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Online sex partner seeking and HIV testing frequency among young Black sexual minority men

A. Lina Rosengren, MD, MPH, MS^a, Thibaut Davy-Mendez, MsPH^{a,b}, Lisa B. Hightow-Weidman, MD, MPH^a

^aDepartment of Medicine, University of North Carolina at Chapel Hill, Chapel Hill, North Carolina, USA

^bDepartment of Epidemiology, Gillings School of Public Health, University of North Carolina at Chapel Hill, Chapel Hill, North Carolina, USA

Abstract

Dating apps are a novel means of delivering HIV prevention messages. Young black sexual minority men (YBSMM) app users are at high risk for HIV and could benefit from frequent testing. Understanding testing behaviors among YBSMM is critical to inform tailored prevention interventions. We analyzed testing behaviors of 273 YBSMM, comparing typical testing frequency between app users and non-users using odds ratios. Overall, testing rates were high. App users were more likely than non-users to test at least every 12 months. App-using YBSMM exhibit high compliance with testing guidelines, which may indicate future successful uptake of biomedical preventions, such as Pre-Exposure Prophylaxis.

Keywords

HIV prevention; men who have sex with men; HIV testing

Introduction

Black sexual minority men (SMM) carry a disproportionate burden of HIV in the United States (Division of HIV/AIDS Prevention, National Center for HIV/AIDS, Viral Hepatitis, STD, and TB Prevention, Centers for Disease Control and Prevention), and are less often aware of their HIV infection (Oster et al., 2011). Sixty-eight percent of new HIV infections occur among SMM. While diagnoses decreased by 10% in 2016 among White SMM, they increased by 4% among Black SMM. HIV incidence is also highest among young persons, with incidence rates of 14,740 per 100,000 individuals age 20-29 in 2016 (N. C. f. H. A. Division of HIV/AIDS Prevention, Viral Hepatitis, STD, and TB Prevention, Centers for

Corresponding author: Lina Rosengren, Department of Medicine, University of North Carolina at Chapel Hill, 130 Mason Farm Road, Chapel Hill, NC 27599, Tel: 919.962.5110, Fax: 919.966.6714, lina_roho@med.unc.edu.

IRB approval

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Declaration of interest statement

The authors have no conflicts of interest to disclose.

Disease Control and Prevention,). Young Black SMM also have the lowest rates of engagement along the HIV care continuum (Marano et al., 2018). Despite the lack of firm correlations between risk behaviors and sex-seeking via apps, there is benefit to frequent HIV testing among young Black SMM (YBSMM) who use apps, and mHealth interventions therefore often target this population. (Hightow-Weidman et al., 2011). A more complete understanding of testing behaviors is needed to inform the development of tailored prevention interventions for maximum efficacy (Oster et al., 2014).

Early initiation of HIV treatment improves clinical outcomes and quality of life, prevents forward HIV transmission (Cohen et al., 2016), and is now universally recommended (Thompson et al., 2012). Routine HIV testing is essential to the diagnosis and early initiation of antiretroviral therapy (Workowski, 2015). The Centers for Disease Control and Prevention (CDC) recommends that clinicians screen asymptomatic sexually active men who have sex with men (MSM) at least annually and consider screening every three to six months for MSM at increased risk for HIV Infection (Workowski, 2015). While MSM, which includes SMM, has been the commonly used behavioral term, we use SMM in this paper to more broadly include variations in sexual behavior (Young and Meyer, 2005).

Young adults are increasingly finding sex partners using sex partner seeking mobile applications (apps) (Bauermeister, Leslie-Santana, Johns, Pingel, & Eisenberg, 2011; Francisco Luz Nunes Queiroz et al., 2017); individuals age 18-29 are the most frequent users (Bauermeister, et al., 2011). There is concern that SMM who find sex partners using apps are more likely to engage in risky sexual behaviors (Whitfield, Kattari, Walls, & Al-Tayyib, 2017). But studies of risk-taking with sex partners met on the Internet and via apps report mixed results. For example, a review by Francisco Luz Nunes Queiroz et al (2017) found several studies identified high frequency of condomless anal sex (CAS) with partners met via apps (Francisco Luz Nunes Queiroz, et al., 2017). The same review also found several studies that showed frequent partner changing among app-using MSM. Other studies show the opposite; SMM who use apps to find sex partners are more likely to use condoms than those SMM who find sex partners in other venues (Rice E et al., 2012). Nevertheless, CAS is often used as a marker for high-risk sexual behaviors (Lewnard and Berrang-Ford, 2014). Importantly, SMM consistently underestimate their risk for HIV (Blumenthal et al., 2019; Landovitz et al., 2013) and perception of HIV risk also does not consistently correlate with safe sex practices among SMM (Klein and Tilley, 2012).

The goal of this study was to describe testing frequency among YBSMM, and to compare HIV testing frequencies between YBSMM app users and non-users. Our hypothesis was that YBSMM app users get tested for HIV more frequently than non-users. We based this hypothesis on the data that show app users to be more likely to use sexual health resources (Macapagal et al., 2018), and express a desire to participate in online HIV prevention interventions (Holloway et al., 2014; Landovitz, et al., 2013). The STROBE guidelines were used to ensure the reporting of this observational study (von Elm et al., 2007).

Methods

[HealthMpowerment.org](https://www.healthmpowerment.org) (HMP) is an online mobile-phone optimized intervention for YBSMM that provides HIV and sexually transmitted infection (STI) prevention information and a social networking platform for peer support (Hightow-Weidman et al., 2019). A randomized controlled trial of HMP enrolled 474 YBSMM aged 18–30 years in North Carolina between November 2013 and October 2015. Recruitment included venue-based flyers, advertisements and messages on apps and social networking sites, and outreach at local case management organizations and HIV/STI clinics. YBSMM who had a mobile device with Internet access who met the following risk criteria in the past six months were eligible: CAS with a male partner, any anal sex with more than three male partners, exchange of money, gifts, shelter, or drugs for anal sex with male partner, or anal sex while under the influence of drugs or alcohol. Additional details regarding the parent study have been published (Hightow-Weidman, et al., 2019). Participants completed a baseline survey and follow-up assessments at three, six and twelve-months post enrollment. Baseline data were used in our study for a cross-sectional study design. Our study investigated the relationship between app use and HIV testing in YBSMM using the HMP study population and their responses to the baseline survey. We excluded participants who reported being HIV-positive (n=199) or did not respond to questions on HIV testing frequency (n=2). Participants who reported being HIV-negative (n=252), and those who reported HIV status as unknown (n=21) including those who had never been tested for HIV (n=15) were included, for a final sample size of 273 participants. The parent study and this secondary analysis were both approved by the University of North Carolina Institutional Review Board.

Study measures

The study exposure was defined as searching for a sex partner on any app within the past three months, including both apps specifically designed for finding romantic and sex partners as well as social networking apps that can also be used for other purposes. The primary outcome was defined as reporting a frequency of HIV testing of 12 months or more often, based on the survey question “How often do you typically test for HIV?” Participants who had never been tested for HIV were included in the lowest frequency category.

A Directed Acyclic Graph was constructed to identify all possible confounders of the exposure-outcome association (Greenland, Pearl, & Robins, 1999). The covariates identified were age, having health insurance, having a college degree, being single, having an HIV-positive partner, recent diagnosis of an STI, number of sex partners, engaging in transactional sex, and having a higher perceived risk of HIV, all reported for the prior three months. Perceived HIV risk was measured using a validated scale as a score ranging from 4 to 20 (lowest to highest perceived risk) based on the combined responses to four statements with 5-point Likert scales (DeHart and Birkimer, 1997). Study measures and definitions are further detailed in Supplemental Table 1.

In sensitivity analyses, we examined the impact of using six months rather than 12 as a threshold of testing frequency, and using other HIV testing survey questions. The additional survey questions examined were “When were you last tested for HIV?” and “In the past year, how many times have you been tested for HIV?”

Statistical analysis

We described the distribution of HIV risk factors and HIV testing frequencies in our sample. We compared demographic characteristics and survey responses of app users and non-users using chi square and Kruskal-Wallis tests. For the primary outcome and sensitivity analyses, we used logistic regression to estimate odds ratios (OR) comparing app users and non-users, unadjusted, and adjusted for all confounders listed above. In the sensitivity analysis examining the number of HIV tests in the past year, Poisson regression was used instead. SAS Software v. 9.4 (Cary, NC) was used for all analyses. All *P* values were two-sided, and <0.05 was considered statistically significant.

Results

The study sample consisted of 273 YBSMM, of which 196 (72%) had searched for a sex partner using an app in the prior three months. Overall, participants had a median age of 24 years (IQR 22-26), 70% were single, and a majority (65%) were high school educated. The median perceived HIV risk score was 10 (IQR 8-13), and 53 (19%) reported having serodiscordant sex in the past three months. A higher number of app users had a college degree (35% vs 17%, $P<0.05$), and were single (70% vs 56%, $P<0.05$) compared to non-users. A higher number of app users also reported having engaged in transactional sex (9.9% vs 1.5%, $p<0.05$), and been diagnosed with an STI in the past three months (10.3% vs 1.5%, $p<0.05$) than non-users. Additionally, app users had a higher number of median partners in the past three months (4 vs 1, $P<0.01$) and higher perceived risk of HIV (median risk score 11 vs 9, $P<0.01$) (Table 1).

HIV testing patterns

Almost all participants (95%) had previously been tested for HIV (Table 2). Overall, most participants reported that their last test was 3 months (52%) or 6 months prior (26%). Similarly, most participants reported a typical testing frequency of every 3 (35%) or 6 months (33%). Among participants engaging in transactional sex, 57% had been tested within the past 3 months. Among participants reporting serodiscordant sex, 65% had been tested within the past 3 months.

App use and HIV testing

App users were more likely to have ever been tested for HIV (Table 2, $P<0.01$). In unadjusted analyses, app users were more likely than non app users to get tested at least every 12 months, with an OR of 2.1 (95% CI 1.1-4.3) (Table 3). In adjusted models, app users had 2.4 times the odds of testing at least every 12 months compared to non-users (95% CI 1.0-5.5). When using a threshold of testing every six months or more often, app users still had higher odds of testing more frequently, with an adjusted OR of 2.1 (95% CI 1.1-3.9). In adjusted analyses, other factors associated with testing at least every 12 months were older age (OR per 1-year increase 1.4, 95% CI 1.2-1.6) and having health insurance (OR 3.0, 95% CI 1.3-6.7).

We conducted sensitivity analyses using last HIV test instead of typical testing frequency and obtained similar results. When using a threshold of testing every 6 months or more

often, app users were more likely to test more frequently, with an unadjusted OR of 1.5 (95% CI 0.9-2.7) and an adjusted OR of 2.1 (95% CI 1.0-4.0). Using a 12-month threshold, the unadjusted OR was 2.1 (95% CI 1.0-4.4) and the adjusted OR 3.2 (95% CI 1.3-7.5). Using multivariable Poisson regression with the number of HIV tests in the past year as outcome, app users had 1.4 times the rate of testing of non-users (95% CI 1.2-1.7), leading to the same conclusions as the main findings. In a sensitivity analysis, additionally adjusting for being in school, employed status, low income, and homelessness, the adjusted OR for app use was 2.6 (95% CI 1.1-6.0).

Reasons for infrequent or no HIV testing

The thirty-four respondents who had either tested over 12 months ago or never tested were asked 'which of the following best describes the most important reason you have not been tested for HIV in the past 12 months?'. The most common responses were 'no particular reason' (n=12, 35%), 'I think I'm at low risk for HIV' (n=6, 18%), 'I didn't have time' (n=5, 15%), and 'I was afraid of finding out that I had HIV' (n=4, 12%). There were no differences between app users and non-users (all $P>0.05$).

Discussion

In our sample of 273 YBSMM, a substantial proportion of participants reported HIV acquisition risk factors in the past 3 months including transactional sex (11%), STI diagnosis (12%), and serodiscordant sex (19%). Almost all participants had previously been tested for HIV, and two-thirds reported getting tested at least every 6 months. Participants who reported seeking sex partners online via apps in the prior 3 months reported getting tested for HIV more frequently than non-app users. These findings were consistent across four separate survey items about typical and actual HIV testing behaviors.

National HIV testing data show that nearly one-quarter of Black SMM ages 18-29 did not test for HIV within the preceding 12 months (Centers for Disease Control and Prevention, 2016 Jan). In contrast, in our study, only 7% had not been tested within the past 12 months. This may be a consequence of selection bias; those YBSMM who chose to participate in a study addressing HIV risk behaviors may be more likely to test than those who did not choose to participate. A meta-analysis (Noble, Jones, Bowles, DiNenno, & Tregear, 2017) of 32 studies of Internet-using SMM found that those individuals who are younger, self-identify as heterosexual or bisexual and those who use drugs are less likely to have ever tested for HIV. Another meta-analysis of studies in the US, UK, and Canada reported mixed results when comparing HIV testing between young Black SMM and other SMM (Millett et al., 2012). However, none of these studies compared app users to non-users. One prior study specifically investigated the relationship between seeking sex via apps and HIV testing among young SMM (Macapagal, et al., 2018). While this study only included a small portion of Black SMM, it demonstrated that SMM-specific app use was associated with a 2.9 times the odds of ever receiving an HIV test among a sample of adolescent SMM.

Perceived HIV risk has been found to be a facilitator of HIV testing, but there is limited research on what predicts consistent HIV testing among YBSMM (Frye et al., 2018). Yet, YBSMM are at the highest risk of acquiring HIV and are frequent users of apps, and as such

are often targeted for HIV testing campaigns and interventions (McGoy et al., 2018) The United Nation's 90-90-90 campaign (Joint United Nations Programme on HIV/AIDS (UNAIDS), 2014 Oct) aims to increase diagnosis of those infected to 90% by 2020. The 90-90-90 campaign also highlights data from the United Nations Gap Report, (Joint United Nations Programme on HIV/AIDS (UNAIDS), 2014 July) in which U.S. YBSMM are described as "people left behind" who should be targeted for testing. Macapagal et al found that app use was associated with higher perceived risk among adolescent SMM (Macapagal, et al., 2018). Our data similarly demonstrate that these individuals exhibit higher frequency of testing than non-users, have a higher perceived risk of HIV, and a higher number of sex partners, suggesting better HIV risk protection self-efficacy among app users than non-users.

YBSMM find mobile apps to be an acceptable means for HIV intervention (Holloway et al., 2017; Rosengren et al., 2016) and prior studies have provided evidence that mobile apps, such as sexual networking apps, are vehicles for YBSMM to access HIV prevention services (Hightow-Weidman et al., 2018; Muessig et al., 2013). Increased testing and knowledge of HIV prevention strategies among YBSMM app users may be a reflection of increasing mobile sexual health campaigns in recent years (Macapagal, et al., 2018). A number of mobile health (mHealth) interventions have been developed that target young, racially diverse SMM for HIV prevention and ART adherence (Bauermeister et al., 2019; LeGrand et al., 2018). Public health campaigns with potential for wider reach have also influenced HIV testing rates and other forms of HIV prevention self-efficacy in this population (Rendina, Jimenez, Grov, Ventuneac, & Parsons, 2014), and several studies have demonstrated the effectiveness of using dating apps as a means for HIV prevention behavior change among SMM (Rosengren, et al., 2016). Consistent with these studies, our study shows that app users are willing and able to access HIV prevention services, further demonstrating that mobile app prevention approaches have a high potential among YBSMM.

A small number of participants in our study (12%) had not been tested for HIV in the past year. The most common reasons for not testing included low risk perception and fear of HIV diagnosis. These findings highlight the importance of interventions aiming to reduce HIV stigmatization in YBSMM's communities. Instead of promoting testing based on individual risk behaviors, and simple provision of risk reduction information, interventions should focus on normalizing HIV testing as part of routine health care. While our population was small, it is possible that the reason they did not test was related to low perceived HIV risk, but we did not find a significant relationship by comparing perceived risk with testing frequency directly. We did not examine the drivers of risk perception further in our study. Given that HIV testing represents an entry point into the pre-exposure prophylaxis (PrEP) continuum, lack of HIV testing represents a missed opportunity for these individuals to enter into PrEP care. Lack of HIV testing may also be linked to financial barriers, as free testing has been shown to be associated with higher likelihood of HIV testing among US youth (Adebayo and Gonzalez-Guarda, 2017). In our study, older age and having insurance were associated with testing at least every 12 months. These findings underscore the importance of providing YBSMM with information on where to access free sexual health services.

This study has several limitations. A small sample size led to some estimates with wide confidence intervals in our analysis. Further, individuals with higher self-perceived HIV risk

may have been more willing to participate in the parent study. However, a survey (Jones et al., 2008) of YBSMM aged 18–30 years in North Carolina reported a similar distribution of age, education, employment, and sexual behavior, suggesting our sample is representative of our study population. Our findings may not be generalizable to older SMM and those of other race/ethnicity. Data on the use of PrEP was not available in this study, but uptake was extremely limited in this population at the time of the study (King et al., 2014) and is unlikely to have impacted our results substantially. Finally, self-reported measures may be subject to social desirability bias, though the use of computer-assisted self-interviewing has been shown to reduce bias substantially (Turner et al., 1998). The strengths of this study include granular data on sexual and HIV testing behavior among YBSMM in the southern US, the demographic group and US region most affected by HIV incidence, highlighting their self-efficacy in HIV prevention. These findings have implications for the scale-up of PrEP, as participants with HIV risk factors who adhere to routine sexual health screenings may be ideal candidates for this prevention intervention. Future studies should examine YBSMM's changes in behavior over time in response to sexual health interventions and safe sex message delivery on apps.

YBSMM who use mobile apps to find sex partners, and who are at substantial risk for HIV, display strong self-efficacy and more frequent HIV testing than YBSMM who do not use app users. These individuals exhibit high compliance with HIV testing guidelines, and awareness of HIV risk. These behaviors may be an indicator of future successful uptake of biomedical prevention strategies, such as Pre-Exposure Prophylaxis.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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Table 1.

Study population demographics overall and stratified by app use.

Characteristic	All participants (N=273) n (%) or median (IQR)	App users (n=196) n (%) or median (IQR)	Non-users (n=77) n (%) or median (IQR)	<i>p</i> ^a
Age	23 (20-25)	24 (21-26)	21 (19-23)	0.17
Currently enrolled in school	144 (53%)	100 (51%)	44 (57%)	0.36
College degree	81 (30%)	68 (35%)	13 (17%)	<0.01
Currently employed	187 (69%)	133 (68%)	54 (70%)	0.72
Income less than \$10,999 per year	139 (51%)	97 (49%)	42 (55%)	0.45
Homeless in last 3 months	37 (14%)	26 (13%)	11 (14%)	0.82
Has health insurance	177 (65%)	127 (65%)	50 (65%)	0.98
Single	180 (66%)	137 (70%)	43 (56%)	<0.05
Number of partners ^b	3 (1-5)	4 (2-7)	1 (1-2)	<0.01
Perceived HIV risk score	11 (8-13)	11 (10-13)	9 (6-12)	<0.01
Engaging in transactional sex ^b	31 (11%)	27 (14%)	4 (5%)	<0.05
STI diagnosis ^b	32 (12%)	28 (14%)	4 (5%)	<0.05

Abbreviations: IQR, interquartile range; STI, sexually transmitted infection.

^a*P* values were obtained from the Kruskal-Wallis test for continuous variables and chi square for dichotomous variables. Bolded estimates are statistically significant.^bWithin the past 3 months.

Table 2.

Reported HIV testing frequency using four instruments among all participants and stratified by app use.

Survey Responses	All participants (N=273)	App users (n=196)	Non-users (n=77)
Have you ever been tested for HIV?			
Yes	258 (95%)	190 (97%)	68 (88%)
When were you last tested for HIV?			
Within the past 3 months	135 (50%)	99 (51%)	36 (47%)
Three to six months ago	66 (24%)	50 (26%)	16 (21%)
Six to 12 months ago	37 (13%)	27 (14%)	10 (13%)
Longer than 12 months ago	20 (7%)	14 (7%)	6 (8%)
How often do you typically get tested for HIV?			
Every month	9 (3%)	6 (3%)	3 (4%)
Every 3 months	91 (33%)	70 (36%)	21 (27%)
Every 6 months	86 (32%)	64 (33%)	22 (29%)
Every year	47 (17%)	33 (17%)	14 (18%)
I don't typically get tested	25 (9%)	17 (9%)	8 (10%)
In the past year, how many times have you been HIV tested?			
Median (IQR)	2 (1-3)	2 (1-3)	2 (1-3)

Table 3.

Factors associated with reported HIV testing frequency every 12 months or more often.

Characteristic	Unadjusted OR (95% CI) ^a	Adjusted OR (95% CI) ^b
App use	2.1 (1.1-4.3)	2.4 (1.0-5.5)
Age	1.3 (1.2-1.5)	1.4 (1.2-1.6)
Insured	1.4 (0.7-2.9)	3.0 (1.3-6.7)
College degree	2.2 (0.9-5.2)	1.2 (0.4-3.5)
Single	1.4 (0.7-2.7)	1.3 (0.6-2.9)
HIV-positive partner ^c	0.7 (0.3-1.5)	0.7 (0.3-2.9)
STD diagnosis ^c	1.8 (0.5-6.1)	2.6 (0.6-12.5)
Number of partners ^c	1.0 (0.9-1.1)	1.0 (0.9-1.0)
Transactional sex ^c	1.7 (0.5-5.8)	1.6 (0.4-6.0)
Perceived HIV risk	0.9 (0.9-1.0)	0.9 (0.8-1.0)

^aOR and 95% CI from separate logistic regression models.^bOR and 95% CI from one logistic regression model including app use and covariates: age, insured, college degree, being single, HIV-positive partner, STI diagnosis, perceived HIV risk, number of partners, being single, and engaging in transactional sex.^cWithin the past 3 months.