Risk Patterns Preceding Diagnosis Among Newly HIV-Diagnosed Men Who Have Sex with Men in New York City

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Abstract

Men who have sex with men (MSM) are at high risk for contracting and transmitting HIV. They are increasingly encouraged to get tested, but understanding of the interplay between HIV testing and risk behavior is limited. One hundred fifty newly HIV-diagnosed (within past 3 months) MSM were recruited from a community clinic in New York City. Participants completed an interview assessing sexual behavior and substance use during the 3 months pre-diagnosis, current depressive symptoms, and prior HIV testing. HIV-related health characteristics at diagnosis were abstracted from medical records. Analyses examined factors associated with unprotected anal intercourse (UAI) in the 3 months pre-diagnosis, and with a negative HIV test in the 12 months pre-diagnosis. The sample was young (mean age = 32.5, SD = 8.8), ethnically diverse (62% racial/ethnic minority), low-income (71% ≤ \$30,000/year), and educated (48% college/advanced degree). Most (95%) had a prior negative HIV test, 55% within the last 12 months. Significant risk behavior was reported, with 79% reporting UAI. UAI was associated with recent testing and use of substances during sexual behavior. Recent testing was associated with being employed/a student, having had UAI, and higher CD4 count. Implications for future research addressing perceived HIV risk, HIV testing utilization, and risk behavior are discussed.

Introduction

THE HIV EPIDEMIC HAS INCREASINGLY impacted men who have sex with men (MSM), who represent 2% of the U.S. population but comprise the 61% of all new HIV infections in the U.S., and are the only population group with a rising HIV incidence.^{1,2} Data from the CDC indicate that between 2006 and 2009, new HIV diagnoses among MSM rose by 14%, and in 2009, MSM represented 79% of new HIV diagnoses among men.¹ The disparate impact of HIV and other STIs on MSM as compared to heterosexual men and women reflects both biological^{3–5} and behavioral^{4,6,7} factors. High levels of HIV risk behavior among MSM, and the resurgence of the HIV epidemic in this population,⁸ may also be the result of several

psychosocial factors, including the changed perception of HIV as a chronic and manageable rather than terminal illness,⁹ lack of awareness of HIV status,¹⁰ substance abuse,¹¹ increased access to and use of testing,¹² condom fatigue,¹³ and use of harm reduction techniques including serosorting.¹⁴ Given that HIV and other STIs are on the rise within MSM populations, it is essential to better understand the factors that currently drive transmission of HIV, in order to better tailor prevention efforts.¹⁵

Several longitudinal cohort studies have identified demographic and behavioral factors associated with HIV infection among MSM.^{16–23} In these studies, participants were tested at least every 6 months as part of study protocol, in order to track seroconversion. Across studies, being younger in age was

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consistently associated with seroconversion.^{16–19} Drug use often predicted seroconversion, specifically use of methamphetamine^{16,18,20} and “poppers.”^{16,17,19–21} Findings from two of the studies suggest that a history of gonorrhea or chlamydia may increase the likelihood of HIV infection.^{17,22} As expected, sexual behavior was consistently a strong predictor of seroconversion, particularly multiple sex partners,^{16,17} having an HIV-infected sex partner,¹⁶ and unprotected anal intercourse with an HIV-infected or HIV status unknown partner.^{16,17,20,23} Of note, these studies provide important information about the characteristics and behavior of MSM immediately prior to HIV infection, detected through the regular HIV testing that was a part of the study protocol. As such, this research does not address the characteristics of MSM prior to HIV diagnosis, as a result of voluntary HIV testing, unrelated to a research study.

Other studies have identified psychosocial and behavioral factors associated with being HIV-infected among MSM. It is well documented that childhood sexual abuse^{24,25} predicts risky sexual behavior and is associated with HIV infection among MSM. Similarly, among a cohort of HIV-infected MSM, those who experienced sexual debut before age 16 demonstrated increased sexual risk behavior in subsequent years, and this effect was exacerbated if debut occurred before age 13.²⁶ A shifting culture around methods of meeting sex partners also presents increased risk, as MSM who utilize the Internet^{27–29} and who attend “group sex parties”³⁰ often engage in higher risk sexual behavior and are more likely to be HIV infected. This behavior may be driven in part by sexual compulsivity, as emerging evidence suggests that sexual compulsivity is a significant predictor of risk behavior and subsequent HIV acquisition.^{27,31}

To better inform prevention efforts, research has begun to explore the profiles of individuals in the months immediately preceding HIV diagnosis that occurs in the context of natural (not study-based) HIV testing behavior.^{32,33} For example, Nunn et al. (2011) found that newly HIV-diagnosed individuals (people who reported same- or opposite-sex sexual behavior) reported high levels of unprotected sexual behavior and cocaine use.³⁴ However, few recent studies examine the characteristics specifically of MSM in the period immediately prior to receiving an HIV diagnosis as part of voluntary HIV testing.

The literature reveals a problematic interplay between the use of HIV testing and sexual risk behavior among MSM. Current CDC guidelines suggest that MSM receive an HIV test at least annually.³⁵ Data suggest a majority of MSM are abiding by this recommendation; according to the National HIV Behavioral Surveillance System, in 2008, about 60% of MSM reported receiving an HIV test in the last year.³⁶ Compared to other groups (i.e., women, heterosexual men), MSM are significantly more likely to get tested for HIV.^{37–39} However, the relationship between HIV testing and risk behavior among MSM gives reason for concern. On the one hand, research suggests that MSM who do not test frequently believe that their HIV risk is “low,”^{40–42} despite the CDC characterization of MSM as “high risk” group.³⁵ In a study providing HIV testing in bathhouses, Mayer reported that two-thirds of the MSM who engaged in UAI in the 2 months prior to HIV testing considered their HIV risk to be low,⁴³ suggesting that some MSM inaccurately assess the risk associated with their behavior. On the other hand, studies consistently demonstrate that MSM who test frequently also engage in more risky

sexual behavior, such as having multiple sexual partners^{42,44,45} and unprotected anal sex.^{37,38,45,46} As a result, when diagnosed, these men are more likely to be acutely infected with HIV, when the likelihood of HIV transmission is significantly increased,^{47,48} likely due to a spike in viral load levels.^{49,50}

Few studies provide insight about the relationship between HIV testing behavior, HIV risk behavior, and other characteristics in the period immediately prior to HIV diagnosis among MSM who monitor their serostatus through voluntary testing. Understanding the characteristics of these MSM in the months before receiving an HIV diagnosis can inform the development of appropriate HIV prevention interventions for both newly HIV-diagnosed MSM, and MSM who recently received a negative result on an HIV test. This study therefore had three specific aims: (1) to describe the demographic, pre-diagnosis behavioral risk, and HIV-related health (including HIV viral load and CD4 count) characteristics of recently HIV-diagnosed MSM; (2) to identify factors associated with UAI in the 3 months prior to HIV diagnosis among recently diagnosed MSM; and (3) to identify factors associated with receiving a negative HIV test within the 12 months prior to diagnosis.

Methods

Setting and participants

The sample included recently diagnosed MSM who were screened for eligibility to participate in a primary care-based secondary HIV prevention trial. Patients were eligible for the screening interview if they met the following criteria: (1) first HIV positive test within the past 3 months, (2) ever engaged in male to male sexual behavior, (3) English fluency, and (4) enrolled in care at Callen-Lorde Community Health Center (Callen-Lorde), a federally qualified health center in New York City specializing in care for the lesbian, gay, bisexual, and transgender community. Patients were referred to the study by providers (physicians, case managers, counselors) at Callen-Lorde after receiving a confirmatory HIV diagnosis. All participants were recruited between June 2009 and May 2011. All study procedures were approved by the Institutional Review Boards at all collaborating institutions, and all participants provided written informed consent.

Measures

Participants completed a structured survey that assessed demographic characteristics, current depressive symptoms, and HIV testing behavior. Detailed sexual and substance use behaviors prior to diagnosis were then assessed using a calendar-based Time Line Follow-Back instrument (TLFB).⁵¹ The TLFB was administered by study staff, all of whom held master’s degrees in social work and had at least 5 years of experience working in HIV prevention research. Callen-Lorde electronic medical records were reviewed by study staff to extract data on participants’ mental health, sexually transmitted infections (STIs), HIV viral load, and CD4 count at the time of HIV diagnosis.

Demographics. Demographic variables included: age, sex, gender identity, sexual orientation, race/ethnicity, employment status, annual income, and educational attainment.

Mental health. Depressive symptoms were assessed using the Beck Depression Inventory, a 21-item measure that includes dimensions of cognition, somatization, and motivation.⁵² Participants rated how they had been feeling in the past week using a 0 to 3 scale. Consistent with clinical utilization of the Beck Depression Inventory as a screening measure,⁵³ a score of 16 or more was used as a cutoff for clinically significant depressive symptoms. Participants who endorsed suicidal ideation or met criteria for depression were referred for mental health services at Callen-Lorde Community Health Center. Diagnosis of a psychiatric disorder in the 2 weeks prior to and after HIV diagnosis was also extracted from participants' electronic medical record.

HIV testing behavior. To evaluate HIV testing behavior, participants were asked the date of their first positive HIV test, whether they had ever tested negative for HIV prior to this positive test, and the date of the most recent prior test. If participants could not recall the month of their test ($n=4$), July 1 was recorded, and if participants could not recall the exact day of their test ($n=10$), the first of the month was recorded. Time since prior negative HIV test was calculated by subtracting the date of prior test from the date of HIV diagnosis and examined as both a continuous variable and a dichotomous variable (≤ 12 months, > 12 months).

HIV-related health characteristics. Participants' electronic medical records were reviewed for the period surrounding the HIV diagnosis (2 weeks before to 2 weeks after). We abstracted participants' HIV viral load, CD4 count, and STI diagnoses. The viral load variable was dichotomized ($< 100,000$, $\geq 100,000$); CD4 count was examined both as a continuous variable, and as a dichotomous variable (< 500 , ≥ 500).

Sexual behavior. Using the TLFB interview, participants indicated the number of unprotected and protected sexual encounters they had during the 3-month period prior to receiving their HIV diagnosis. Participants also indicated if sex occurred with or without substance use, their perception of the HIV status of their partner(s), and whether they engaged in receptive or insertive intercourse on each occasion.

Data analysis

For Aim 1 of the study, descriptive statistics (means, standard deviations, and proportions) were calculated for demographics, mental health, HIV-testing, HIV-related health characteristics, and sexual behaviors, for all participants. For Aim 2, a set of logistic regression models were run to identify factors associated with participant engagement in unprotected anal intercourse (UAI) in the 3 months prior to HIV diagnosis. Predictor variables included demographics, mental health, HIV testing behavior, HIV-related health characteristics, and sexual behavior. Participants who reported no sexual behavior in the 3 months prior to HIV diagnosis were excluded from analyses that included sexual behavior variables as predictors. For Aim 3, a second set of logistic regression models were run to identify factors associated with recent HIV testing (a negative test within the 12 months prior to diagnosis). Predictor variables included demographics, sexual behavior, mental health, and HIV-related health characteristics. For analyses conducted for both Aim 2 and Aim 3,

variables that were associated with the outcomes at $p < 0.10$ in bivariate analyses were included in multivariate models. In the multivariate models, logistic regression was conducted using simultaneous entry. Demographic variables found to be significantly associated with the outcome variables in bivariate models were entered in the first step of each model. Age was entered in the first block for the multivariate model predicting UAI, and current employment status was entered in the first block in the multivariate model predicting recent HIV testing; all other variables were entered in the second block. When more than one variable measuring the same construct (e.g., CD4 count was operationalized as both a continuous and a categorical variable) was significantly associated with the outcome variables in bivariate analyses, the variable that was most significantly correlated was included in the multivariate model. All analyses were conducted using SPSS 19.0.

Results

Description of the sample

Demographics and mental health. Demographic and behavioral characteristics for this sample ($n=150$) of recently HIV-diagnosed MSM are presented in Table 1. Overall, participants were young (mean age=32.5, SD=8.8), ethnically diverse (62% racial/ethnic minority), low-income (71% annual income $\leq \$30,000$), and well educated (48% some college or advanced degree). Most participants (95%) identified as gay/homosexual, 3% identified as bisexual, and 2% (three of the four transgender individuals in the sample) identified as straight/heterosexual. Almost 40% of the sample met criteria for clinically significant depression, and medical record data indicated that 21% received a mental health diagnosis within the 4 weeks surrounding the HIV diagnosis, with the most common diagnosis being adjustment disorder with mixed anxiety and mood disturbance.

HIV testing behavior. A small percentage of participants (5%) reported no previous HIV testing experience prior to receiving their HIV diagnosis. Two participants (1%) reported receiving a previous negative result on an HIV test, but could not remember the year of the test. Just over half of the participants (55%) had a negative HIV test in the 12 months prior to their diagnosis, and 39% had a negative test more than 12 months prior to their HIV diagnosis (mean number of months prior to diagnosis = 19.5, SD = 27.7).

HIV-related health characteristics. At the time of HIV diagnosis, there was substantial variability within the sample in terms of HIV-related health characteristics. Of the participants for whom medical record data was available ($n=136$ for CD4 count and STI diagnosis, $n=135$ for viral load), 53% had a CD4 count ≤ 500 , and 46% had a CD4 count ≥ 500 (mean CD4 count = 482.8, SD = 234.5). Very few participants (3%) had an undetectable viral load, 70% had a viral load $< 100,000$, and 27% had a viral load $\geq 100,000$. Medical records indicated that 9% received a diagnosis of a sexually transmitted infection (STI; e.g., Chlamydia, herpes simplex, gonorrhea) within 4 weeks surrounding the HIV diagnosis.

Sexual behavior and substance use prior to HIV diagnosis. Participants had a mean of 10.9 (SD = 16.1, range = 0–91)

TABLE 1. PARTICIPANT DEMOGRAPHIC CHARACTERISTICS (N=150)

<i>Demographics</i>	<i>Descriptive statistic^a</i>
Age	
Mean (standard deviation)	32.5 (8.8)
Race	
White	57 (38%)
African-American/black	28 (19%)
Hispanic/Latino	38 (25%)
Other (Asian, Pacific-Islander, Native-American)	27 (18%)
Income (<i>n</i> = 149)	
≤\$30,000	107 (71%)
Over \$30,000	42 (28%)
Current employment status	
Working/student	101 (67%)
Unemployed	49 (33%)
Education	
≤12 th grade/GED	33 (22%)
At least some college	117 (78%)
Mental health	
Clinically significant depression symptoms	59 (40%)
Mental health dx at time of HIV dx	32 (21%)
Recent negative HIV test	
Tested in 12 months pre-HIV dx	82 (55%)
Number of months since last negative test	29.5 (27.8)
HIV-related health measures	
CD4 count at HIV dx	482.8 (234.5)
CD4 count <500 at HIV dx	73 (49%)
Viral load >100,000 at HIV dx	36 (24%)
STI dx at time of HIV dx	14 (9%)
Sexual behavior	
Had a sexual partner in 3 months pre-HIV dx	143 (95%)
Total no. of sexual partners	10.9 (16.1)
Had an HIV+ partner	32 (21%)
Total no. of HIV+ partners	0.3 (0.8)
Had an HIV- partner	53 (35%)
Total no. of HIV- partners	0.9 (2.1)
Had an HIV serostatus unknown partner	109 (73%)
Total no. of serostatus unknown partners	9.7 (16.3)
Had UAI	119 (79%)
Total no. of UAI occasions	18.9 (29.6)
Had PAI	93 (62%)
Total no. of PAI occasions	12.2 (21.5)
Had insertive anal intercourse	90 (60%)
Had receptive anal intercourse	109 (73%)
Had sex while using alcohol or drugs	90 (60%)
Total no. of anal intercourse occasions while using substances	16.3 (26.7)

^aMeans and standard deviations reported for continuous variable is *N* and proportions reported for categorical variables. dx, diagnosis; STI, sexually transmitted infection.

sexual partners in the 3-month time period, with almost half (48%) reporting six or more partners. Just over one-fifth (21%) of participants reported having a known HIV-infected sexual partner, and 73% reported having a sexual partner whose HIV serostatus was unknown at the time of the sexual encounter. Participants had far fewer known HIV-infected partners (mean=0.3, SD=0.8) than HIV serostatus unknown partners (mean=9.7, SD=16.3). Twelve percent had a primary partner (a partner with whom the participant considered himself to be in a significant relationship) who was HIV-infected.

The majority of participants (79%) engaged in UAI in the 3 months prior to HIV diagnosis (mean number of UAI occasions=18.9, SD=29.6); 29% engaged in only UAI (no protected sex). Almost one-fifth (19%) had UAI with an HIV-infected sexual partner(s), over one-quarter (27%) had UAI with a partner(s) they perceived to be HIV-negative, and over half (58%) had UAI with an HIV serostatus unknown sexual partner(s). Almost three-quarters (73%) reported receptive, and over half (60%) reported insertive, unprotected anal intercourse.

Approximately one-fifth of participants did not report any HIV-risk behavior in the 3 months prior to diagnosis. Specifically, 13% of participants reported engaging only in protected anal intercourse (PAI), and 8% reported no sexual behavior. Additionally, 15% of participants reported having only partners whom they believed to be HIV negative.

Almost two-thirds (60%) of the participants used alcohol or drugs while engaging in sexual behavior in the 3 months prior to diagnosis (mean number of intercourse occasions while using substances=16.3, SD=26.7). The most common drugs reported were marijuana (27%), methamphetamine (15%), and amyl nitrate (9%).

Factors associated with report of unprotected anal intercourse

As shown in Table 2, in bivariate analyses, report of any UAI was significantly associated with lower age, more recent testing, higher CD4 count at HIV diagnosis, a greater total number of sexual partners, more HIV serostatus unknown partners, lower odds of having a partner that was perceived to be HIV-negative, and higher odds of having engaged in sexual behavior while using substances. Neither the mental health nor the sexual positioning variables were associated with UAI. In the multivariate model, UAI remained significantly associated with a more recent negative HIV test, and with report of sexual behavior that occurred while using substances. The association between UAI and higher CD4 count approached significance in the multivariate model ($p=0.053$). In the multivariate model, prediction was significantly improved over a constant only model (Model $\chi^2=39.87$; Nagelkerke $R^2=0.43$).

Comparisons by report of recent HIV test

As presented in Table 3, in bivariate models, HIV testing within the 12 months prior to HIV diagnosis was significantly associated with being unemployed or disabled, a greater total number of sexual partners, a greater total number of HIV serostatus unknown partners, higher odds of having engaged in UAI in the 3 months prior to HIV diagnosis, and higher odds of having engaged in receptive anal intercourse. Recent HIV testing was not associated with any of the mental health, HIV-related health characteristics, or substance use variables. In the multivariate model, being disabled/unemployed, and engaging in receptive anal intercourse remained significantly associated with having a negative HIV test in the twelve months prior to HIV diagnosis. In this model, prediction was significantly improved over a constant only model (Model $\chi^2=20.55$; Nagelkerke $R^2=0.18$).

Discussion

This study makes use of detailed behavioral data to examine the characteristics and behavior of newly HIV-diagnosed MSM

TABLE 2. BIVARIATE AND MULTIVARIATE LOGISTIC REGRESSION MODELS PREDICTING UAI BEFORE HIV DIAGNOSIS

Predictor	Bivariate analyses		Multivariate analyses	
	OR	95% CI	AOR	95% CI
Demographics				
Age	0.96 ⁺	0.92, 1.00	0.96	0.90, 1.02
Mental health				
Clinically significant depression symptoms	1.40	0.60, 3.25	—	—
Mental health dx at time of HIV dx	1.17	0.43, 3.14	—	—
Recent negative HIV test				
Tested in 12 months pre-HIV dx	3.36**	1.38, 8.22	3.28*	1.03, 10.44
Number of months since last HIV test	0.98*	0.97, 0.99	—	—
HIV-related health measures				
CD4 count at HIV dx	1.00 ⁺	1.00, 1.00	—	—
CD4 count <500 at HIV dx	2.11*	0.88, 5.08	1.63 ⁺	0.98, 3.45
Viral load >100,000 at HIV dx	1.43	0.53, 3.87	—	—
STI dx at time of HIV dx	0.62	0.18, 2.13	—	—
Sexual behavior ^a				
Total no. of sexual partners	1.13*	1.01, 1.27	1.06	0.96, 1.18
Had an HIV+ partner	0.00	0.00, 0.00	—	—
Total no. of HIV+ partners	0.00	0.00, 0.00	—	—
Had an HIV- partner	0.29*	0.11, 0.81	0.69	0.21, 2.31
Total no. of HIV- partners	0.99	0.80, 1.24	—	—
Had an HIV serostatus unknown partner	2.74 ⁺	0.99, 7.52	1.80	0.47, 6.99
Total no. of serostatus unknown partners	1.11 ⁺	0.99, 1.24	—	—
Had insertive anal intercourse	0.84	0.30, 2.39	—	—
Had receptive anal intercourse	1.93	0.66, 5.61	—	—
Had sex while using alcohol or drugs	7.00**	2.34, 20.94	11.62**	3.49, 38.71
Total no. of anal intercourse occasions while using substances	1.03	0.99, 1.07	—	—

⁺ $p < 0.10$, * $p < 0.05$, ** $p < 0.01$; AOR, Adjusted Odds Ratio; dx, diagnosis; STI, sexually transmitted infection.

^aAnalyses examining sexual behavior variables excluded ($n = 12$) participants who reported no sex.

TABLE 3. BIVARIATE AND MULTIVARIATE LOGISTIC REGRESSION MODELS PREDICTING RECENT NEGATIVE HIV TEST

Predictor	Bivariate analyses		Multivariate analyses	
	OR	95% CI	AOR	95% CI
Demographics				
Employment status—disabled/unemployed	0.42*	0.21, 0.87	0.42*	0.19, 0.89
Mental health				
Clinically significant depression symptoms	0.90	0.45, 1.80	—	—
Mental Health dx at time of HIV dx	0.76	0.34, 1.72	—	—
HIV-related health measures				
CD4 count at HIV dx	1.00	1.00, 1.00	—	—
Viral load >100,000 at HIV dx	0.91	0.42, 1.99	—	—
STI dx at time of HIV dx	0.99	0.30, 3.29	—	—
Sexual behavior ^a				
Total # of sexual partners	1.03*	1.00, 1.07	1.13	0.95, 1.34
Had an HIV+ partner	1.38	0.60, 3.15	—	—
Total # of HIV+ partners	1.17	0.72, 1.90	—	—
Had an HIV- partner	1.77	0.86, 3.65	—	—
Total # of HIV- partners	1.09	0.92, 1.30	—	—
Had an HIV serostatus unknown partner	1.20	0.57, 2.56	—	—
Total # of serostatus unknown partners	1.03*	1.00, 1.06	0.91	0.77, 1.08
Had UAI	3.36**	1.38, 8.22	1.97*	1.32, 5.37
Total # of UAI occasions	1.01	0.99, 1.02	—	—
Had PAI	1.39	0.70, 2.76	—	—
Total # of PAI occasions	0.99	0.98, 1.01	—	—
Had insertive anal intercourse	1.34	0.68, 2.65	—	—
Had receptive anal intercourse	2.73*	1.26, 5.90	2.14	0.89, 5.13
Had sex while using alcohol or drugs	0.89	0.44, 1.78	—	—
Total # of anal intercourse occasions while using substances	1.00	0.99, 1.01	—	—

* $p < 0.05$, ** $p < 0.01$; AOR, Adjusted Odds Ratio; dx, diagnosis; STI, sexually transmitted infection.

in the months before their HIV diagnosis. It is one of the first studies to elucidate relationships between naturalistic HIV testing, sexual behavior, and HIV diagnosis in MSM. Additionally, it is one of the first to compare the behavior of newly HIV-diagnosed MSM who engaged in UAI to those who engaged only in protected sex, and to examine co-occurring substance use and sexual behavior in this population. Our sample of newly HIV-diagnosed MSM reported engaging in high levels of HIV-related risk behavior in the 3 months prior to HIV diagnosis. Most of the sample engaged in UAI during this time, and almost a third of the sample (30%) reported never using protection during anal intercourse. Report of UAI in the months preceding diagnosis was a significant marker of behavioral risk, with UAI associated with significantly increased odds of having used alcohol or drugs during sexual behavior. UAI was also significantly associated with more recent prior HIV testing.

These results suggest several possibilities. First, a subgroup of MSM who engage in UAI and other risk behavior may be aware of their higher risk for HIV infection and thus utilize more frequent HIV testing. Among heterosexual men, such testing has been described as a "check-up" used after sexual encounters that are perceived as risky.⁵⁴ It is possible that a riskier subgroup of MSM perceives a negative result on an HIV test as a rationalization for continued risk behavior, or as a method of monitoring HIV status rather than an opportunity to re-evaluate behavioral risk. Moreover, some data suggest that perception of the increased effectiveness of current HIV treatment is associated with increased sexual risk behavior,^{33,55,56} which may reflect reduced fear about an HIV diagnosis and the testing process more generally.

Alternatively, MSM, particularly those who test often, may be aware of their risk but are unable to change their behavior for multiple syndemic psychosocial reasons,⁵⁷ including substance use difficulties,³² mental health problems,⁵⁸ and the psychological sequelae of childhood sexual abuse,⁵⁹ and may thus utilize more frequent testing as a means of self-monitoring. Depression was a significant burden for a large subset of this sample of MSM. Though UAI in this study was not associated with mental health difficulties, it was significantly associated with substance use during sexual behavior, suggesting that substance use may be driving this behavior. These findings suggest that further qualitative work is warranted to examine the psychosocial barriers to safer sex among MSM.

Taken together, these results suggest an important missed opportunity for successful prevention efforts at the time of a negative HIV test result, as well as the need to develop innovative approaches to prevention. These results confirm current policy recommendations regarding post-test counseling, which advocate for access to prevention-oriented counseling at the time of a negative HIV test for individuals who engage in high-risk behavior.³⁵ Evidence suggests that theory-based, intensive (i.e., frequent sessions) prevention interventions can produce successful reductions in sexual risk behavior.⁶⁰ Results from the current study therefore suggest that innovative prevention efforts implemented at the time of a negative HIV test could be effective if they are theory-driven, frequent, capitalize on the propensity for individuals who engage in riskier behavior to seek out more frequent testing, and target behavior that may increase risky sexual activity, including substance use.

Our findings that participants who reported UAI trended toward higher CD4 counts at HIV diagnosis, and were more likely to be tested recently, also suggest that these participants may have been infected more recently. In contrast, participants who reported only PAI had significantly lower CD4 counts at HIV diagnosis, and were tested less recently, suggesting that perhaps these participants were infected less recently. These results suggest that a subset of participants may have been aware of their higher risk and the possibility that they may have been infected, and consequently reduced their risk behavior (engaging in PAI only) prior to HIV testing and diagnosis. Alternatively, for these participants, risk behavior such as unprotected intercourse may have been far less common, and thus they may have been infected for a longer period of time without being aware of their HIV status. In addition, men who reported only PAI did not report any known HIV-positive partners. As a result, for these men, a positive HIV test may have come as a surprise. Of course, the level of risk behavior of these men before the immediate pre-diagnosis period is unknown in this study. Overall, these results highlight the importance of primary HIV prevention that emphasizes both the HIV risk inherent even in infrequent or rare risk behavior, as well as the importance of frequent, routine HIV testing, regardless of perceived risk.⁴⁰⁻⁴²

Results from this study also show that unemployed MSM were significantly less likely to be recently tested for HIV, even after controlling for whether they engaged in risky sexual behavior. Importantly, income was not associated with recent HIV testing, and the "employed" group included individuals who were full-time students, suggesting that the observed association is not being driven by access to financial resources alone. In addition, employment status was not significantly associated with UAI, meaning that HIV risk behavior did not influence recency of testing among unemployed participants. Rather, these MSM utilized testing less frequently for reasons other than financial means and perceived risk. For example, unemployed MSM may place a higher priority on activities related to securing a job than on accessing HIV testing services, especially if such services are provided at sites with extensive wait-times. Further research is warranted to determine what barriers to HIV testing services exist among MSM who are unemployed.

The results of this study are qualified by several limitations. Though every effort was made to reach all newly HIV-diagnosed MSM at Callen-Lorde Community Health Center, it is difficult to ascertain what proportion of the overall population of newly HIV-diagnosed patients were referred to the study; furthermore, some patients chose not to be contacted by study staff. Thus, it is not known to what extent the results from this study are generalizable to the Callen-Lorde Community Health Center population or the broader population of newly HIV-diagnosed MSM. Furthermore, the results, to the extent that they are generalizable, may only be applicable to a relatively well-educated, care-seeking subset of the MSM population. It is also important to note that, in analyses of sexual behavior variables associated with UAI, the power of the study to detect group differences (between participants who reported UAI and those who reported only PAI) was limited by the small number ($n=19$) of men who reported only protected sexual behavior. Additionally, as noted, while the most recent HIV test was assessed, patterns of testing were not, thus permitting only inferences about repeat testing.

While it can be assumed that participants in the recent prior HIV negative testing group were recently infected with HIV, it is not possible to make a determination about the recency of infection among participants who did not receive a recent HIV test. Given concern about the higher probability of forward transmission during the acute infection stage,⁶¹ and the possibility that a significant number of transmissions occur in the early months of infection before HIV status is known, future research is warranted to explicate how patterns of behavior differ by recent testing status.

Despite these limitations, the study offers important insight into the behavior of MSM in the period leading up to HIV diagnosis. As was demonstrated here, a large proportion of newly HIV-diagnosed MSM engage in high levels of sexual risk behavior leading up to diagnosis, as well as prior HIV testing. Further, these data suggest the possibility that many of these men represent recent HIV infections with higher likelihood of viral transmission to others. The men in this study are a diverse, accessible population that engages the health service system through voluntary HIV testing. These men may therefore represent a prime target for innovative prevention strategies such as pre-exposure prophylaxis,^{62,63} and may be especially receptive to the technical advances and new approaches in HIV testing, including use of more frequent routine testing,¹² test and treat,⁶⁴ and in-home testing.⁶⁵ Furthermore, while the need to conduct research on high risk men prior to an HIV diagnosis is critical, there is also a need to understand the risk trajectories of these men in the months following an HIV infection, as they adapt or fail to adapt to the HIV diagnosis and engage in HIV medical care. The results of this study underscore the importance of further research about the connections between perceived HIV risk, HIV testing utilization, and HIV-related risk behavior pre-HIV diagnosis. Such research is critical to informing HIV prevention interventions to reduce the acquisition and transmission of HIV among MSM.

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