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The Prevalence of Annual HIV Testing among men who have sex with men within the United States and its Association with HIV Testing Location

By

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Master of Public Health

Epidemiology

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By

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B.A., Biological Sciences

University of California, Santa Barbara

2015

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An abstract of
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Abstract

The Prevalence of Annual HIV Testing among men who have sex with men within the United States and its Association with HIV Testing Location

By Ganesh Rajasekar

Men who have sex with men (MSM) are recognized by the Centers for Disease Control and Prevention (CDC) as being an at-risk population for acquiring HIV infections, with an estimated 15% of undiagnosed HIV infections among this population as of 2015. To counteract the prevalence of these undiagnosed cases, annual HIV testing is encouraged as per the recommendations of the CDC. However, even though previous studies have observed associations between HIV testing frequency and well-established demographic correlates such as race and income, nothing is known about how the locations where MSM are tested for HIV are associated with HIV testing frequency. To measure the association between HIV testing location and HIV testing frequency, we used data from 6436 participants from the American Men's Internet Survey (AMIS) from 2016 and employed logistic regression models with predicted margins. Most of the participants were tested at private doctor's offices (45.9%) and nearly two-thirds of participants were tested annually for HIV (62.7%). We found significant associations between testing frequency and all examined variables except for income, with the strongest association being between provider disclosure and HIV testing frequency ($\gamma = 0.43$, χ^2 (1) = 207.25, $p<0.0001$). There was significantly higher prevalence ($p < 0.001$) of MSM testing annually for HIV at private doctor's offices than at any other location (e.g. emergency rooms, correctional facilities, HIV counseling and testing sites, at-home testing, outreach testing). Based on these results, there is strong evidence of disparities in HIV testing frequency by testing location, especially among locations that are not private doctor's offices. To lessen these disparities, we recommend interventions aimed at increasing HIV testing frequency at these alternative testing locations.

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Introduction

From the 1980s to the 1990s, an infection by the HIV virus in the United States was considered fatal, at some points killing tens of thousands per year [1,2]. Since the development of various treatments and preventative measures, such as anti-retroviral therapy, mortality rates have both dropped and stabilized, with many of those infected with HIV now living normal life expectancies [1,2]. Nevertheless, at the end of 2015, 973,846 people still lived with the condition within the United States [3]. Although the incidence of HIV infection has gone down by 3.1% between 2010 and 2014, challenges remain in further reducing undiagnosed HIV infections among those most at risk of being infected with HIV [4].

One such group is men who have sex with men (MSM) [2,5]. This group comprises most persons living with HIV infection in the United States as of 2015, with nearly 70% of prevalent cases being MSM [6]. Similarly, the percentage of MSM living with an undiagnosed HIV infection nationally is an estimated 14.8% [7].

The primary method of reducing these undiagnosed HIV infections among MSM is through the promotion of HIV testing [8,9,10]. The 2006 HIV testing recommendations from the Centers for Disease Control and Prevention (CDC) recommend that MSM be tested at least once annually due to their high risk for infection [2]. These recommendations continue to remain unchanged, after a review by an expert panel in 2017 concluded that there was insufficient evidence to warrant recommending that MSM get tested for HIV more frequently than once per year [2,8]. In addition to the individual health benefits of learning one's HIV status and starting treatment, HIV testing is considered vital in preventing HIV infections due to the mitigating effect of self-awareness on condomless sexual behavior. In one meta-analysis in 2005 with 11 studies, the awareness of one's HIV status led to a 68% reduction in unprotected vaginal or anal

intercourse, after adjusting for individuals with partners who were not HIV positive [11]. However, much remains unknown about the frequency at which high-risk populations voluntarily takes these tests, including whether MSM are being tested for HIV according to these long-standing CDC recommendations [12].

Many studies take the cross-sectional approach to quantifying HIV testing frequency by simply asking participants the date of their most recent HIV test or if they had their most recent HIV test within a certain number of months [9,13-17]. Even if a participant says that they did so, this question cannot assess whether the participant is getting routinely tested once per year. To remedy this, participants can instead be asked how many HIV tests they had taken within a certain period of time, such as the number of HIV tests within the past 6,12, or 18 months, as was done in other HIV testing studies with MSM [18-20].

Knowing the HIV testing frequency of MSM can not only help evaluate HIV prevention programs for this population but also provide information on their compliance towards the CDC-recommended annual HIV testing [12,21]. Moreover, understanding any correlating factors to HIV testing frequency, such as race, income, and education could serve as indicators of deeper problems in dealing with HIV disparities among certain groups of people based on lower HIV testing frequencies [22,23].

Previous studies using data from the National HIV Behavioral Surveillance System (NHBS) have examined associations between MSM, race, age, and HIV testing frequency through the comparison of adjusted prevalence ratios [24,25]. Moreover, other factors, such as race and income, have also been accounted for in these prevalence analyses [24,25]. One factor that wasn't considered in the literature reviewed was HIV testing location. HIV testing location and HIV testing frequency have been separately reported in previous NHBS publications, yet the

potential association between HIV testing location and HIV testing frequency has not yet been explored by the NHBS [26,27]. Data from the 2008 NHBS, which had the most detailed information available on the usage of HIV testing locations among MSM, found a majority of MSM had taken their most recent HIV test at private doctor's offices compared to other areas such as HIV counseling and testing sites and emergency departments [26].

In the few non-NHBS studies where HIV testing location was mentioned, HIV testing location was also present primarily as a participant descriptive variable and not as a predictor of HIV testing behavior among MSM [22,28,29]. There were also striking gaps in the literature regarding descriptions of differences in HIV testing by testing location. For example, one study found 92% of MSM who had their most recent HIV test at an HIV-focused community organization had their test results explained to them compared to 64% of MSM who had the test at a doctor's office [29]. Another potential source of variation in testing frequency by location may be the willingness of MSM to admit their attraction to men to their healthcare provider. In these scenarios previously reported, MSM who didn't admit their sexuality would be less likely to receive HIV tests due to their primary care providers being unaware of their status as an individual at high risk of HIV infection [15,30].

Based on evidence from the only other study found on MSM HIV testing locations, which assessed routine HIV testing location by surveying a participant's first-time and most recent HIV testing location, race and income were found to be significant predictors of testing location. More specifically, race was found to be a predictor of testing location among low-income (sub $20,000 a year) participants, with Latino and White participants being more likely to get tested in hospital clinics while MSM who were Black, Latino, Asian, or other races were

more likely to have had their most recent test at high-risk settings such as prisons, homeless shelters, and drug treatment centers [29].

Our study examined the prevalence of annual HIV testing among a nationwide sample of US MSM and potential correlation between annual HIV testing and the location of the most recent HIV test. We hypothesize that those most recently tested a private doctor's office would be more likely to have annual HIV testing compared to those most recently tested at other locations. We also examined whether this potential correlation would be confounded by other key covariates such as age, income, race, health insurance status, or disclosure of sexual attraction to other men to a healthcare providers.

Methods

Participants and Procedures

The data analyzed in this study are from the 2016 American Men's Internet Survey (AMIS). The participants were recruited from September 2016 to April 2017 through advertisements on various websites and social media applications. Any MSM who had participated in the previous year's AMIS survey cycle were recruited for the current cycle through email if they had consented to being contacted again. Participants were deemed eligible if they were 15 years or older, identified as male, and had oral or anal sex with another man at least once in the past. Any potential participants who were either less than 15 years of age or refused to provide their age were disqualified from completing the remainder of the screening survey. MSM who met the eligibility criteria and provided their consent to participate in the study could complete the entire online survey afterwards. This study is classified as human subjects research and has been reviewed and approved by our institution's human subjects

research review board. The study complies with all ethical standards in human subjects research.

Measures

The CDC recommends all persons at higher risk of HIV infection, including MSM, be tested annually [2,8]. The dependent measure in the study was whether the participant had the recommended annual testing (dichotomous, no/yes) and was calculated as having at least 2 HIV tests within the past 2 years. This information was captured with a direct question regarding the number of HIV tests in the past 2 years and was asked of anyone who had ever had an HIV test. The purpose of the study was not to understand correlates of ever having an HIV test, but rather to examine correlates of annual testing. Therefore, those who had never had an HIV test were excluded from analysis. Participants who reported a previous positive HIV test were also excluded from analyses since recent HIV testing frequency for this group has different implications than the current study objectives.

The main independent measure was the location of the participant's most recent HIV test. This variable is used as a proxy of an MSM participant's routine HIV testing location because the AMIS survey does not assess all of the participant's testing sites within the past 2 years. The most recent HIV test may or may not have been within the same 2-year time frame as the testing frequency question. The original HIV testing location questions had 10 response options , but for this study 4 response options were kept as categories (private doctor's offices, HIV counseling or test sites, public health/community health clinics, and unspecified other location) and 6 others were collapsed into 2 categories, facility-based testing sites, and community-based testing sites, to account for sparse data in some response categories. Facility-based testing sites were a combination of hospitals, emergency rooms, and sexually transmitted

disease clinics. Community - based testing sites were a combination of at-home testing, street-outreach programs, and mobile units.

The other independent variables tested in this analysis are age (categorized as 15-24, 25-29, 30-39, 40+ years), race/ethnicity, annual household income (categorized as $0-19k, $20-39k, $40-75k, $75k+) , highest education achieved, current health insurance status, and whether the participant had ever admitted their sexual attraction to men to their healthcare provider (dichotomous, no/yes), henceforth referred to as "provider disclosure".

Data Analyses

Descriptive analyses were conducted to determine prevalence of annual HIV testing overall and within covariate subgroups, including most recent HIV test location. Bivariate chi-square analyses were used to test the significance of association between covariates and annual HIV testing. For any significant bivariate analyses where directionality and magnitude could be assessed, gamma statistics were used to display these. For any significant bivariate analyses where only magnitude could be assessed, Cramer's V was used instead. A binary multivariable logistic regression model, using a predictive margins standardized logistic distribution, was created to examine the association between HIV testing location and annual HIV testing. The starting model adjusted for all other covariates, and a confounding analysis was performed to determine which covariates would be retained in the most parsimonious model. To do this, the model was re-run with different combinations of dropped variables and the prevalence ratios (PR's) were examined. Any model in which the PR's were greater than or less than 10% of the PR's from the "gold standard", or model with all covariates included, were noted, and the patterns of dropped covariates determined any potential confounding. Each test model's fit was also examined through the Pearson goodness-of-fit statistics. Final model findings are presented

as adjusted PR (aPR) with 95% confidence interval (95%CI). Significance was determined at alpha=0.05. All analyses were conducted with SAS Version 9.4 (SAS Institute, Cary, NC) and SUDAAN 11.0.1 (RTI International, Research Triangle Park, NC).

Results

There were 6436 participants included in the study (Table 1). The participants were predominantly non-Hispanic white (69.50%), had disclosed their sexual attraction to men to their healthcare provider (69.73%), had a college degree or beyond (57.0%), had an annual household income of $75000 or over (31.2%), had private health insurance (64.4%), and were 40+ years of age (41.5%). Nearly two-thirds (62.7%) of participants were tested for HIV annually. The most commonly reported location for the most recent HIV test was a private doctor's office (45.8%).

In the bivariate analyses, annual HIV testing was associated with all variables except income (Table 1). There were weak negative associations between age and annual HIV testing (γ = -0.11) and between income and annual HIV testing (γ = -0.03). There was also a weak positive association between education and annual HIV testing (γ = 0.12) and a moderate positive association between provider disclosure and annual HIV testing (γ = 0.43). Among the covariates where directionality could not be assessed, there was a weak association between HIV testing location and annual HIV testing (Cramer's V=0.08), race and annual HIV testing (Cramer's V= 0.11), and between health insurance status and annual HIV testing (Cramer's V = 0.05).

In the final regression model, participants who had their most recent HIV test at a private doctor's office were significantly more likely to have tested annually compared to all

other locations (Table 2). This association was not confounded by any of the independent covariates and there was no evidence of lack of fit in this model (χ^2=2.34, p = 0.8010).

Table 1: Demographic Characteristics of MSM Participants in the American Men's Internet Survey, United States, 2016 and Comparisons by Annual HIV Testing

		n (%)	n (%)	
	Total (N=6436)	**No Annual HIV Testing† (n=2356)**	**Annual HIV Testing‡ (n=3959)**	
Location of Most Recent HIV test				χ^2 (5) = 41.31, p<0.0001
Private Doctor's Office	2951	988 (33.5)	1963 (66.5)	
HIV counseling and testing site	703	272 (38.7)	431 (61.3)	
Public health clinic/community health clinic	1225	496 (40.5)	729 (59.5)	
Facility-based testing site *	355	147 (41.4)	208 (58.6)	
Community-based testing site**	640	249 (38.9)	391 (61.1)	
Other	251	122 (48.5)	129 (51.4)	

Race/Ethnicity				χ^2 (5) = 72.11 , p<0.0001
White	4473	1805 (40.4)	2668 (59.7)	
African American	473	125 (26.4)	348 (73.6)	
American Indian/Alaska Native	32	10 (31.3)	22 (68.8)	
Asian/ Native Hawaiian/ Pacific Islander	181	63 (34.8)	11 (65.2)	
Hispanic/Latino	804	227 (28.2)	577 (71.8)	
Other/Multiple	269	92 (34.20)	177 (65.80)	
Disclosure of Attraction to Men				χ^2 (1) = 207.25, p<0.0001
No	1245	663 (53.3)	582 (46.8)	
Yes	4488	1397 (31.1)	3091 (68.9)	
Education				χ^2 (3) = 35.06 , p<0.0001
<HS Diploma	104	47 (45.2)	57 (54.8)	
High School Diploma or GED	470	225 (47.9)	245 (52.1)	

Some college, Associate Degree, or Technical Degree	2016	778 (38.6)	1238 (61.4)	
College, Post Graduate or Professional School	3667	1283 (35.0)	2384 (65.0)	
Income				χ^2 (3) = 2.34, p=0.51
$0 to $19,999 annually ($0 to $1667 monthly)	719	264 (36.7)	455 (63.3)	
$20,000 to $39,999 annually ($1668 to $3333 monthly)	1042	383 (36.8)	659 (63.2)	
$40,000 to $74,999 annually ($3334 to $6250 monthly)	1557	576 (37.0)	981 (63.0)	
$75,000 or more annually ($6251 or more monthly)	2008	782 (38.9)	1226 (61.1)	
Health Insurance Status				χ^2 (3) = 15.73, p= 0.00013
None	812	290 (35.71)	522 (64.329)	
Private Only	4145	1492 (36.00)	2653 (64.00)	
Public Only	632	269 (42.656)	363 (57.44)	
Others/Multiple	568	236 (41.655)	332 (58.545)	
Age Categories				χ^2 (3) = 98.81, p<0.0001
15-24	1374	528 (38.43)	846 (61.657)	

	25-29	1264	379 (30.029)	885 (70.02)
	30-39	1005	293 (29.219)	712 (70.985)
	40+	2672	1156 (43.326)	1516 (56.74)

* includes sexually transmitted infection clinics, hospitals (inpatient), correctional facilities or prisons, and emergency rooms

**Includes at-home HIV tests, street outreach programs, and mobile units

† Calculated as <2 HIV tests within 2 years

‡ Calculated as >= 2 HIV tests within 2 years

Table 2: Estimated Prevalence of Annual HIV Testing among men who have sex with men by HIV Testing Location

HIV Testing Locations	aPR*	95% CI	P-value**
HIV Testing Site vs. Private Doctor's Office	0.92	(0.86 -0.98)	<0.001
Public Health Clinic/Community Health Clinic vs. Private Doctor's Office	0.89	(0.85 - 0.94)	<0.001
Facility-Based Testing vs. Private Doctor's Office	0.88	(0.80 – 0.96)	<0.001
Community-Based Testing vs. Private Doctor's Office	0.92	(0.86 – 0.98)	<0.001
Other (Non - Specified) Testing Site vs. Private Doctor's Office	0.77	(0.68 - 0.97)	<0.001

* Adjusted prevalence ratios found using predicted margins in logistic regression

** Unadjusted P-value

Discussion

The overall prevalence of annual HIV testing among our study population was 62.7%. Compared to private doctor's offices, all other testing locations, including facility-based locations, community-based locations, and public health clinics, had significantly lower prevalence of annual HIV testing. None of the covariates that were examined confounded the association between HIV testing location and HIV testing frequency even though all covariates, except income, had significant bivariate associations with annual HIV testing.

A high prevalence of annual HIV testing not only ensures the timely diagnosis of and awareness about preventing any potential HIV infections in large populations, but also quick linkage to HIV treatment services among those who were already infected but not tested and diagnosed until the infection had advanced significantly [5]. Although nearly two-thirds of the MSM sampled were tested annually, as recommended by the CDC, this prevalence of annual testing is far from ideal in terms of reducing the percentage of undiagnosed HIV infections among MSM in a timely manner.

When viewing the demographics of the study population descriptively, most participants in all types of HIV testing locations, income groups, educational groups, ethnic groups, age groups, and health insurance statuses were all tested for HIV annually. In the bivariate analyses, the main measures and the independent covariates, except income, were all significantly associated with annual HIV testing. Moreover, the strongest observed bivariate association was between provider disclosure and annual HIV testing.

The willingness of MSM to disclose their sexual attraction to men to their healthcare provider may have had the strongest bivariate association out of all variables tested because of

the suppressive effect a lack of disclosure has on the willingness of MSM to seek healthcare. This reduced willingness to seek healthcare may, therefore, reduce their willingness receive HIV testing. A lack of disclosure of a participant's attraction to men to their healthcare provider encompasses not only on stigma towards the LGBTQ community, but also the possible difference in recommendations about HIV tests associated with this disclosure. Past research had also found that MSM who didn't admit their sexuality to their healthcare providers have been found to be less likely to receive HIV tests due to their primary care providers being unaware of their status as an individual at high risk of HIV infection [15,30]. Past research also found significant differences in information about HIV testing at different locations such as whether the HIV test results were explained or when to get tested again [29]. Another study using data from the Behavioral Risk Factor Surveillance System (BRFSS) found that participants who had ever been tested for HIV were more likely to have disclosed their attraction to men to their healthcare provider [30]. Finally, studies that surveyed MSM within the United States have found that a healthcare provider's stigma against LGBTQ individuals can have suppressive effects on MSM seeking healthcare, particularly among rural populations and African American MSM [31-33]. Therefore, it is possible that the amount of trust a participant places in their healthcare provider regarding the participant's sexual identity may play a role in whether they receive information about HIV testing which, in turn, affects the frequency at which they get tested.

That fact that a majority of each group received annual HIV testing by a 5% margin or more, with the exception of those who did not disclose their sexual attraction to men to their healthcare provider, can be considered a testament to the success of the activism, policy changes, research, and medical advances that have occurred in the United States, as well as around the world, since the discovery of the virus [34-36]. The high prevalence of annual HIV

testing among MSM is also confirmed by previous data, with the prevalence of MSM receiving annual HIV testing comprising 50% or more of all racial groups and age groups of MSM in the 2008 and 2014 NHBS [24,27]. Unlike in our study, HIV testing frequency was measured as having been tested within 12 months of taking the survey, possibly indicating that the current commonly-used methodology is still sufficient for representing testing frequency.

We found a significantly higher prevalence of annual HIV testing among MSM who had most recently been tested at a private doctor's office compared to MSM who had been tested at any other location. Even though HIV testing frequency and HIV testing location have both been measured separately in previous NHBS cycles, our study was the first to look directly at the association between these variables [5,26,27]. There is some data about where MSM generally receive this testing. Over 45% of our sample had their most recent HIV test in a private doctor's office. This result is higher than the estimate from the NHBS 2014 data, where only 42% were tested in a clinical setting [27]. Because the NHBS HIV Surveillance Report defined clinical settings as including "private doctor's office[s] …. emergency department[s], hospital[s] (inpatient), public health clinic[s] or community health center[s], family planning or obstetrics clinic[s], correctional facilit[ies], or drug treatment program[s]", it is likely that a lower percentage of MSM surveyed in the NHBS were tested at a private doctor's office than in our study [27]. Similarly, another study found approximately 32% of MSM participants recruited were from clinical areas compared to 26% at private doctor's offices [28]. The differences in HIV tests taken at private doctor's offices may be primarily due to differences in survey methodology. The previous study and the NHBS both collect data from venue-based surveys, whereas our study population was surveyed online [27,28]. It is possible that online participants

are more likely to be routinely tested at a private doctor's office, but future research is needed to confirm this.

Private doctor's offices may be associated with better adherence to annual HIV testing recommendations because they may have more resources, incentives, or awareness of guidelines regarding routine HIV tests for at risk populations such as MSM. Our study was not able to determine whether the HIV testing received was routine for the participants, and it is possible that the lower prevalence of annual HIV tests at locations such as HIV counseling and testing sites or facility-based testing sites reflect how these locations primarily serve participants who only seek out HIV tests in non-routine circumstances. For example, these locations may primarily see MSM patients who do not see the need for annual HIV testing unless they suspect they are experiencing the symptoms of an HIV infection. However, more research must be conducted to confirm if different locations provide more impromptu HIV tests in response to urgent requests by patients. Further research into MSM compliance of the annual HIV testing recommendations at these locations could also help guide interventions aimed at increasing HIV testing frequency in those areas.

Although this study is the first to model the association between HIV testing location and annual HIV testing, there were several limitations. First, the "other" testing location is non-specified and cannot be adequately interpreted because the AMIS survey had no option to write in the testing location if the site in question could not be specified. Had write-in's been allowed, there may have been more opportunities to check the variable to make sure no testing sites were misclassified. Second, testing locations had to be combined to allow for statistical modeling. Though this was done in groups that could be considered similar in some respects, the grouping we chose may have resulted in misclassification or may have hidden other

associations or confounding. Third, although this study did measure the frequency of HIV tests within 2 years, we were unable to account for the time in between the two tests. For example, if a person had 2 or more tests within 2 years, the survey could not distinguish if these tests were all within the same year or spaced out evenly between the 2 years. Finally, there is the issue of temporality when using the most recent test as a proxy for the routine testing location. We mitigated this issue by excluding those who had never had an HIV test, and therefore maximized the likelihood that the study population would have had a chance of routinely testing for HIV. However, it is possible that some participants incorrectly remembered the number of HIV tests they had within 2 years, either through overstating or understating that number. A simple solution to this would be to reword the location question on future surveys to ask for the location of each HIV test within the past 2 years.

Conclusions

We found that the majority of our MSM participants were tested for HIV approximately once per year, as recommended by the CDC, and that those who have been tested at private doctor's offices are even more likely to have adhered to this recommendation than those in other locations. Our findings suggest that MSM who get tested at locations other than a private doctor's office have significantly lower rates of annual HIV testing. These alternative locations may be less conducive to annual HIV testing due to how MSM either interact with them on a non-routine basis or to how these locations lack clear policies on how to implement routine HIV tests to MSM and other high-risk populations. To mitigate these disparities, educational campaigns designed to raise awareness about HIV testing services at these locations could be implemented to further increase the prevalence of annual HIV testing at these locations.

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