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HIV Testing among Men who Have Sex with Men in the Northeastern United States

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Abstract

Men who have sex with men (MSM) continue to be at especially high risk for HIV in the United States. Past studies have shown that rates of HIV testing differ across a number of demographic and behavioral factors, and this research may be helpful for targeting efforts to increase testing among certain subgroups of MSM. In this study, MSM were recruited from several online sources to complete a questionnaire on HIV testing. Generalized ordered logit models suggested that the odds of having tested within the last 12 months were higher among racial/ethnic minority MSM, those with a college degree, and those who engaged in more recent HIV-risk behavior. The odds of having tested within the last 12 months were also higher among those who reported having sex with a partner they met online in the last 12 months. Conversely, the odds of having tested in the last 12 months were lower among those who reported drinking alcohol heavily, when compared with more moderate drinkers, highlighting yet another potential impact of alcohol on HIV outcomes.

Keywords

HIV; routine testing; gay and bisexual men; LGBT; internet

INTRODUCTION

In the United States, recent estimates suggest that approximately 20% of MSM who have HIV are unaware of their status (CDC, 2014), and modeling studies show that approximately 50% of new infections stem from these individuals (Hall, Holtgrave, & Maulsby, 2012). Testing is a cornerstone of HIV prevention efforts, since it can facilitate early diagnosis and treatment (i.e., “test and treat”) and may ultimately reduce HIV incidence through “treatment as prevention.” For this reason, current Centers for Disease Control and

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Conflicts of Interest

The authors have no conflicts of interest to report.

Prevention (CDC) guidelines suggest that MSM should be tested for HIV *at least* annually, but ideally every 3 to 6 months if they have had a new sex partner since their last test (CDC, 2015).

Past research has identified a number of demographic and behavioral factors that are associated with HIV testing among MSM in the US. For example, some studies have shown that demographic characteristics such as older age, having a college education, and gay or homosexual sexual orientation identity were associated with lifetime testing. Studies investigating racial/ethnic differences in testing, however, have shown mixed results, with some suggesting that racial/ethnic minority MSM may be more likely to have tested within their lifetimes or the past year (Johnson et al., 2016; Rendina, Jimenez, Grov, Ventuneac, & Parsons, 2014), and others suggesting no differences in testing rates between racial/ethnic minority MSM and White MSM (Khosropour, Johnson, Ricca, & Sullivan, 2013; Margolis, Joseph, Belcher, Hirshfield, & Chiasson, 2012). Several behavioral characteristics have also been identified. For example, studies have shown that those who have engaged in condomless anal sex (CAS) may be more likely to test (Rendina et al., 2014; Rowe et al., 2017), while others found that those who inject drugs may be less likely to test (Rowe et al., 2017). Using national survey data, Fenton et al. (2010) also showed that men and women who were classified as “hazardous drinkers” (according to criteria established by the National Institute on Alcohol Abuse and Alcoholism [NIAAA]) were less likely to have ever tested, compared with lighter drinkers. Similarly, in a study of MSM, Rowe et al. (2017) showed that heavy drinking was negatively associated with HIV testing. While difficult to synthesize given differences across samples and outcomes (i.e., lifetime testing versus recent testing), these study findings nevertheless contribute to both the scientific literature and public health efforts to identify at-risk subgroups that test less frequently than recommended.

Given that MSM increasingly use the internet to meet sex partners, understanding rates of HIV testing among MSM who use smartphone apps and internet websites to seek partners is of increasing interest (e.g., Noble, Jones, Bowles, DiNenno, & Tregear, 2016). Past studies suggest that internet-mediated sexual partnerships may be a frequent source of sexually-transmitted infections (e.g., Beymer et al., 2014), in part because these apps/sites provide quick access to more partners (Horvath, Rosser, & Remafedi, 2008; Liao, Millett, & Marks, 2006). At the same time, these apps/sites may also provide users with greater anonymity, which may lead to less social responsibility for safety (Balán, Carballo-Diéguez, Ventuneac, & Remien, 2009; Garofalo, Herrick, Mustanski, & Donenberg, 2007). Some past studies also suggest that a greater percentage of MSM who use apps/sites to meet partners do not identify as gay or may be on the “down low” (Rhodes, DiClemente, Cecil, Hergenrather, & Yee, 2002; Ross, Tikkanen, & Månsson, 2000) and so, may be uncomfortable testing for HIV regularly and less likely to engage with traditional clinical services (Rhodes, Bowie, & Hergenrather, 2003; Sanchez, Smith, Denson, DiNenno, & Lansky, 2012). Together, these studies raise concerns that MSM who use the internet to meet partners may be less likely to test for HIV regularly, while at the same time engaging in more risk. The few available studies exploring rates of HIV testing among MSM who meet partners online, however, show mixed results. For example, Rendina et al. (2014) showed that a higher proportion of MSM who use *Grindr* had never tested in their lifetimes, but that more *Grindr* users had

tested in the last year compared to MSM who did not use the app. Given their growing popularity, further research on rates of HIV testing among those who use the internet/smartphone apps to meet partners is needed, and may help guide prevention efforts aimed at increasing testing among those most at-risk.

In this study, we examined rates and predictors of having tested for HIV within CDC-recommended intervals among MSM in the northeastern US who were recruited from several online sources. Specifically, we explored whether certain demographic and behavioral factors were associated with having tested within at least the minimum recommended interval (every 12 months), as well as those that were associated with having tested with the more optimal recommended interval (every 6 months).

METHOD

Participants

Participants were recruited from the greater Boston, Massachusetts and Providence, Rhode Island areas from June 2016 to June 2017. Participants were recruited from a variety of online sources, including social media platforms (e.g., Facebook, Instagram, Reddit, and Craigslist) and MSM-oriented smartphone dating apps (e.g., Grindr and Scruff). Eligible participants were (1) males, (2) over age 18, (3) who reported anal sex with another man in the past 12 months, (4) self-reported being HIV-negative or unsure, and (5) were able to read in English. Those who reported (6) currently taking pre-exposure prophylaxis (PrEP) were excluded, since these individuals should receive HIV testing as a part of routine PrEP care.

Procedures

Advertisements placed on each of these platforms inquired about participants' interest in participating in an online survey on "gay and bisexual men's health." Those expressing interest were directed to a survey landing page, where they were provided with information about the study before completing the full survey. Online questionnaires were developed and hosted using Qualtrics survey software (Qualtrics, LLC). To ensure that participants were unique, they were required to enter complete, unique contact information at the end of the survey, including first and last name, email address, and phone number. Those who did not or who completed multiple entries were excluded from analyses. Multiple survey entries from the same IP address were blocked to prevent "ballot stuffing." The survey took an average of 15 minutes to complete, and participants were not paid. Procedures were approved by the Brown University Institutional Review Board.

Measures

Demographics—The survey inquired about participants' demographic characteristics, including age, gender, relationship status, income, education, race, ethnicity, and sexual identity.

Sex with Partners Met Online—A single yes/no item was used to assess whether participants had engaged in sex (oral or anal) with a male partner they met online in the last 12 months.

HIV Testing and other behavioral variables—HIV testing was assessed by first asking participants whether they had tested for HIV in their lifetime, followed by an item asking about how long ago they last tested for HIV. Participants could use an interactive calendar to respond to this question to aid in recall and could report only month and year if they were unsure. *Sexual risk behavior* was assessed by asking participants whether they had *ever* engaged in anal sex without a condom or without having taken PrEP with a partner outside of an exclusive, monogamous sexual relationship. A follow-up item assessed when this behavior last occurred, and participants could use an interactive calendar to assist them in responding. *PrEP use* was assessed by asking participants whether they had been prescribed PrEP in the last six months and whether they were currently taking PrEP.

Alcohol and drug use/problems—Three items assessed participants' recent (i.e., past 30 days) pattern of alcohol use, including their drinking frequency (*Never to 4+ times per week*), drinking quantity (*1 or 2 drinks on each occasion to 10 or more*), and frequency of "binge" drinking, or having 5 or more drinks on one occasion (*Never to Daily or almost daily*). The Alcohol Use Disorders Identification Test (AUDIT) was used to assess alcohol-related problems in the past 12 months. The AUDIT is a 10-item questionnaire that is one of the most commonly used screening instruments for alcohol-use disorders and has excellent reliability and validity (Allen, Litten, Fertig, & Babor, 1997). Those who scored ≥ 8 were classified as high-risk for alcohol-related problems. The Drug Abuse Screening Test (DAST-10) was used to assess drug-related problems, and those who scored ≥ 3 were classified as high-risk for drug-related problems (Skinner, 1982). Finally, a single item was used to assess whether participants had used injection drugs in the past three months.

Data Analysis

We first examined the final dataset thoroughly, excluding those who provided any incomplete or duplicate contact information. We then explored variables of interest for extreme or implausible values and outliers, and deleted these cases listwise. Next, we calculated descriptive statistics for the study variables. We then generated an ordinal response variable that reflected whether participants had tested within the minimum CDC-recommended interval of 12 months, versus within the more ideal 6-month interval. As such, this outcome variable was coded *0* if participants had not tested within the last 12 months, *1* if they had tested within the last 12 months but not the last 6 months, and *2* if they had tested within the last 6 months. Then, we created indicator variables for binary predictors and calculated descriptive statistics for the sample and each outcome category. Indicator variables reflecting meaningful comparisons were generated for categorical demographic and behavioral predictors. For example, age was categorized into general age groups, with *0* = 18–24 year olds, *1* = 25–34, and *2* = >35 years old. "Minority status" reflected participants who reported race other than White and/or Hispanic/Latino ethnicity. "Low income" reflected participants who reported personal income $< \$30,000$, which is less than a living wage in urban northeastern cities. Consistent with criteria used by the National Institute on Alcohol Abuse and Alcoholism (NIAAA), "hazardous drinking" participants were those who had ≥ 5 drinks on a single occasion in the past month or ≥ 14 drinks in a typical week.

While we initially estimated an ordinal logistic model with time since last test as the outcome, likelihood ratio ($\chi^2[24]=120.6, p < .001$) and Brant tests ($\chi^2[24]=114.7, p < .001$) suggested that several predictors did not meet the parallel regressions assumption (i.e., that the relationship between each predictor and outcome level is the same). As such, we then estimated a partial proportional odds model using the ordinal testing variable as the outcome (Williams, 2006). This model allowed us to estimate separate odds ratios for only those explanatory variables for which the association appeared to vary across each outcome category. Odds ratios were used to interpret associations between each predictor and the model outcome.

RESULTS

Descriptive Statistics

Overall, 1,506 MSM completed the entire survey and met basic eligibility criteria for the study (see Table 1 for descriptive statistics). Of those who were eligible, 54% reported having tested for HIV within the last 6 months, 15% reported having tested within the last 12 months, and 31% reported having last tested 12 months or more in the past.

Partial Proportional Odds Model of HIV Testing in the Past Year or 6 Months

The full proportional odds model ($LR\chi^2[15]=146.7, p < .001$) provided an overall odds ratio for each predictor that reflected the odds of having tested within the last 12 months versus 12 months or more ago. However, when the odds ratios comparing testing within the last 12 months versus the last 6 months differed substantially from these comparisons for specific predictors, separate odds ratios were estimated for each comparison. Results suggest that only the odds ratios for education and employment differed when comparing testing within the last 12 months (versus not) and testing within the last 6 months versus within the last 12 months. Among MSM with a college degree, the odds of having tested within the last 12 months were 1.5 times higher than those without a degree, but their odds of having tested within the past 6 months (versus within 12 months) were not different than those without a college degree. The odds of having tested at least in the last 12 months were also 1.4 times higher among racial/ethnic minority MSM than White MSM. In those who reported at least one episode of CAS within the last 12 months, the odds of having tested within that same time period were about 1.3 times higher than those who had CAS a year or more ago or never. Next, the odds of testing within at least the last 12 months were more than 3 times higher among those who had sex with a partner they met online than those who did not. The odds of testing in the last 12 months were 2.6 times *lower* among those who injected drugs in the last 3 months than those who had not. However, we would interpret these results with some caution, since fewer than 40 participants (2.4%) in the overall sample reported having injected drugs in the past 3 months. Finally, the odds of testing within the last 12 months were 1.4 times *lower* among MSM who reported “hazardous drinking,” compared with those who drank more moderately. Unadjusted testing rates show that 34% of hazardous drinkers had not tested in the last year compared with 30% of more moderate drinkers, and that 49% of hazardous drinkers had tested in the last 6 months compared with 56% of more moderate drinkers. See Table 2 for model results.

DISCUSSION

In this sample of MSM who were recruited online in the northeastern United States, findings suggested that over half reported testing at least once in the last 6 months, in line with the CDC's most stringent current recommendations on the frequency of HIV testing for MSM. However, roughly 31% reported not having tested within the last year, exceeding the recommendation that all MSM test at least annually. This is approximately consistent with recent data suggesting that approximately 1 in 4 MSM who are infected with HIV are unaware of their infection (CDC, 2014) and affirms calls to increase testing in this particularly affected population. Moreover, these rates are consistent with those reported in meta-analyses of studies exploring rates of HIV testing among "internet-using" MSM (Noble et al., 2016). Our results add, however, that those MSM who have used the internet to meet a sex partner in the last 12 months had substantially higher rates of testing than those who had not. While one explanation for this difference could be that MSM who meet partners online have more partners or engage in more risk and thus are more vigilant about testing regularly, it is also notable that this finding was observed even after controlling for having engaged in UAS with a casual partner in the last year. Another explanation could be that, in recent years, many gay-oriented dating sites/apps (e.g., Grindr) have begun advertising HIV testing to their users and allowing users to include their most recent HIV test among their profile information. As such, it is possible that MSM who have met partners online may have had more exposure to this information, which reinforced the need to test regularly. While the result is clear, the mechanisms of this relationship are yet unknown.

Models examining demographic and behavioral predictors of HIV testing showed that the odds of having tested in the last 12 months were higher among MSM with a college degree, when compared with those who did not have a college education. This finding is consistent with at least one past study, which showed that MSM without a college education were more likely to have never tested in their lifetimes (Margolis et al., 2012). Our results also suggest racial/ethnic minority MSM had a higher odds of having tested in the last 6 months compared with White MSM. Testing rates were especially high among African American, Hispanic/Latino, and multiracial MSM, with over two-thirds of these participants having tested at least once in the last 6 months. These findings are consistent with some past studies (e.g., Johnson et al., 2016; Rendina et al., 2014), but contrast with others showing no differences in testing rates in racial/ethnic minority MSM compared to White MSM (Khosropour et al., 2013; Margolis et al., 2012). Together, these findings suggest that continued efforts to connect those with less formal education with testing are needed, but that similar efforts to boost testing among African American and Hispanic/Latino MSM in the Northeast may be making progress toward addressing high HIV incidence in these subgroups.

Among behavioral predictors, the odds of having tested within at least the last 12 months were higher among those who reported having engaged in CAS with a casual partner in the last year when compared to those who had not. This finding is consistent with several past studies (Johnson et al., 2016; Rendina et al., 2014; Rowe et al., 2017), and suggests that those who are at highest risk for HIV are more likely to have tested recently. Our results also suggested that MSM who reported recent injection drug use were *less* likely to have tested

within the CDC-recommended intervals. While this conclusion is largely similar to those reported in past research (Margolis et al., 2012; Rendina et al., 2014), it should likely be interpreted with caution in this sample, since fewer than 40 participants reported injection drug use in the past 3 months.

Finally, our findings also suggest that those who drink at levels considered “hazardous” by NIAAA guidelines may be less likely to test at CDC-recommended intervals. That is, those who drank 4 or more drinks on a single occasion at least once in the past month, or drank 14 or more drinks in a typical week, may be less likely to have tested within the past 6–12 months, as recommended. These findings are consistent with two past studies suggesting that heavier drinkers may be less likely to test within recommended intervals (Fenton, Leggio, Kenna, & Swift, 2010; Rowe et al., 2017). Our study provides further evidence of this association specifically among MSM, adding to a growing body of evidence supporting yet another way that alcohol may have harmful effects on HIV outcomes. Yet, it is interesting that this association emerged specifically for alcohol *use*, and that those with alcohol-related problems were no less likely to test than those who did not. This pattern of findings could suggest that those who drink heavily but either (1) do not drink heavily enough to experience problems, or (2) are not willing to acknowledge problems, may be uniquely less likely to believe that their drinking puts them at risk for HIV or see the need to test regularly. Alternatively, it is possible that more of those who acknowledge current alcohol-related problems may have sought out alcohol/drug treatment in the recent past and may have been connected with HIV testing through these programs. In the northeast, many drug and alcohol treatment facilities and programs have adopted recommendations described in the literature encouraging them to provide on-site, “opt-out” rapid HIV testing (Volkow & Montaner, 2010). As such, if more of those reporting alcohol-related problems have had contact with these facilities, they may have been connected with testing through these programs. Overall, these results suggest the need for initiatives to encourage regular HIV testing among MSM who drink heavily but who do not necessarily see their drinking as problematic.

Limitations

While this study adds to the available literature by exploring rates and predictors of HIV testing, several limitations should be noted. First, these data are cross-sectional and focused on participants’ self-reported *most recent* HIV test, which may have been difficult to recall for some participants. This approach limits our ability to understand patterns in HIV testing among participants over time and assumes that their most recent test reflects their typical testing behavior. Second, our findings reflect those reported from a sample of MSM from the northeastern United States who were recruited via the internet. As such, while these results are informative, they may not generalize to MSM in other geographic areas or MSM recruited using other methods (e.g., in-person outreach).

Summary

In summary, this study explored rates and predictors of HIV testing among MSM in the northeast who were recruited online. Results suggest that MSM who engaged in more recent

HIV-risk behavior and who reported sex with partners they met online may be more likely to test at CDC-recommended intervals, compared with those at lower risk or who met partners in other ways. The odds of testing within these intervals were higher among minority MSM and those with a college education, compared with White MSM and those without a college degree. Finally, the odds of having tested for HIV recently were lower among those who were heavier drinkers. Further research should explore ways of expanding HIV testing among heavy-drinking MSM who do not necessarily experience or acknowledge alcohol-related problems, such as in-person or virtual outreach efforts focusing on gay-oriented bars and drinking venues.

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TABLE 1

Demographic and Behavioral Characteristics of the Study Sample (N = 1,506)

Characteristics	Mean (SD) or N (%)
Age (Range: 18 – 72, $M \pm SD$)	30.4 (11.7)
Race	
White	1,089 (75.8)
Black or African American	114 (7.9)
American Indian/Alaska Native	5 (0.4)
Asian	123 (8.6)
Pacific Islander/Native Hawaiian	5 (0.4)
Multiracial	100 (7.0)
Ethnicity (Hispanic or Latino)	244 (16.3)
Currently in Exclusive Relationship ¹	373 (24.8)
College degree	810 (53.8)
Low income ²	425 (28.2)
Unemployed	166 (11.0)
Gay or bisexual identity	1,453 (96.5)
Sex with partner met online, past 12 mo.	1,230 (81.7)
Condomless anal sex with casual partner ³	51 (46.8)
Within the past 6 months	712 (47.7)
Within the past 12 mo., but not past 6 mo.	89 (6.0)
Within their lifetime, but not the past 12 mo.	177 (11.8)
Never	515 (34.2)
“Hazardous” drinkers	550 (36.6)
Alcohol-related problem (AUDIT = 8)	515 (38.6)
Other drug-related problem (DAST > 3)	220 (14.6)
Injection drug use, past 3 months	36 (2.4)

Note.

¹Represents participants who reported currently being in a sexually exclusive, monogamous relationship with one partner.²Represents those with a household annual income <\$30,000/year.³Represents when participants last engaged in anal sex without a condom with a partner outside of an exclusive, monogamous relationship.

TABLE 2

Generalized ordered logit models for HIV testing in the past 6, 12 month, and > 12 months among MSM who met partners online (N = 1,506)

Variable	OR ₁₌₂	OR ₁	OR ₂	SE	p
Age ¹	0.93 [0.80 – 1.07]			0.07	.304
No college degree		0.66 [0.51 – 0.86]	0.81 [0.64 – 1.04]	0.09, 0.10	.002 , .096
Minority status	1.38 [1.09 – 1.74]			0.16	.007
Low income	1.07 [0.83 – 1.38]			0.14	.588
Unemployed		0.78 [0.52 – 1.16]	1.07 [0.73 – 1.58]	0.16, 0.21	.219, .730
Gay/bisexual identity	0.76 [0.41 – 1.41]			0.24	.377
Exclusive relationship	0.87 [0.66 – 1.34]			0.12	.303
UAS ²	1.25 [1.11 – 1.41]			0.08	< .001
Sex w/online partner	3.14 [2.31 – 4.27]			0.49	< .001
“Hazardous” drinking	0.74 [0.55 – 0.99]			0.11	.045
Alcohol problem ³	1.05 [0.78 – 1.43]			0.16	.732
Drug problems ⁴	0.97 [0.70 – 1.34]			0.16	.844
Injection drug use	0.38 [0.17 – 0.84]			0.15	.017

Note.

¹ Age categories were coded 0 = 18–24, 1 = 25–34, and 2 = 35 or older.

² Unprotected Anal Sex, coded 0 = UAS not within the past 12 months, 1 = UAS within the past 12 months.

³ Indicates those scoring 8 on the AUDIT, or those considered “high-risk” for alcohol-related problems.

⁴ Indicates those scoring > 3 on the DAST-10, or those considered “high-risk” for drug-related problems.

OR₁₌₂ reflects odds ratios for having tested within the last 12 months. OR₁ reflects odds ratios for having tested at 12 months (but not within the last 6 months) versus > 12 months ago. OR₂ reflects odds ratios for having tested within 6 months versus within 12 months. OR₁ and OR₂ are presented only for explanatory variables that did not meet the parallel regressions assumption.