HIV they perceived under certain sex behavior scenarios. Questions included "How risky is anal sex without a condom as the bottom partner with a man you just met who tells you his HIV status is negative?" Responses ranged from 0 = *no/low risk* to 10 = *very high risk*. These five items were averaged to create one risk perception variable, and higher scores indicated greater perceived risk associated with CAI. This measure demonstrated good internal consistency (Cronbach's  $\alpha = .84$ ).

### HIV treatment optimism

Participants were asked to respond to six items about the extent to which they felt optimistic about HIV treatment.<sup>23</sup> Items included "New treatments for HIV have brought hope for a cure" and "HIV is a less serious threat than it used to be because of new treatments". Response set for each question ranged from 1 = *strongly disagree* to 6 = *strongly agree*. Participants' scores were averaged across all six items to create one HIV treatment optimism variable, and higher scores indicated higher levels of HIV treatment optimism. This measure demonstrated acceptable internal consistency (Cronbach's  $\alpha = .71$ ).

### HIV status communication self-efficacy

The extent to which participants felt confident in their ability to discuss HIV status with a new sex partner was assessed.<sup>24</sup> Questions included "I am certain that I can ask a new sex partner his or her HIV status." Response set for each question ranged from

1 = *strongly disagree* to 6 = *strongly agree*. Participants' scores were averaged across all three items to create one HIV status communication self-efficacy variable, and higher scores indicated greater perceived ability to discuss HIV status with sex partners. This measure demonstrated good internal consistency (Cronbach's  $\alpha = .82$ ).

### Data analysis

For the current study, we sought to examine whether there were factors associated with PrEP awareness and PrEP use among BMSM diagnosed with STIs. Means and standard deviations or frequencies and percentages were provided for each variable (Table 1). Odds ratios (ORs) were calculated for identifying differences between PrEP aware and PrEP unaware BMSM, as well as differences between PrEP users and PrEP non-users, with respect to the above-mentioned demographic variables as well as the other variables of interest (Table 1 and Table 2). Generalized linear modeling (GLM) was used to conduct univariate regression analyses to assess the relationships between PrEP awareness and PrEP use as the dependent variables and (1) demographic variables, (2) HIV risk behavior, (3) HIV risk perceptions,

(4) HIV treatment optimism, and (5) HIV status communication self-efficacy as the independent variables (Table 3). Independent variables with  $p < .10$  in bivariate analyses were included in the multivariable analyses for PrEP awareness and PrEP use as the dependent variables. Multivariable analyses were conducted to establish which variables were uniquely associated with PrEP awareness and PrEP use (Table 3). Data analyses were completed between June 2017 and September 2017. Less than 5% of data were missing for any given variable. For all analyses,  $p < .05$  was used to define statistical significance. IBM SPSS® Statistics version 24.0 was used to conduct all analyses.

## Results

### Socio-demographic characteristics

Men who identified as gay/same gender loving comprised 62.2% ( $n = 130$ ) of the sample, while the remaining participants identified as bisexual (31.4%,  $n = 65$ ) or heterosexual (5.8%,  $n = 12$ ). The average age of participants was 31.6 ( $SD = 11.1$ , range = 19–73), and the average income for the sample was 2.06

**Table 1.** Demographic characteristics of  $N = 209$  BMSM diagnosed with STIs residing in the Atlanta, GA metropolitan and surrounding areas.

	PrEP awareness				PrEP use			
	PrEP unaware ( $n = 55$ )		PrEP aware ( $n = 152$ )		PrEP non-users ( $n = 136$ )		PrEP users ( $n = 15$ )	
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>
<i>Age</i>	35.6	13.5	30.2	9.8	30.6	10.1	26.4	5.4
<i>Education</i>	1.4	1.2	2.1	1.0	2.1	0.9	2.1	1.3
<i>Income</i>	1.7	1.3	2.2	1.5	2.2	1.4	2.3	1.6
	<i>N</i>	%	<i>N</i>	%	<i>N</i>	%	<i>N</i>	%
<i>Sexual orientation</i>								
Gay/same gender loving	30	54.5	100	65.8	89	65.4	11	73.3
Bisexual	22	40.0	43	28.3	40	29.4	3	20.0
Heterosexual	3	5.5	9	5.9	7	5.1	1	6.7
<i>HIV status</i>								
HIV-	51	92.7	139	91.4	124	91.2	14	93.3
HIV+	4	7.3	13	8.6	12	8.8	1	6.7

**Table 2.** Descriptives of the independent variables for the PrEP unaware, PrEP aware, PrEP non-users, and PrEP users groups.

Independent variables	PrEP awareness				PrEP use			
	PrEP unaware ( $n = 55$ )		PrEP aware ( $n = 152$ )		PrEP non-users ( $n = 136$ )		PrEP users ( $n = 15$ )	
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>
<i>Sex behaviors</i>								
Total # CAI acts in last 3 months	0.7	2.1	0.1	0.6	0.1	0.6	1.3	2.1
Total # CVI acts in last 3 months	1.3	3.7	0.3	1.1	0.3	0.4	0.1	0.3
Total # male partners in last 3 months	1.2	0.4	1.2	0.4	0.2	0.3	1.1	0.4
Total # female partners in last 3 months	0.6	1.3	0.2	0.6	0.2	0.6	0.1	0.3
<i>HIV treatment optimism</i>	4.1	0.9	4.2	1.0	4.1	1.0	4.7	1.1
<i>HIV status communication self-efficacy</i>	5.0	1.4	5.5	0.9	5.5	0.9	5.5	1.1
<i>HIV risk perceptions</i>	7.3	1.9	8.0	1.4	8.1	1.3	7.4	1.6

**Table 3.** Odds ratios from the bivariate and multivariable logistic regression models with PrEP awareness as the dependent variable.

Independent Variables	PrEP awareness <i>N</i> = 209		PrEP use <i>N</i> = 152	
	Bivariate model OR (95% CI)	Multivariable model OR (95% CI)	Bivariate model OR (95% CI)	Multivariable model OR (95% CI)
<i>Demographics</i>				
Age	0.98 (0.96-0.99)*	0.97 (0.94-0.99)*	0.94 (0.87-1.02)	
Sexual orientation				
Gay/same gender loving	ref		ref	
Bisexual	0.59 (0.30-1.13)		0.62 (0.16-2.36)	
Heterosexual	0.90 (0.23-3.54)		1.18 (0.13-10.60)	
Income	1.31 (1.02-1.69)*	1.10 (0.78-1.56)	1.03 (0.71-1.50)	
Education	2.10 (1.45-3.07)***	1.89 (1.22-2.94)**	0.97 (0.57-1.65)	
HIV status	0.90 (0.27-2.92)		1.46 (0.08-5.70)	
<i>Sex behaviors</i>				
Total # CAI acts in last 3 months	0.68 (0.49-0.96)*	0.89 (0.60-1.33)	1.19 (1.06-1.33)**	1.10 (0.97-1.27) <sup>a</sup>
Total # CVI acts in last 3 months	0.82 (0.70-0.96)**	0.88 (0.72-1.07)	0.72 (0.22-2.32)	
Total # male partners in last 3 months	0.98 (0.92-1.05)		1.16 (1.06-1.28)**	1.04 (0.83-1.13)
Total # female partners in last 3 months	0.66 (0.45-0.97)*	1.06 (0.66-1.72)	0.70 (0.21-2.36)	
<i>Alcohol and drug use during sex</i>				
# sex acts with alcohol in last 3 months	0.99 (0.98-1.01)		1.13 (1.02-1.26)*	1.10 (0.97-1.24)
# sex acts with drugs in last 3 months	1.03 (0.94-1.13)		1.10 (0.99-1.22) <sup>a</sup>	1.04 (0.91-1.18)
<i>HIV treatment optimism</i>				
HIV status communication self-efficacy	0.96 (0.69-1.33)		1.88 (1.01-3.54)*	1.49 (1.05-2.89)*
<i>HIV risk perceptions</i>				
	1.31 (1.08-1.58)**	1.30 (1.05-1.60)*	0.78 (0.58-1.05) <sup>a</sup>	0.82 (0.59-1.15)

Note. In the multivariable model with PrEP awareness as the outcome variable, 0 = PrEP unaware, 1 = PrEP aware. In the second multivariable model with PrEP use as the outcome variable, 0 = PrEP non-users, 1 = PrEP users.

<sup>a</sup> = trending relationship ( $p < .10$ ).

(corresponding to approximately \$12,000 annually;  $SD = 1.4$ , range = 1-6). The average level of education for the sample was, which corresponded to “some college,” was 1.91 ( $SD = 1.1$ ). For additional details on the sample’s socio-demographic characteristics, see Table 1.

Bivariate analyses revealed that PrEP aware and PrEP non-aware BMSM did not differ significantly with respect to sexual orientation; however, PrEP aware participants were significantly younger in age than PrEP non-aware participants (OR = 0.98, 95% CI: 0.96-0.99,  $p = 0.021$ ) and PrEP aware participants had significantly higher incomes than PrEP unaware participants (OR = 1.31, 95% CI: 1.02-1.69,  $p = 0.037$ ). In addition, PrEP aware participants had significantly higher educational attainment than PrEP unaware participants (OR = 2.10, 95% CI: 1.45-3.07,  $p = 0.001$ ). Finally, PrEP users and PrEP non-users did not significantly differ with respect to sexual orientation, age, education, or income.

While we found that a number of study participants tested positive for HIV at the 12-month follow-up appointment ( $n = 15/209$ , 7.2%), HIV status did not significantly differ by PrEP awareness or PrEP use groups.

### PrEP awareness and use

The majority of participants ( $n = 152$ , 73.4%) reported that they were aware of PrEP for HIV prevention. However, a minority of the sample reported ever having used PrEP ( $n = 15$ , 7.1% among the full sample and 9.9% among the sub-sample of BMSM who were PrEP aware).

### HIV risk behaviors

The average number of male partners in the past three months was 2.75 ( $SD = 4.25$ , range = 0-30), and the average number of female partners in the past three months was 0.34 ( $SD = 0.89$ , range = 0-8). Number of male partners did not differ between PrEP aware and PrEP non-aware participants, however, PrEP aware participants had significantly fewer female partners in the past three months (OR = 0.66, 95% CI: 0.45-0.97,  $p = 0.016$ ). In addition, PrEP users had a significantly greater number of male partners on average than did PrEP non-users (OR = 1.16, 95% CI 1.06-1.28,  $p = 0.012$ ), but did not differ with respect to female partners.

The average number of CAI acts in the past three months was 1.24 ( $SD=2.16$ , range = 0-27). Number of CAI acts were significantly less among PrEP aware persons than among PrEP unaware persons ( $OR=0.68$ , 95% CI 0.49-0.96,  $p=0.029$ ). Additionally, PrEP users had a significantly greater number of CAI acts in the past three months than PrEP non-users ( $OR=1.19$ , 95% CI 1.06-1.33,  $p=0.032$ ).

The average number of CVI acts in the past three months was 0.70 ( $SD=0.31$ , range = 0-4). Number of CVI acts were significantly less among PrEP aware persons than among PrEP unaware persons ( $OR=0.82$ , 95% CI 0.70-0.96,  $p=0.008$ ). PrEP users and PrEP non-users did not differ with respect to number of CVI acts.

PrEP aware and PrEP non-aware persons did not significantly differ with respect to the number of CAI acts in the past three months under the influence of alcohol or drugs. However, PrEP users had significantly more CAI acts in the past three months under the influence of alcohol than PrEP non-users ( $OR=1.13$ , 95% CI: 1.02-1.26,  $p=0.002$ ). In addition, PrEP users trended toward having more CAI acts under the influence of drugs ( $OR=1.10$ , 95% CI: 0.99-1.22,  $p=0.098$ ).

### **HIV risk perceptions**

The average HIV risk perceptions score for the total sample was 7.86 ( $SD=1.59$ , range = 0-9), indicating relatively high perceptions of risk. PrEP aware persons had significantly higher HIV risk perceptions than PrEP non-aware persons ( $OR=1.31$ , 95% CI: 1.08-1.58,  $p=0.008$ ). PrEP users, however, were trending toward having lower HIV risk perceptions than PrEP non-users ( $OR=0.78$ , 95% CI: 0.58-1.05,  $p=0.079$ ).

### **HIV treatment optimism**

The average HIV treatment optimism score for the total sample was 4.16 ( $SD=0.98$ , range = 1-6), indicating relatively high optimism about HIV treatments in the future. HIV treatment optimism did not differ between PrEP aware and PrEP non-aware persons, but PrEP users had significantly greater HIV treatment optimism than PrEP non-users ( $OR=1.49$ , 95% CI: 1.05-2.89,  $p=0.037$ ).

### **HIV status communication Self-Efficacy**

The average HIV status communication self-efficacy score for the total sample was 5.38 ( $SD=1.12$ ,

range = 1-6), indicating high levels of confidence discussing HIV status with new sex partners. PrEP aware persons felt significantly more confident discussing HIV status with new sex partners than PrEP non-aware persons ( $OR=1.34$ , 95% CI: 1.03-1.74,  $p=0.040$ ). PrEP users and PrEP non-users did not differ with respect to HIV status communication self-efficacy.

### **Multivariable logistic regression models with PrEP awareness and PrEP use as the dependent variables**

Two multivariable logistic regression models were conducted to determine the factors uniquely associated with the dependent variables of interest: PrEP awareness and PrEP use. The results of the following multivariable regressions are organized by dependent variable.

#### **PrEP awareness**

In the multivariable model with PrEP awareness as dependent variable, age, education, and HIV risk perceptions remained significant. PrEP aware persons were significantly younger in age ( $OR=0.97$ , 95% CI: 0.94-0.99,  $p=0.030$ ) and had significantly higher educational attainment ( $OR=1.89$ , 95% CI: 1.22-2.94,  $p=0.027$ ). In addition, participants who were PrEP aware had significantly higher levels of HIV risk perceptions ( $OR=1.30$ , 95% CI: 1.08-1.58,  $p=0.019$ ) than PrEP unaware participants.

#### **PrEP use**

In the multivariable model with PrEP use as the outcome variable, PrEP users had a significantly higher level HIV treatment optimism than did PrEP non-users ( $OR=1.49$ , 95% CI: 1.05-2.89,  $p=0.034$ ). In addition, PrEP users were trending toward having a greater total number of CAI acts in the past three months than PrEP non-users ( $OR=1.10$ , 95% CI: 0.97-1.27,  $p=0.079$ ).

### **Discussion**

Relatively little is known about the factors that are related to awareness and utilization of PrEP among BMSM, in particular, BMSM with a recent STI diagnosis.<sup>3, 16, 20, 25</sup> While these data were collected from late 2012 through to late 2015, recent estimates show that the landscape of PrEP awareness and use among community samples of BMSM have generally remained the same, such that rates have largely

remained stable in this population over time.<sup>19</sup> Further, there is emerging evidence for growing disparities between BMSM and MSM of other races/ethnicities with respect to PrEP implementation.<sup>26</sup> The present study serves as one step toward increasing our understanding of the factors that are associated with PrEP awareness and use among BMSM who have recently been diagnosed with a STI. BMSM with recent STI diagnoses are at disproportionately high risk for HIV infection<sup>27</sup> and may experience additional barriers to PrEP awareness and uptake as compared with their counterparts of other races/ethnicities, particularly their counterparts in the southeastern U.S.<sup>28</sup> Addressing the factors that are associated with awareness and use of PrEP among BMSM with a recent STI diagnosis will aid in improving targeted strategies to increase awareness and uptake of the drug in this key population in the future.

First, the results of the present study showed that, while nearly three-fourths of BMSM diagnosed with a STI were aware of PrEP, a small minority (7.1% of the full sample and 9.9% of the sub-sample of BMSM who are PrEP aware) reported ever having used the medication. These findings are quite similar to Goedel et al.'s findings<sup>29</sup> from their sample of MSM in Atlanta, GA, 77.4% of whom were aware of PrEP, and 11.9% of whom were currently using the medication. Our findings were also somewhat similar to another Atlanta-based study by Kelley et al.,<sup>20</sup> who found that, among their sample of BMSM, 50% were aware of PrEP, but only 28% reported that they had access to PrEP. The results of the present study, paired with Goedel et al.<sup>29</sup> and Kelley et al.'s<sup>20</sup> studies, demonstrate that there is a significant gap between awareness and use of PrEP among BMSM, including among BMSM who have been recently diagnosed with a STI. While awareness of PrEP is key for successful implementation, there are likely additional, unique barriers specifically to PrEP use for this population that must be further explored and addressed.

Second, our study highlights the importance of HIV treatment optimism in the context of PrEP use among BMSM with a recent STI diagnosis. We found that PrEP users had significantly higher levels of HIV treatment optimism than their PrEP non-using peers. While it is true that this finding is in opposition to the results of other studies,<sup>30</sup> it is possible that it can be explained by the fact that individuals who are more optimistic about the future of HIV treatments may be more knowledgeable about available HIV treatments generally, including using HIV treatments

as PrEP, and/or may be better connected to health care and HIV prevention services where PrEP may be discussed and accessed. Further, it is possible that PrEP users are more optimistic about HIV treatments due to their direct experiences with using PrEP to manage their HIV-related risks. The repackaging of HIV medications for HIV prevention, from a biomedical standpoint has been a significant breakthrough, and those who have directly benefitted from this progress (i.e., PrEP users) may be more optimistic about continued HIV treatment progress.<sup>31</sup>

Third, we found that an alarming number of study participants tested positive for HIV at the 12-month follow-up appointment (7.2%). This HIV seroconversion rate is strikingly high and supports previous arguments that PrEP implementation among BMSM at risk for HIV must be a top public health priority.<sup>3,19</sup> We found that there were no differences in PrEP awareness and use between individuals who did and did not seroconvert at the end of the study; however, the pattern of PrEP awareness and use among participants who tested HIV positive at the final follow-up appointment appeared to mirror the pattern that was observed in the full sample. Specifically, participants who tested HIV positive reported awareness of PrEP at about the same rate as the overall sample (76.5%). These results, paired with the alarmingly high seroconversion rate among this sample, underscore the urgent need to address factors beyond PrEP awareness to improve uptake and sustained use of the medication among BMSM at risk for HIV, including those with a recent STI diagnosis.

Fourth, the present study highlights the importance of improving efforts to effectively disseminate information about PrEP.<sup>32</sup> Our study found that BMSM with recent STI diagnoses who were PrEP aware were significantly younger and achieved higher levels of education than those who were unaware of PrEP. This finding is in may be at least partially the consequence of research and outreach efforts around PrEP adoption that have largely focused on MSM who are younger and more educated.<sup>33,34</sup> Strategies promoting PrEP awareness among BMSM with a recent STI diagnosis who are older in age and/or who have lower levels of educational attainment must be prioritized.

Fifth, we found a significant positive association between PrEP awareness and HIV risk perceptions such that the likelihood of being aware of PrEP increased as HIV risk perceptions also increased. This finding is similar to that of other studies about PrEP and HIV risk perceptions,<sup>35</sup> which have found that PrEP aware individuals typically report being



somewhat concerned or very concerned about becoming HIV infected, and that perceived higher risk for HIV infection may serve as a motivator to remain up-to-date about available HIV prevention options. Although individuals' HIV risk perceptions do not always accurately reflect their actual risk,<sup>36</sup> in the future, it will be especially important to target individuals with low HIV risk perceptions for PrEP awareness efforts. A study by Gallagher et al.<sup>37</sup> found that, among their sample of MSM who were determined to be PrEP candidates, only 22% of them perceived that their risk was significant enough to warrant PrEP use. In the present sample of BMSM with a recent STI diagnosis and reported HIV sexual risk behavior (i.e., CAI), individuals with reported low levels of HIV risk perceptions may be under-estimating their level of risk. Public health efforts in the future will need to educate this population about personal risk assessment and various HIV prevention strategies, including PrEP.<sup>37</sup>

The present study's findings must be interpreted in light of the following limitations. Specifically, the data presented in this study were collected with a cross-sectional approach; therefore, any conclusions based on causality or directions of specific relationships cannot be made. In addition, participants in the current study were recruited primarily from LGBT-friendly venues or through online venues targeted toward LGBT populations, such as online dating websites or apps, which may have resulted in sampling bias.

## Conclusions

The current study highlights the factors that are associated with PrEP awareness and use among a key population for HIV prevention, BMSM with a recent STI diagnosis. In creating interventions aimed at improving awareness and use of PrEP for this population, researchers and community agencies must put forth even stronger efforts to reach BMSM with a recent STI diagnosis. In addition, factors beyond PrEP awareness must be addressed to improve uptake of PrEP among BMSM; doing so may further increase the rates of PrEP use for this group who have the potential to greatly benefit from this advancement.

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## References

- Centers for Disease Control and Prevention (CDC). HIV among gay and bisexual men. Published February 2017. <https://www.cdc.gov/nchhstp/newsroom/docs/factsheets/cdc-msm-508.pdf>.
- Centers for Disease Control and Prevention (CDC). Data are estimates from all 50 states, the District of Columbia, and 6 U.S. dependent areas. vol 25. *HIV Surveillance Report 2013*. Published February 2015. <http://www.cdc.gov/hiv/library/reports/surveillance/>.
- Matthews DD, Herrick AL, Coulter RW, POWER Study Team, et al. Running backwards: consequences of current HIV incidence rates for the next generation of Black MSM in the United States. *AIDS Behav*. 2016;20(1):7–16.
- Pettifor A, Nguyen NL, Celum C, et al. Tailored combination prevention packages and PrEP for young key populations. *J Int AIDS Soc*. 2015;18(2(Suppl 1):19434.
- Millett GA, Peterson JL, Wolitski RJ, et al. Greater risk for HIV infection of black men who have sex with men: a critical literature review. *Am J Publ Health*. 2006;96(6):1007–1019.
- Millett GA, Peterson JL, Flores SA, et al. Comparisons of disparities and risks of HIV infection in black and other men who have sex with men in Canada, UK, and USA: a meta-analysis. *Lancet*. 2012;380(9839):341–348. doi:10.1016/S0140-6736(12)60899-X.
- Ward H, Rönn M. The contribution of STIs to the sexual transmission of HIV. *Curr Opin HIV AIDS*. 2010;5(4):305.
- Bernstein KT, Marcus JL, Nieri G, et al. Rectal gonorrhea and chlamydia reinfection is associated with increased risk of HIV seroconversion. *JAIDS*. 2010;53(4):537–543.
- Chin-Hong PV, Husnik M, Cranston RD, et al. Anal human papillomavirus infection is associated with HIV acquisition in men who have sex with men. *AIDS (London, England)*. 2009;23(9):1135. doi:10.1097/QAD.0b013e32832b4449.
- Ayala G, Bingham T, Kim J, Wheeler DP, Millett GA. Modeling the impact of social discrimination and financial hardship on the sexual risk of HIV among Latino and Black men who have sex with men. *Am J Publ Health*. 2012;102(S2):S242–S249.
- Irvin R, Wilton L, Scott H, et al. A study of perceived racial discrimination in Black men who have sex with men (MSM) and its association with healthcare utilization and HIV testing. *AIDS Behav*. 2014;18(7):1272–1278.
- Grant RM, Lama JR, Anderson PL, et al. Preexposure chemoprophylaxis for HIV prevention in men who have sex with men. *New Eng J Med*. 2010;363(27):2587–2599.

13. Krakower D, Mayer KH. What primary care providers need to know about preexposure prophylaxis for HIV prevention: a narrative review. *Ann Intern Med.* 2012; 157(7):490–497.
14. Leibowitz AA, Parker KB, Rotheram-Borus MJ. A US policy perspective on oral preexposure prophylaxis for HIV. *Am J Publ Health.* 2011;101(6):982–985.
15. Golub SA, Gamarel KE, Rendina HJ, et al. 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(4):248–254.
16. Eaton LA, Driffin DD, Smith H, et al. Psychosocial factors related to willingness to use pre-exposure prophylaxis for HIV prevention among black men who have sex with men attending a community event. *Sex Health.* 2015;11(3):244–251.
17. Gupta S, Lounsbury DW, Patel VV. Low awareness and use of preexposure prophylaxis in a diverse online sample of men who have sex with men in New York City. *J Assoc Nurses AIDS Care.* 2017;28(1):27–33.
18. Arrington-Sanders R, Rosenberger JG, Matson P, et al. Factors associated with emotional satisfaction during first anal intercourse in a sample of YMSM. *J Homosex.* 2016;63(7):968–984.
19. Rolle CP, Rosenberg ES, Siegler AJ, et al. Challenges in Translating PrEP Interest into Uptake in an Observational Study of Young Black MSM. *JAIDS.* 2017;76(3):250.
20. Kelley CF, Kahle E, Siegler A, et al. Applying a PrEP continuum of care for men who have sex with men in Atlanta, Georgia. *Clin Infect Dis.* 2015;61(10): 1590–1597.
21. Koblin BA, Husnik MJ, Colfax G, et al. Risk factors for HIV infection among men who have sex with men. *AIDS.* 2006;20(5):731–739.
22. Eaton LA, Kalichman SC, Kalichman, Driffin MO, et al. Randomised controlled trial of a sexual risk reduction intervention for STI prevention among men who have sex with men in the USA. *Sex Transm Infect.* 2017; 94(1):40–45. doi:10.1136/sextrans-2016-052835.
23. Kalichman SC, Eaton LA, Cain D, et al. HIV treatment beliefs and sexual transmission risk behaviors among HIV positive men and women. *J Behav Med.* 2006;29(5):401–410.
24. Eaton LA, West TV, Kenny DA, et al. HIV transmission risk among HIV seroconcordant and serodiscordant couples: dyadic processes of partner selection. *AIDS Behav.* 2009;13(2):185–195.
25. Smith DK, Toledo L, Smith DJ, et al. Attitudes and program preferences of African-American urban young adults about pre-exposure prophylaxis (PrEP). *AIDS Educ Prevent.* 2012;24(5):408–421.
26. Liu AY, Cohen SE, Vittinghoff E, et al. Preexposure prophylaxis for HIV infection integrated with municipal and community-based sexual health services. *JAMA Intern Med.* 2016;176(1):75–84. doi:10.1001/jamainternmed.2015.4683.
27. Sullivan PS, Peterson J, Rosenberg ES, et al. Understanding racial HIV/STI disparities in black and white men who have sex with men: a multilevel approach. *PLoS One.* 2014;9(3):e90514. doi:10.1371/journal.pone.0090514.
28. Elope L, Kudroff K, Westfall AO, et al. Brief Report: The Right People, Right Places, and Right Practices Disparities in PrEP Access Among African American Men, Women, and MSM in the Deep South. *JAIDS.* 2017;74(1):56–59.
29. Goedel WC, Halkitis PN, Greene RE, et al. HIV risk behaviors, perceptions, and testing and preexposure prophylaxis (PrEP) awareness/use in Grindr-using men who have sex with men in Atlanta, Georgia. *J Assoc Nurses AIDS Care.* 2016;27(2):133–142.
30. Mimiaga MJ, Case P, Johnson CV, et al. Preexposure antiretroviral prophylaxis attitudes in high-risk Boston area men who report having sex with men: limited knowledge and experience but potential for increased utilization after education. *JAIDS (1999).* 2009;50(1):77–83.
31. 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(5):e64038. doi:10.1371/journal.pone.0064038.
32. Golub SA, Gamarel KE, Lelutiu-Weinberger C. The importance of sexual history taking for PrEP comprehension among young people of color. *AIDS Behav.* 2017;21(5):1315–1324.
33. Hosek SG, Rudy B, Landovitz R, et al. An HIV preexposure prophylaxis demonstration project and safety study for young MSM. *JAIDS (1999).* 2017;74(1): 21–29.
34. Liu A, Cohen S, Follansbee S, et al. Early experiences implementing pre-exposure prophylaxis (PrEP) for HIV prevention in San Francisco. *PLoS Med.* 2014; 11(3):e1001613. doi:10.1371/journal.pmed.1001613.
35. Corneli AL, Deese J, Wang M, et al. FEM-PrEP: adherence patterns and factors associated with adherence to a daily oral study product for pre-exposure prophylaxis. *J Acquir Immune Defic Syndr.* 2014;66(3): 324–331. doi:10.1097/QAI.0000000000000158.
36. Plotzker R, Seekaew P, Jantarapakde J, et al. Importance of Risk Perception: Predictors of PrEP Acceptance Among Thai MSM and TG Women at a Community-Based Health Service. *JAIDS.* 2017;76(5): 473–481. doi:10.1097/QAI.0000000000001536.
37. Gallagher T, Link L, Ramos M, et al. Self-perception of HIV risk and candidacy for pre-exposure prophylaxis among men who have sex with men testing for HIV at commercial sex venues in New York City. *LGBT Health.* 2014;1(3):218–224.