Missed Opportunities for HIV Testing Among High-Risk Heterosexuals

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Background: HIV testing is an important HIV prevention strategy, yet heterosexuals at high risk do not test as frequently as other groups. We examined the association of past year HIV testing and encounters with institutional settings where the Centers for Disease Control and Prevention recommends annual testing for high-risk heterosexuals.

Methods: We recruited high-risk heterosexuals in New York City in 2006 to 2007 through respondent-driven sampling. Respondents were asked the date of their most recent HIV test and any potential encounters with 4 testing settings (homeless shelters, jails/prisons, drug treatment programs, and health care providers). Analyses were stratified by gender.

Results: Of the 846 respondents, only 31% of men and 35% of women had a past year HIV test, but over 90% encountered at least one testing setting. HIV seroprevalence was 8%. In multiple logistic regression, recent HIV testing was significantly associated with recent encounters with homeless shelters and jails/prisons for men, and encounters with health care providers for both men and women.

Conclusions: HIV testing was low overall but higher for those with exposures to potential routine testing settings. Further expansion of testing in these settings would likely increase testing rates and may decrease new HIV infections among high-risk heterosexuals.

HIV testing has become A focal point for HIV prevention efforts.[1] It is estimated that HIV-positive persons currently aware of their status comprise only 75% of all HIV-positive persons in the United States.[2] HIV testing helps to prevent further HIV transmission since most HIV-positive persons reduce risk behaviors after diagnosis.[3,4] Because of that, those unaware of their HIV status contribute to a disproportionately higher share of HIV transmission.[5,6]

The Centers for Disease Control and Prevention (CDC) has recommended various HIV testing strategies to increase the proportion of HIV-positive persons who know their status. In 1994 and 2001 guidelines, CDC recommended a risk-based approach targeting men who have sex with men (MSM), injection drug users (IDU), and high-risk heterosexuals.[7,8] Routine testing was recommended in testing settings (e.g., certain clinics) or geographic areas (e.g., NY) with an HIV prevalence of at least 1%. In 2003, CDCs Advancing HIV Prevention initiative suggested testing outside medical settings, enabled by rapid testing technology.[9] In 2006, CDC recommended routine testing of all adults in all medical settings, with annual testing for those at high risk.[10] Guidelines from the New York City Department of Health and Mental Hygiene are similar to these CDC recommendations.[11]

These strategies have resulted in relatively high testing rates for MSM and IDU,[12] but not for high-risk heterosexuals.[13] Infrequent testing may be one factor driving the growing heterosexual HIV epidemic in the United States and New York City, an epidemic that disproportionately impacts women and racial and ethnic minorities.[14,15] Increasing testing for high-risk heterosexuals may require reconsideration of existing testing recommendations: unclear or overly broad definitions of heterosexual risk may complicate risk-based testing,[7] and routine testing is still uncommon in medical settings.[16] Routine testing also may not engage the highest risk heterosexuals: many factors associated with heterosexual HIV, such as poverty, are also linked to infrequent access to the medical settings where testing would be routine.[17]

Previous studies have explored psychological barriers to testing from the perspective of the test taker.[18–20] However, recent research suggests that clients largely support the idea of routine HIV testing.[21,22] How, where, and why testing is offered, therefore, requires closer attention, particularly for high-risk heterosexual populations. In this study, we explored factors related to HIV testing among a high-risk group of heterosexuals in New York City. We examined encounters with 4 institutional settings where the CDC has recommended routine, annual HIV testing for high-risk heterosexuals. We describe overall self-reported testing rates and examine the association of recent testing with encounters with these settings.

MATERIALS AND METHODS

Sampling and Eligibility

Data were collected as part of the National HIV Behavioral Surveillance (NHBS) study, described in detail elsewhere.[23,24] NHBS is a cross-sectional study to investigate HIV behavioral risks among core risk groups in US cities with high HIV prevalence. This analysis examines data from the NHBS study cycle on high-risk heterosexuals conducted in New York City during 2006 to 2007.

High-risk heterosexuals were principally defined through geographic and social network terms (the definition did not refer to sexual orientation). For each NYC zip code, we ob-

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tained rates of heterosexually-related adult HIV diagnoses for 2001 to 2006 from NYC HIV surveillance data and rates of household poverty from 2000 census data. A "high-risk area" (HRA) index was calculated for each zip code by summing the 2 rates standardized to overall rates of HIV and poverty for all NYC zip codes. The formula for the HRA index for each zip code was:

$$HRA_{zc} = (H_{zc}/H_{nyc}) + (P_{zc}/P_{nyc})$$

where H_{zc} and H_{nyc} are the HIV rates for the zip code and NYC overall, and P_{zc} and P_{nyc} are the poverty rates for the zip code and NYC overall, respectively. After removing nonresidential zip codes, the 30 zip codes with the highest index values (top quintile from Jenks' natural breakpoint) (ESRI, Redlands, CA) were chosen as HRAs for sampling purposes. A main eligibility criterion for participating in the study was having either a geographic or social connection to 1 of the 30 HRAs, meaning participants had to live in an HRA (geographic) or be recruited into the study by someone who did (social).

Assessment of this social connection occurred through the use of respondent-driven sampling (RDS) for recruitment. RDS is a variation on chain-referral sampling that permits the generation of unbiased population estimates if methodological assumptions are met.[25,26] We recruited an initial group of participants (n = 8), called seeds, from the highest ranked HRAs through street outreach and referrals from social service organizations.[27] Seeds were then asked to recruit 3 members of their social networks. The seeds' recruits were then offered the same opportunity, and recruitment continued until we met the target sample size. Participants who did not live in an HRA were not allowed to recruit.

Other eligibility criteria were: (1) age between 18 and 50, (2) opposite-sex vaginal or anal sex in the past year, (3) current residency in New York City, and (4) English or Spanish comprehension. MSM and IDU were not excluded from participating. For this analysis, we removed respondents who reported HIV-positive during the study because questions on recent HIV testing did not apply.

This study was reviewed and approved by the institutional review boards of the CDC, NY Department of Health and Mental Hygiene, and the National Development and Research Institutes. All participants provided informed consent and were compensated for their time.

Measures

The study consisted of an HIV test and a structured survey administered privately by a trained interviewer. Main survey domains were sociodemographics, sexual and injection-related HIV risk behaviors, and exposure to HIV testing and prevention services. Blood collected by a trained phlebotomist through traditional venipuncture was tested by the NYC health department laboratory on HIV1/2 enzyme-linked immunosorbent assay and HIV1 Western blot platforms (Bio-Rad Laboratories, Hercules, CA).

The main outcome for this analysis was a self-report of having an HIV test within 12 months before the interview. We also described participants' history of ever testing. Questions on beliefs about routine testing were derived from a Kaiser Family Foundation survey.[21] We examined associations between recent testing and recent encounters with 4 potential testing settings: health care providers, homeless shelters, jails or prisons, and drug and alcohol treatment. Past year homelessness and arrest were used as proxy indictors for past year shelter or jail encounters. Participants were asked if they were homeless (livings in shelters, single-room occupancy hotels, or on the street), were arrested and booked, entered drug or alcohol treatment, or visited a health care provider in the past year. In addition, we examined 6 potential confounders for the hypothesized association: current health care insurance, age, history of injecting drugs, past year male-to-male anal sex, past year diagnosis of a sexually transmitted disease, and past year risky heterosexual sex (unprotected vaginal or anal sex with an opposite-sex casual or exchange partner, the latter of which is a partner with whom money or drugs are traded for sex).

Statistical Analysis

Weighted analysis of survey data were conducted through the RDS Analysis Tool 5.6 (Cornell University, Ithaca, NY) and SAS 9.1 (SAS Institutes, Cary, NC). RDS Analysis Tool generates participant weights that control for biases common with peer-referral sampling: participants with large networks and participants who recruit others like themselves tend to be overrepresented in the sample.[27] RDS weights were generated for each variable and univariate test.[28,29] Weighted survey data were analyzed in SAS with procedures created for complex study designs.[30]

Gender-stratified Rao-Scott χ^2 tests of association between recent HIV testing and testing settings (and potential confounders) were conducted at the univariate level. Multiple logistic regression models (stratified by gender) were constructed to examine the associations between recent HIV testing and encounters with testing settings, controlling for confounders. Because RDS regression modeling techniques are still developing, we conducted a sensitivity analysis of regression outcomes by comparing weighted and unweighted models.[31,32]

RESULTS

Of the 850 eligible high-risk heterosexuals who participated in the study, 4 who reported that they were HIV-positive were removed from this analysis. Of the remaining 846 who reported a negative or unknown HIV status, 23 did not test, 756 tested HIV-negative, and 67 tested HIV-positive during the study (Table 1). Respondents were largely black or Hispanic, and most were between the ages of 40 and 50. Men and women were similarly distributed in the sample. Most men and women earned less than $10,000 annually, but most had some form of health insurance. Over half of men (55.3%) and women (60.7%) reported risky heterosexual sex in the past year. Approximately one-quarter of men and women had a history of injection drug use, 22.2% of men and 32.1% of women had a past year STD diagnosis, and 7.6% of men reported past year male-to-male sex (Table 1). Weighted HIV seroprevalence estimates are 7.4% for men and 9.0% for women; these estimates represent previously undiagnosed infection. Prevalence of undiagnosed HIV infection remained high once MSM and IDU were excluded: 6.0% for men and 7.1% for women.

Table 2 presents HIV testing history and beliefs, as well as potential encounters with testing settings. For our main outcome, 32.4% of men and 38.3% of women reported having an HIV test in the past year. Few participants believed that HIV testing was currently a routine procedure in medical care, but most believed that it should be. Nearly all men (91.3%) and women (93.0%) encountered one of the 4 potential HIV testing settings in the past year. Health care providers were the most common testing setting encounter for men (72.9%) and women (76.5%). In addition, over half of men (52.0%) and women (56.5%) were homeless, 40.3% of men and 25.9% of women were

TABLE 1. Demographics and HIV Seroprevalence and Risk Factors of New York City High-Risk Heterosexuals, Stratified by Gender, 2006 to 2007

Characteristic	Men (n = 410) (Weighted %)	Women (n = 436) (Weighted %)
Race/ethnicity		
Black	68.9	69.3
Hispanic	24.1	19.7
White	4.3	9.3
Other	2.7	1.7
Age		
18–29	19.9	35.0
30–39	19.1	19.3
40–50	61.0	45.7
Income in past yr		
<10k	65.9	77.4
≥10k	34.1	22.6
Current health insurance		
Uninsured	15.2	16.5
Insured	84.8	83.5
HIV seroprevalence		
Did not test	1.6	5.6
HIV-negative	91.0	85.4
HIV-positive	7.4	9.0
HIV-positive (excluding MSM and IDU)	6.0	7.1
HIV risk factors		
History of injection (ever)	26.9	23.4
Male-to-male sex (past yr)	7.6	—
STD diagnosis (past yr)	22.2	32.1
Risky heterosexual sex (past yr)	55.3	60.7

arrested, and 38.1% of men and 26.8% of women entered drug or alcohol treatment.

At the univariate level, recent HIV testing was higher for those who encountered potential testing settings (Table 3), although the associations varied by gender. For men, potential testing encounters with shelters, jails, and drug treatment were all significantly associated with increased likelihood of recent HIV testing; health care provider visits were marginally significant. For women, only encounters with health care providers were significantly associated with increased likelihood of testing. Less than half of men or women who had encountered any one of these 4 settings in the past year had an HIV test in the past year.

TABLE 2. HIV Testing History, Beliefs About Testing, and Testing Setting Encounters for New York City High-Risk Heterosexuals, Stratified by Gender, 2006 to 2007

Characteristic	Men (n = 410) (Weighted %)	Women (n = 436) (Weighted %)
Testing history		
Ever HIV tested	81.5	78.6
HIV tested in past yr	31.3	35.3
Testing beliefs		
HIV testing is routine	23.5	18.9
HIV testing should be routine	67.1	75.6
Testing setting encounters		
Health care provider	72.9	76.5
Homeless shelter	52.0	56.5
Jail/prison	40.3	25.9
Drug/alcohol treatment	38.1	26.8
Any testing setting	91.3	93.0

TABLE 3. Univariate Associations of Past Year HIV Testing With Testing Setting Encounters, Demographics, and Risk Factors, Stratified by Gender, 2006 to 2007

	Men		Women	
Characteristic	Tested (%)	*P*	Tested (%)	*P*
Health care provider		0.08		<0.01
No	19.7		13.7	
Yes	35.5		42.0	
Homeless shelter		<0.01		0.32
No	19.2		39.1	
Yes	41.8		32.5	
Jail/prison		<0.01		0.41
No	23.5		33.7	
Yes	43.2		40.3	
Drug/alcohol treatment		0.02		0.41
No	24.3		33.6	
Yes	41.6		39.8	
Current health insurance		0.15		0.29
Uninsured	22.2		43.7	
Insured	33.1		34.2	
Age		0.03		<0.01
18–29	19.0		47.2	
30–50	33.6		29.2	
History of injection		0.53		0.36
No	30.1		37.1	
Yes	35.3		29.5	
Male-to-male sex		0.23		—
No	30.2		—	
Yes	44.4		—	
STD diagnosis		0.81		0.72
No	31.9		36.3	
Yes	29.6		33.7	
Risky heterosexual sex		0.29		<0.01
No	35.6		46.4	
Yes	27.8		28.2	

In the weighted multiple logistic regression models, men were more than twice as likely to test if they encountered a health care provider, homeless shelter, or jail/prison (Table 4). The increased likelihood of testing with drug treatment encounters was marginally significant. For women, only encounters with health care providers were significantly associated with increased likelihood of testing. Women who visited providers in the past year were over 4 times as likely to test in the past year. Drug treatment was not significantly associated with increased likelihood of testing for either gender.

In our sensitivity analysis, the effect of RDS weighting in the regression model minimally changed the hypothesized associations. None of the setting encounters lost or gained significance with the weighting. This may suggest minimal recruitment bias along these characteristics.

DISCUSSION

Infrequent HIV Testing

Despite regular encounters with potential testing settings and high levels of risk, we observed low levels of HIV testing

TABLE 4. Multiple Logistic Regression Models of HIV Testing in the Past Year Among New York City High-Risk Heterosexuals, Stratified by Gender, 2006 to 2007

	Men			Women		
Testing Setting Encounters	Adjusted OR	95% CI	*P*	Adjusted OR	95% CI	*P*
Health care provider			0.03			<0.01
No	1.00			1.00		
Yes	2.57	1.12–5.94		4.33	1.66–11.27	
Homeless shelter			0.02			0.77
No	1.00			1.00		
Yes	2.27	1.11–4.62		0.91	0.48–1.73	
Jail/prison			0.05			0.73
No	1.00			1.00		
Yes	2.02	1.00–4.08		1.15	0.51–2.59	
Drug/alcohol treatment			0.06			0.09
No	1.00			1.00		
Yes	2.11	0.97–4.62		1.91	0.90–4.10	

Controls for current health insurance, age, history of injection, past year male-to-male sex, risky heterosexual sex, and STD diagnosis.

in this study of high-risk heterosexuals. Overall, heterosexuals in our study tested at rates similar to the general population but had much higher levels of HIV risk. Estimates show that 30% of all NYC adults in 2006 had a past year HIV test but that only 6% of all NYC adults in 2003 had a STD diagnosis in the past year,[33] compared with 22% of men and 32% of women in our study. Past studies have found that MSM and IDU test more frequently than high-risk heterosexuals.[13,34] Analyses of NYC NHBS data from MSM and IDU cycles since 2004 are consistent with these studies, as 60% of MSM and 69% of IDU reported past year HIV testing.[35,36]

Further expansion of routine HIV testing would likely increase testing rates substantially. Because most HIV-positive persons who know their HIV status reduce their risk behaviors,[37] increased testing of high-risk heterosexuals is needed to reduce growing rates of undiagnosed HIV infection and transmission among this population.[15] The HIV prevalence among non-MSM and non-IDU heterosexuals in our study was unexpectedly high (6.0% for men and 7.1% for women). Infrequent testing may be a driving factor in this seroprevalence.

Medical Testing Settings

CDC and the NYC Department of Health recommend routine testing for all persons in medical settings–regardless of risk–and suggest that persons at high-risk test at least annually.[10,11] High-risk heterosexuals include those who exchange sex for money or drugs, have sex with HIV-infected persons, or have had a recent STD diagnosis or more than one sex partner since their most recent HIV test.[7] On this basis, one might expect to find high rates of testing among our sample of high-risk heterosexuals who commonly encounter health care providers. However, while approximately three-quarters of respondents visited a provider in the past year only 36% of men and 42% of women who did had a recent HIV test.

Testing is not routinely conducted in medical settings, despite longstanding recommendations for routine testing in high-prevalence areas like NYC. NYC efforts to promote routine testing include launching 2 public health campaigns to provide tools and support for clinicians to integrate HIV testing into routine care,[38] distributing health bulletins and recommendations on routine testing aimed at patients and providers,[11,39] and providing funding for routine testing. Nonetheless, providers still commonly cite barriers to routine testing that include insufficient time, competing priorities, and inadequate reimbursement.[16] New York State law requires a burdensome written consent for each HIV test performed despite CDCs call for a streamlined opt-out approach to testing. For high-risk heterosexuals specifically, unclear definitions of "high risk" may complicate assessments used to determine testing frequency.[40,41]

Nonetheless, the positive associations we found between health care encounters and recent testing for both men and women suggest that medical setting visits are by themselves an important influence on testing. The strength of these associations, even controlling for encounters with other testing settings and risk factors that may also trigger HIV testing, suggest that medical settings should remain a focus for further efforts to routinize testing. Despite challenges to implementing routine testing, past research shows clients support HIV testing as a routine procedure[42,43]; nearly three-quarters of all respondents in our study believed that HIV testing should be routine. Any psychological barriers to testing, such as denial of risk or fear of positive results, may be overcome by destigmatizing HIV testing through treating it as routine.[44,45]

Non-Medical Testing Settings

Alternative institutional settings, where health care is provided but is not a primary focus, are also recommended settings for routine testing, because of high HIV prevalence.[7] A recent serosurvey of adults in an NYC jail, for example, found an HIV prevalence of 4.7% for men and 9.7% for women; high-risk heterosexuals were less likely than MSM and IDU to be aware of their HIV infection.[46] Our respondents frequently encountered homeless shelters, jails, and drug treatment, partially because of connections between unstable housing, incarceration, and substance abuse in this population.[47,48]

Our findings suggest that encounters with these institutions may influence testing. Yet, interestingly, the associations were significant for men only. These gender differences may stem from 3 factors. First, men encountered nonmedical settings more frequently than women, thereby increasing the chances that men will test in these settings. Second, women may test more often in medical settings because of personal preference or public health initiatives like prenatal testing.[10,49] Finally, women may more frequently encounter specific set-

tings in these categories where testing is offered less frequently, such as smaller family shelters rather than larger single-adult shelters.

Shelter and jail encounters may influence HIV testing among high-risk heterosexual men, even controlling for encounters with health care providers and risk factors. Yet, less than half of men who potentially encountered shelters (43.7%) or jails (45.3%) had an HIV test. Providers in these settings may encounter higher refusal rates due to preferences to test with health care providers outside these institutions, and previous research has found mixed client acceptance of HIV testing in these institutions.[22,50,51] Another challenge is that testing opportunities there are often brief and are complicated by competing medical and mental health priorities. The use of rapid testing may overcome these barriers.[52,53] The NYC jail system, for example, offers routine testing to all new inmates and conducts over 25,000 tests annually despite rapid turnover of its population.[48] Overall, nonmedical settings are important environments to provide HIV testing for high-risk heterosexuals who do not regularly encounter the traditional health care system.

Non-Institutional Testing Settings

Alternative methods may be needed to reach the small proportion of high-risk heterosexuals who do not enter any of these institutional testing settings.[54] Although less than 10% of respondents in our study were in this category, their testing rates were much lower. This may constitute a higher risk group generally, since the health-seeking traits influencing persons to enter health care or drug treatment may also influence decisions to test.

Risk-based strategies may be needed to target high-risk heterosexuals "outside the system." CDC piloted 2 projects to increase testing outside traditional settings, involving outreach testing in geographic venues where high-risk persons congregated,[55] and peer-referral testing to recruit social network members with high HIV risk.[56] Both methods have been replicated for testing initiatives in NYC. The sampling method for our NHBS study mirrored some geographical and social network elements of these projects. Innovative definitions of heterosexual risk, like those that take into account the social clustering of HIV infection, should be considered. Finally, the cost-effectiveness of outreach testing programs, such as are underway in NYC, should be compared against routine testing in institutional settings.[57,58]

Limitations

The potential limitations to this study are as follows. First, RDS weighting may not generate valid population estimates for all high-risk heterosexuals in the defined HRAs if the assumptions of RDS are not met.[28] However, our sensitivity analysis indicated that RDS weighting resulted in minimal changes in the study outcomes.[59] Second, homelessness and arrest may be imprecise proxies for encounters with homeless shelters and jails or prisons. Respondents who were "on the street," homeless, or released quickly after arrest may not have encountered a HIV testing environment. However, estimates show that the majority of New York City homeless live in shelters or related housing rather than on the street,[60] and many engage with the shelter system (for food or hygiene) even if they live on the street.[51] Furthermore, among those entering the NYC jail system most are offered HIV tests, as rapid testing technology has allowed for HIV testing in short-term incarcerations.[52,53] A final limitation is that the results may be biased if respondents misreport the study measures due to issues of recall or social desirability.

CONCLUSIONS

In our study, we found low rates of HIV testing overall despite high HIV risk and widespread encounters with potential testing settings. However, individuals who had recently encountered potential settings for HIV testing were more likely to have a recent HIV test. Since over 90% of participants reported encountering at least one testing setting in the past year, most high-risk heterosexuals may be effectively reached through further expansion of routine testing in these settings. Additional efforts are needed to ensure that routine, annual HIV testing of high-risk heterosexuals is a standard of care for those who enter these institutional settings. Testing should also include risk reduction counseling and partner notification activities that further decrease HIV risk after diagnosis. Revised policies and laws are needed to reduce the provider barriers to HIV testing, such as "opt-out" test provision, streamlined consent, and addressing providers' other challenges in routinizing testing. Past studies and our study sample of high-risk, high-prevalence heterosexuals show strong support for a system of routine testing in medical care. Ultimately, efforts to encourage routine and annual HIV testing will serve to combat the growing heterosexual HIV epidemic.

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