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Prevalence and Risk Factors for Rectal and Urethral Sexually Transmitted Infections from Self-Collected Samples Among Young Men Who Have Sex With Men Participating in the *Keep It Up! 2.0* Randomized Controlled Trial

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Abstract

Background—Despite recommendations that sexually active men who have sex with men be regularly tested for sexually transmitted infections (STIs) and that testing reflect anatomical sites of potential exposure, regular testing is not widely performed, especially for rectal STIs. As such, little is known about the prevalence of rectal and urethral STIs among young men who have sex with men (YMSM).

Methods—The current study examined the prevalence and risk factors for rectal and urethral chlamydia and gonorrhea in a sample of 1,113 YMSM ages 18 to 29 (mean: 24.07 years). Before participating in a randomized controlled trial for an online HIV prevention program (*Keep It Up! 2.0*), participants completed self-report measures and self-collected urine and rectal samples. Participants mailed samples to a laboratory for nucleic acid amplification testing. Viability of self-collected samples was examined as a potential method to increase STI screening for MSM without access to STI testing clinics.

Results—Results indicated that 15.1% of participants tested positive for an STI, 13.0% for a rectal STI, 3.4% for a urethral STI, and 1.2% for both rectal and urethral STIs. Rectal chlamydia was significantly more common (8.8%) than rectal gonorrhea (5.0%). Rectal STIs were higher among Black YMSM compared to White YMSM. Additionally, rectal STIs were positively associated with condomless receptive anal sex with casual partners.

Conclusions—Findings call attention to the need for healthcare providers to test YMSM for rectal STIs. This study also demonstrates the viability of including self-collected samples for STI testing in an eHealth program.

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Conflicts of Interest

There are no conflicts of interest to report.

Keywords

men who have sex with men; sexually transmitted infections; rectal; urethral; young adults

INTRODUCTION

The Centers for Disease Control and Prevention (CDC) recommends that sexually active men who have sex with men (MSM) be regularly tested for chlamydia (CT) and gonorrhea (GC), and that testing reflect the anatomical sites of potential exposure¹. Despite recommendations, regular sexually transmitted infection (STI) testing is not widely performed, particularly for rectal STIs. In a sample of HIV-positive MSM in 6 US cities, annual screening rates for STIs were 13.8–18.3% for urethral STIs and 2.3–8.5% for rectal STIs². HIV-positive MSM receiving care are likely to have more access to STI testing and as such these rates may overestimate STI testing rates among all MSM. Further, young MSM (YMSM) are less likely than adult MSM to regularly test for STIs³. Given that YMSM have the highest rate of new HIV diagnoses among all age and risk groups⁴ and that STIs are associated with HIV transmission risk⁵, research is needed to understand the prevalence of STIs and their risk factors in this population.

There is relatively limited data on the prevalence of rectal and urethral STIs among YMSM. In a 2014 sample of HIV-negative MSM across 26 STI clinics, prevalence was 5.7% for urethral CT, 7.5% for rectal CT, 8.6% for urethral GC, and 5.5% for rectal GC⁶. Prevalence was lower in a US national sample of HIV-negative MSM⁷, such that 1.4% tested positive for urethral CT, 4.4% for rectal CT, 0.5% for urethral GC, and 1.8% for rectal GC. In a community sample of HIV-negative MSM, rectal STIs were also more common than urethral STIs and CT was more common than GC⁵.

In addition, few studies have examined risk factors for STIs among MSM. Grov and colleagues⁷ found that younger MSM had greater odds of STIs compared to older MSM, and Latino MSM had greater odds of rectal STIs compared to White MSM. Number of male partners was a risk factor for both urethral and rectal STIs, whereas number of receptive/insertive anal sex acts and number of receptive condomless anal sex (CAS) acts were risk factors for rectal STIs only. Engaging in both insertive and receptive anal sex was associated with increased odds of rectal STIs (compared to insertive sex only) and urethral STIs (compared to receptive sex only). Kelley and colleagues⁵ also found that prevalence of rectal CT/GC and urethral GC were higher for Black MSM compared to White MSM.

Regarding other contextual factors, there has been debate in the field regarding the association between CAS and meeting partners online or through apps⁸, but very little research has examined the association with STIs. One of the most frequently cited risk factors for CAS is drug use⁹, whereas results have been inconsistent for alcohol use¹⁰. One study found that methamphetamine use before sex was associated with self-reported STIs among adult MSM¹¹ and another study found that club drug use was associated with diagnoses of HIV and syphilis among MSM in China¹². However, associations between substance use and diagnosed rectal and urethral CT/GC among YMSM remain unexamined.

Despite increased research on STIs among MSM in recent years, several gaps remain. While Grov and colleagues⁷ provided the first national US data on STI prevalence among HIV-negative MSM, the average age of their sample was 40 and the majority identified as White. Given that younger, Black, and Latino MSM have higher prevalence of STIs^{5,7}, it is important to examine the prevalence among YMSM, including those of color. The current study examined: (1) the prevalence of STIs in a large US sample of HIV-negative YMSM (ages 18–29) that included a large percentage of men of color (65.7%); and (2) demographic, behavioral, and contextual risk factors. Additionally, the current study examines the feasibility and acceptability of using remote self-collected testing for urethral and rectal STIs among YMSM. Prior studies suggest that self-collection is feasible and acceptable⁷, but it is unclear if this generalizes to YMSM.

MATERIALS AND METHODS

Study design and population

Keep It Up! 2.0 is a randomized controlled trial (RCT) of an online HIV prevention program for YMSM. Information about the intervention and the design of the RCT can be found in previous articles¹³. Participants were recruited in-person in Atlanta, Chicago, and New York City from HIV testing clinics, health department clinics, street outreach, referrals from ongoing studies, as well as through national advertisements¹³. In clinics, upon an HIV-negative test result staff explained the study and offered an eligibility screener. For online recruitment, participants completed screeners online and provisionally eligible participants either obtained an HIV test at a participating site in Atlanta, Chicago, or New York City or were mailed an FDA-approved at-home HIV test. Eligible participants were HIV-negative, age 18–29 years, assigned a male sex at birth, currently identified as male, reported CAS with a male in the past 6 months, were not in a behaviorally monogamous relationship for longer than 6 months, were able to read English at an 8th grade level, and had a functioning email address.

The current study uses pre-intervention data from 1,113 participants who completed the assessment between June 2013 and December 2015. Participants completed online self-report measures and self-collected samples for rectal/urethral CT/GC testing. Sample collection could be completed at a recruitment clinic or at home. Those who did it at home were mailed test kits with a placemat that identified all of the materials contained in the shipping container and provided instructions for sample collection (including a link to a video demonstrating collection) and how to return the samples to the laboratory using pre-paid shipping containers. Participants who tested positive were provided with results via phone and/or through an encrypted and password protected email message and with local referrals for free or low cost treatment. Positive results were reported to the health department where the participant resided. Procedures were approved by the affiliated institutional review boards.

Laboratory procedures

Specimens were self-collected using the Aptima Urine and Unisex Swab Specimen Collection Kits and tested for CT/GC by the CDC Division of STD Prevention Laboratory

using the Aptima Combo 2 CT/NG Assay (Hologic Gen-Probe, San Diego, CA). Specimens were analyzed on the Aptima Panther automated platform system, which has a sensitivity of 94.4–98.7% and specificity of 99.7–99.8% when male urine is tested for CT/GC¹⁴. A prior validation study by the laboratory indicated >95% sensitivity and >99% specificity for rectal swabs; values that are similar to prior validation studies^{15,16}.

Measures

Demographics—Participants reported their age, race/ethnicity, sexual orientation, relationship status, and student/employment status.

Behavioral characteristics—The HIV-Risk Assessment for Sexual Partnerships (H-RASP) assessed sexual behaviors in the past 3 months on a partner-by-partner basis for the three most recent partners and in aggregate for additional partners¹⁷. Items used in the current study include: number of partners with whom participants had CAS, count of insertive or receptive CAS acts with each partner, whether partners met online, and drug use before sex.

Frequency of drug use in the past 3 months was measured with an adaptation of the National Institute on Drug Abuse modified Alcohol, Smoking, and Substance Involvement Screening Test (ASSIST)¹⁸. Pre-exposure prophylaxis (PrEP) use was measured with one question: “Have you taken anti-HIV medications in the past 3 months prior to engaging in high-risk sexual behavior (sometimes called PrEP, Truvada, ‘taking a T’ or using the 3 Vs)?” The wording of this question was finalized before PrEP received FDA-approval and the dosing schedule was determined. Participants were asked during their lifetime which (if any) STIs they were diagnosed with and how many times they were tested for HIV. To reduce the effects of possible spurious outliers, responses to number of past HIV tests were winsorized by transforming values above three standard deviations to that value. Frequency of condom failures in the past 3 months was measured with the condom failure subscale of an adapted version of the Condom Use Errors and Problems Questionnaire¹⁹ (e.g., “As a bottom during anal sex in the last 3 months, how often did the condom break during sex?”). Responses were on a 5-point scale (1 = never, 5 = always) and summed across items.

Analyses

We calculated the prevalence of urethral/rectal CT/GC and descriptive statistics for demographics and behavioral characteristics. Likelihood ratio confidence intervals for binomial proportions were calculated for STI prevalence. Chi-square tests and bivariate/multivariate logistic regressions were used to examine associations between demographics and behavioral characteristics and STIs. Analyses were run with three outcomes: (1) urethral STIs; (2) rectal STIs; and (3) total (urethral and rectal) STIs. Analyses were conducted in SPSS 24.

RESULTS

Demographic and behavioral characteristic data are presented in Tables 1 and 2. The average age of participants was 24.07 (SD = 3.00). Of 1,113 participants, 1,001 returned STI kits

(89.9% overall return rate: 992 both rectal and urine, 3 rectal only, and 6 urine only). STI prevalences are reported in Table 3. Of those with urethral STIs, 35.3% also had rectal STIs. Of those with rectal STIs, 9.3% also had urethral STIs. Overall, 1.2% ($n = 12$) tested positive for both rectal and urethral STIs. CT was more common than GC for rectal (8.8% vs. 5.0%) and urethral (2.6% vs. 0.9%) infections, and these differences were significant based on non-overlapping 95% confidence intervals.

Results of chi-square tests for demographic and categorical predictors of rectal STIs are presented in Tables 1 and 2. Results are only reported for rectal STIs, because there were no significant associations for urethral or total STIs. The only significant predictor was CAS in the previous 3 months. Rectal STIs were higher among those who had receptive CAS only (19.4%) compared to those who had both receptive and insertive CAS (12.6%), those who did not have CAS in the previous three months (but engaged in CAS sometime in the previous six months to be eligible for KIU) (11.8%), and those who had insertive CAS only (8.2%). There were no significant differences in the chi-square models based on participant age, sexual orientation, race/ethnicity, relationship status, employment status, PrEP use, meeting sexual partner online, previous STI diagnosis, or drug use prior to sex.

Bivariate logistic regression results for continuous predictors of rectal STIs are in Table 4. Older participants were significantly less likely to have a rectal STI, with each year of age decreasing the odds by 6% (OR = .94; CI: .88–1.00). Marijuana use in the previous 3 months (OR = 1.09; CI: 1.01–1.18) was significantly associated with higher odds of rectal STIs. Sensitivity analyses were conducted to examine non-linear effects of independent variables at theoretically meaningful cut points (e.g., any drug use versus number of drugs) and results were consistent.

Results for all independent variables in a multivariate logistic regression model are in Table 5. Rectal STIs were significantly higher for Black compared to White YMSM (OR = 1.74; CI: 1.00–3.02). This effect was not significant in bivariate analyses and only emerged as significant in the multivariable analysis that included other cofactors. Receptive CAS with a casual partner was significantly associated with higher odds of rectal STIs (OR = 1.60; CI: 1.05–2.46), whereas insertive CAS with a casual partner was significantly associated with lower odds of rectal STIs (OR = .60; CI: .40–.92). No other effects were significant in the multivariable analysis.

DISCUSSION

We found a high prevalence of STIs in our sample, most of which were rectal. Our prevalence was slightly higher than previous studies^{6,7}, which is likely due to our study requiring participants to have recently engaged in CAS. Our sample was also younger and had a higher proportion of racial minorities, both of which are risk factors for rectal STIs^{5,7}. Consistent with this, the prevalence of rectal STIs in our sample was higher among younger and Black participants. Also consistent with previous studies of MSM^{5,7}, CT was more common than GC and rectal STIs were more common than urethral STIs. Such high prevalence of rectal STIs are concerning given that regular STI testing is not widely performed, especially for rectal STIs², and that younger MSM are also less likely to

regularly test for STIs³. This puts YMSM at higher risk for having an unknown rectal STI, contributing to forward transmission to partners.

Several potential explanations have been proposed for why rectal STIs are more common than urethral STIs among MSM⁷. First, YMSM may not recognize that they have rectal STIs, because they are often asymptomatic or symptoms are less noticeable than with urethral STIs²⁰. Second, providers and patients may be uncomfortable with rectal STI testing²¹. Third, YMSM may have a misconception that urine/blood tests for other STIs will detect STIs at all anatomical sites²². Fourth, nucleic acid amplification tests for extragenital CT/GC have not been FDA-approved despite CDC recommendations for their use²³, so providers need to utilize labs that performed a validation study demonstrating acceptable sensitivity/specificity for the testing of rectal swabs.

The prevalence of rectal STIs was higher among Black compared to White MSM in our sample and previous research^{5,7}. There was also a trend for a higher prevalence among Latinos. Black MSM have the highest prevalence of new HIV diagnoses and the rate is increasing for Latino MSM⁴. Given the established association between STIs and HIV transmission risk⁵, detecting and treating rectal STIs may reduce racial disparities in HIV. While population-based STI treatment among heterosexuals in Africa was not found to decrease HIV transmission²⁴, populations with high-risk behaviors and high prevalence of STIs may benefit more than populations with generalized epidemics²⁵. A simulation estimated that 14.6% of HIV infections among YMSM were due to CT/GC, with the majority attributed to rectal infections²⁶. Another study estimated that nearly 15% of HIV infections may have been prevented if rectal STIs had not occurred⁵. Thus, identifying risk factors for rectal STIs has the potential to inform prevention efforts, promote detection and treatment, and reduce STI/HIV transmission. Screening MSM for rectal STIs has been shown to be cost-effective (or cost-saving depending on assumptions), based on its impact in averting new HIV infections²⁷.

Consistent with Grov and colleagues⁷, we found that receptive CAS was associated with rectal STIs. In fact, 19.4% of YMSM who reported receptive CAS had rectal STIs. Prevalence of rectal STIs were also high among those who did not report recent CAS in the previous three months (11.8%) and those who only reported insertive CAS (8.2%), suggesting that recent receptive CAS should not be the sole criterion for rectal STI testing. The small number of urethral STIs may have limited our ability to detect similar significant associations between CAS and urethral STIs.

Although we found a significant bivariate association between marijuana use and rectal STIs, it became non-significant in a multivariable analysis and we did not find a significant association between polydrug use and STIs. The reduced effect of marijuana use in the multivariable analysis implies a potential indirect effect via receptive CAS that should be investigated in future longitudinal studies that can test mediation. Similarly, Grov and colleagues found that the association between drug use and rectal STIs became non-significant after accounting for demographics.

The current findings have important implications for clinical practice and future research. Given that most of the STIs in our sample were rectal, providers who only utilize urine-based testing will miss the majority of CT/GC among YMSM. If we had only utilized urine-based testing, we would have missed 117 people who tested positive for rectal STIs, but negative for urethral STIs (77.5% of those who tested positive for any STI). Some participants denied recent receptive anal sex, but tested positive for rectal STIs. These participants may be more likely to underreport their behavior, or may have acquired a rectal STI prior to the past three months, given that rectal STIs may persist for a year without treatment²⁸. The cross-sectional nature of our study limited our ability to test temporality. It will be important for future research to use longitudinal designs to test whether the risk factors are associated with incident STI diagnoses over time. It is also possible that some men felt uncomfortable disclosing that they had engaged in receptive anal sex even in our online survey. If true, it is likely that they will be even less comfortable disclosing this to a clinician. Clinicians are encouraged to create a nonjudgmental environment to facilitate discussions of sexual health by including questions about sexual orientation and behavior on intake forms and initiating these conversations. When assessing sexual health, all males should be asked about insertive and receptive sexual behavior with male and female partners. For researchers, it is important to separate insertive and receptive anal sex in analyses. We found that they had opposite associations with rectal STIs, which would have been overlooked if they were not separated or we focused on broad measures like number of CAS partners.

Our study demonstrated that distance self-collection of specimens for STI testing is feasible, which is important because it provides an opportunity to increase the coverage of STI screening for MSM, including rural MSM and MSM who do not have access to clinics offering rectal testing. Rectal STI screening has been found to be acceptable in a large cohort of urban MSM provided with collection kits at clinic visits⁵ and in a national online sample of MSM⁷, but our data provide additional validation that the method is acceptable to young MSM. Our study did not test for pharyngeal STIs because they have less implications for susceptibility to HIV infection²⁹. However, pharyngeal specimen collection has been demonstrated to be acceptable to MSM³⁰, and could readily be added to future studies of self-collected specimens for STI testing among YMSM.

The current findings call attention to the high prevalence of rectal STIs among YMSM and the need for healthcare providers to screen and test for them. They also point to risk factors that can be targeted by prevention programs to reduce incident STIs. Additionally, our study demonstrates the feasibility and acceptability of using self-collected samples for urethral/rectal STI testing among YMSM in the context of an eHealth intervention. It also demonstrates how home-based sample collection can be used to deliver STI testing without geographic boundaries as part of an eHealth program.

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Demographic Associations with Rectal STI Prevalence Among YMSM Aged 18 – 29 Participating in the Keep It Up! Randomized Controlled Trial,
United States, 2013 – 2015

Table 1

	Total		Negative		Positive		Chi-square	P Value
	N (%)	N (%)	N (%)	N (%)	N (%)	N (%)		
Age								
18–24	529 (53.2)	451 (85.3)	78 (14.7)	3.17	0.075			
25–29	466 (46.8)	415 (89.1)	51 (10.9)					
Sexual Orientation								
Gay	860 (86.4)	747 (86.9)	113 (13.1)	1.42	0.493			
Bisexual	113 (11.4)	98 (86.7)	15 (13.3)					
Other	22 (2.2)	21 (95.5)	1 (4.5)					
Race/Ethnicity								
White	349 (35.1)	315 (90.3)	34 (9.7)	5.68	0.129			
Black	249 (25.0)	213 (85.5)	36 (14.5)					
Latino/Hispanic	300 (30.2)	253 (84.3)	47 (15.7)					
Other/Multiracial	97 (9.7)	85 (87.6)	12 (12.4)					
Relationship Status								
Casual Partner/Single	800 (80.6)	692 (86.5)	108 (13.5)	0.94	0.331			
Serious Partner	193 (19.4)	172 (89.1)	21 (10.9)					
Student/Employment Status								
Student + Employed	255 (25.7)	225 (88.2)	30 (11.8)	0.86	0.834			
Employed	524 (52.7)	457 (87.2)	67 (12.8)					
Student	110 (11.1)	95 (86.4)	15 (13.6)					
Neither	105 (10.6)	89 (84.8)	16 (15.2)					

Abbreviation: STI, Sexually transmitted infection; YMSM, young men who have sex with men

Bivariate Associations with Rectal STI Prevalence Among YMSM Aged 18 – 29 Participating in the Keep It Up! Randomized Controlled Trial, United States, 2013 – 2015

Table 2

		Total		Negative		Positive		Chi-square	P Value
		N (%)	N (%)	N (%)	N (%)	N (%)	N (%)		
Met Partner Online	Yes	696 (69.9)	606 (87.1)	90 (12.9)	0.00	0.961			
	No	299 (30.1)	260 (87.0)	39 (13.0)					
PrEP Before Risky Sex (Last 3 months)	Yes	103 (10.4)	91 (88.3)	12 (11.7)	0.18	0.675			
	No	892 (89.6)	775 (86.9)	117 (13.1)					
Previous STI (self-report)	Yes	453 (45.6)	401 (88.5)	52 (11.5)	1.66	0.198			
	No	541 (54.4)	464 (85.8)	77 (14.2)					
Condomless Anal Sex (Last 3 Months)	No Condomless Anal Sex	238 (26.0)	210 (88.2)	28 (11.8)	12.21	0.007			
	Receptive	206 (22.5)	166 (80.6)	40 (19.4)					
	Insertive	208 (22.8)	191 (91.8)	17 (8.2)					
	Receptive + Insertive	262 (28.7)	229 (87.4)	33 (12.6)					
Drugs Before Sex (Last 3 Months, dich)	Yes	292 (29.3)	250 (85.6)	42 (14.4)	0.74	0.391			
	No	703 (70.7)	616 (87.6)	87 (12.4)					

Abbreviations: Dich, dichotomous; PrEP, pre-exposure prophylaxis; STI, Sexually transmitted infection; YMSM, young men who have sex with men.

Table 3

STI Prevalence Among YMSM Aged 18 – 29 Participating in the Keep It Up! Randomized Controlled Trial, United States, 2013 – 2015

	Negative	Positive	95% CI	
	N (%)		Lower	Upper
Any STI	850 (84.9)	151 (15.1)	12.9	17.3
Rectal STI	866 (87.0)	129 (13.0)	10.9	15.1
Rectal Chlamydia	907 (91.2)	88 (8.8)	7.2	10.8
Rectal Gonorrhea	945 (95.0)	50 (5.0)	3.7	6.4
Urethral STI	964 (96.6)	34 (3.4)	2.4	4.7
Urethral Chlamydia	972 (97.4)	26 (2.6)	1.7	3.7
Urethral Gonorrhea	989 (99.1)	9 (0.9)	0.4	1.6

Abbreviations: CI, confidence interval; STI, Sexually transmitted infection; YMSM, young men who have sex with men

Table 4

Bivariate Associations with Rectal STI Prevalence Among YMSM Aged 18 – 29 Participating in the Keep It Up! Randomized Controlled Trial, United States, 2013 – 2015

	<i>P</i> Value	OR	95% CI	
			Lower	Upper
Age (years, range: 18–29)	0.048	0.94	0.88	1.00
Condom Failure Scale (range: 0–11)	0.550	1.08	0.84	1.40
Number of Lifetime HIV Tests (range: 0–46)	0.428	0.99	0.97	1.01
Marijuana (Number of Times Used in Last 3 Months, range: 0–6)	0.038	1.09	1.01	1.18
Poly Drug (Number of Unique Illicit Drugs used in Last 3 Months, range: 0–5)	0.284	1.10	0.92	1.32
Number of Condomless Anal Sex Partners (Last 3 Months, range: 0–43)	0.999	1.00	0.95	1.06
Drugs Before Sex (Last 3 Months, mean score, range: 0–4)	0.658	1.05	0.86	1.28

Abbreviations: CI, confidence interval; OR, odds ratio; YMSM, young men who have sex with men.

Table 5

Multivariable Associations of Rectal STI Prevalence Among YMSM Aged 18 – 29 Participating in the Keep It Up! Randomized Controlled Trial, United States, 2013 – 2015

	<i>P</i> Value	OR	95% CI	
			Lower	Upper
Age	0.213	0.96	0.89	1.03
Sexual Orientation				
Bisexual/Other ^a	-	-	-	-
Gay	0.760	1.10	0.60	2.02
Race/Ethnicity				
White ^a	-	-	-	-
Black	0.050	1.74	1.00	3.02
Latino	0.100	1.53	0.92	2.54
Other	0.356	1.41	0.68	2.90
Relationship Status				
Single/Casual Partner ^a	-	-	-	-
Serious Partner	0.652	0.88	0.51	1.53
Previous STI (self-report, dichotomous)	0.402	0.83	0.54	1.28
Number of Lifetime HIV Tests (range: 0–46)	0.969	1.00	0.98	1.03
PrEP Before Risky Sex (Last 3 Months, dichotomous)	0.969	0.99	0.50	1.95
Met Partner Online (dichotomous)	0.685	1.10	0.89	1.38
Marijuana (Number of Times Used in Last 3 Months, range: 0–6)	0.278	1.06	0.95	1.19
Poly Drug (Number of Unique Illicit Drugs used in Last 3 Months, range: 0–5)	0.353	1.11	0.89	1.38
Drugs Before Sex (Last 3 Months, dichotomous)	0.934	0.98	0.56	1.69
Condom Failure Scale (range: 0–11)	0.746	1.05	0.80	1.37
Receptive Condomless Anal Sex Acts (non-serious, dichotomous)	0.031	1.60	1.05	2.46
Insertive Condomless Anal Sex Acts (non-serious, dichotomous)	0.017	0.60	0.40	0.92

Abbreviations: CI, confidence interval; aOR, adjusted odds ratio; PrEP, pre-exposure prophylaxis; STI, sexually transmitted infection; YMSM, young men who have sex with men.

^aReference Group