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HIV transmission risk behaviors among people living with HIV/AIDS: The need to integrate HIV prevention interventions and public health strategies into HIV care

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Introduction

Prevention of human immunodeficiency virus (HIV) infection has been an important public health challenge since the first AIDS case was reported 30 years ago. It is estimated by the Centers for Disease Control and Prevention (CDC) that approximately 1.1 million people are living with HIV and 48,100 new HIV infections occur annually in the United States (US).[1,2] Although the majority of HIV-infected people adopt safer practices after learning their HIV-positive status, some people continue to engage in high-risk behaviors such as unprotected sex with HIV-negative partners and may represent an important source of transmission.[3–10] As HIV-infected people live longer in the era of highly active antiretroviral therapy (HAART), HIV prevention efforts have been targeted toward prevention of secondary transmission (known as "prevention with positives") by reducing HIV transmission risk behaviors among people living with HIV/AIDS (PLWHA).[11–16] Since HIV primary care settings serve as an essential venue to reach PLWHA, screening for high-risk behaviors has been advocated as a necessary part of HIV care.[12,17–19] Specific strategies such as Partnership for Health, have been developed by the Diffusion of Effective Behavioral Interventions (DEBI) project for clinicians to conduct a brief safer-sex intervention.[20] Evidence demonstrates that clinician-delivered counseling and behavioral interventions based on risk screening have been effective in reducing unprotected sexual intercourse and the number of sexual partners among PLWHA.[19,21–25] These strategies, however, have not been widely utilized by HIV primary care providers due to medical priorities, time constraints, and the sensitive nature of risk screening questions.[26–29]

Previous studies examining HIV transmission risk behaviors among PLWHA in care have mainly focused on factors associated with unprotected sex with HIV-negative or HIV-unknown partners. Predictors of unprotected sex include multiple sexual partners, casual partner(s), drug or alcohol use, exchange sex for money or drugs, and psychosocial

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factors.[6–9,17,18,30–37] Non-disclosure of HIV infection status to sexual partner(s), an important barrier for HIV prevention, has also been assessed but has shown a wide range (3%–47%) across studies because of different study populations and partner types.[7,18,38–40] Partners' sexual behaviors, however, have not been well evaluated among PLWHA in the era of HAART.[40]

In order to plan more effective and feasible HIV prevention strategies at HIV primary care settings, we conducted a risk assessment survey to describe behavioral characteristics and to identify factors associated with high-risk behaviors among PLWHA in care.

Methods

Study population and procedures

Our institution is the largest HIV primary care provider in south central Pennsylvania, a region that includes mainly rural areas and small urbanized cities. Our HIV Comprehensive Care Program was established in the early 1990s and has been funded as a Ryan White Title III (now Part C) clinical site since 2000 to serve diverse PLWHA comprising both rural populations and urban dwellers living in small cities.

The study participants were recruited from five HIV outpatient clinics. Beginning in October 2007, a rapid risk assessment survey was introduced during routine clinical care to all HIV patients who were older than 18 years. The survey was developed based on the CDC's recommendations for brief screening of behavioral risk factors among PLWHA at the clinical settings.[12] Survey questions included pregnancy intention, sexual activity, specific sexual practices, partners' information, sexually transmitted disease (STD) symptoms, and injection drug use (IDU) during the last 12 months.[12] The survey was administered via a face-to-face interview by a member (a nurse or a treating physician) of the HIV primary care treatment team. HIV patients could decline to respond to any question that they did not want to answer. Responses to the screening questions were recorded by the interviewer. The survey data were linked with the HIV clinical care database, which included patients' socio-demographics, HIV transmission risk category, and HIV/AIDS-related medical information. This study was approved by the Pennsylvania State University College of Medicine Institutional Review Board (IRB) in compliance with the IRB and federal regulations governing the protection of human subjects. All work was performed in accordance with the ethical standards that guide biomedical research involving human subjects.

Study outcomes

Because few patients reported injection drug use and needle sharing in the last 12 months, the study outcomes focused on two high-risk behaviors that may increase HIV transmission risk: (1) any unsafe sexual behavior and (2) non-disclosure of HIV infection to their partner(s).[12] An unsafe sexual behavior was defined if patients answered "Yes" to inconsistent condom use, have had sex under the influence of alcohol or drugs, or exchange of sex for money. Non-disclosure of HIV infection status to sexual partner(s) was determined if patients answered "No" to "partner(s) know you have HIV". Practice of unprotected anal intercourse (UAI) was also examined as the study outcome for men who

have sex with men (MSM) or MSM/IDU patients. UAI was defined as having anal sex without consistent condom use in the last 12 months.

Covariates of interest

Based on previous findings and our research interests, [6–9,17,18,30–37] patients' demographic characteristics (age, race-ethnicity), HIV transmission risk category based on CDC's definition (MSM, MSM/IDU, IDU, heterosexual contact, and other/unknown),[1] HIV-related clinical factors (length of HIV infection, history of any AIDS complications, and HIV viral load at the time of risk screening) as well as their partners' HIV infection status and the perceived partners' sexual behavior (i.e., partner(s) may have sex with other people) were included in the analyses to examine factors associated with high-risk behaviors.

Statistical analysis

All the analyses were stratified by sex as sexual behaviors differed between HIV-infected women and men.[7,33–35] Descriptive analyses were conducted to depict the characteristics of the study population. The Mantel-Haenszel chi-square test for general association or the Fisher's exact test was used to assess the statistical significance of the associations between patients' characteristics and high-risk behaviors. In the multivariate analyses restricted to sexually active HIV patients, separate models for women and men were used to assess two dichotomous study outcomes: (1) having any unsafe sexual behavior; and (2) non-disclosure of HIV infection status to sexual partner(s). The logistic regression models were used to adjust for demographic characteristics, HIV-related clinical factors, and partners' characteristics to obtain the adjusted odds ratios (aOR) and their 95% confidence intervals. Statistical significance was evaluated at two-sided P-value <0.05. A subgroup analysis was also conducted to examine factors associated with UAI among sexually active MSM patients. All data were analyzed using software by SAS ®, Version 9.2 (SAS Institute Inc., Cary, NC, U.S.A.).

Results

The risk assessment was conducted during October 2007 through September 2008. A total of 530 HIV patients were encountered, but 11 patients (2 women and 9 men) declined the risk assessment, resulting in 519 (97.9%) patients participating in the risk assessment. Three men were excluded from the analyses due to missing responses for sexual behavior questions, leaving 516 patients for final analyses.

Characteristics of the study participants

The participating patients in our study were mainly men (70.3%), older than 40 years (77.4%) and non-Hispanic whites (71.3%) (Table 1). Consistent with the national distributions of the HIV transmission risk category, the majority of women were heterosexual (79.1%) and 73% of men were categorized as MSM or MSM/IDU. Compared with men, the proportions of younger age groups (<40 years, 30.7%) and racial and ethnic minorities (37.3%) were higher among women (P<0.05). Based on available clinical information, 30% of patients had been infected with HIV for 10 years or longer, 57% had a

history of any AIDS complication, and 60.8% had an undetectable HIV viral load (<75 copies/ml) at the time of risk assessment.

Among 516 patients who completed the risk assessment, 58 (11.2%) patients thought that they or their partner could become pregnant, but few patients (1.0%) were currently planning a pregnancy (Table 2). Having STD symptoms (3.3%) and IDU (1.2%) in the last 12 months were uncommon. A total of 339 (65.7%) patients had been sexually active in the last 12 months. Sexually active patients were younger and were less likely to have a prior AIDS complication compared with non-sexually active patients (P<0.05). Among 339 sexually active patients, 33.1% had new sexual partner(s), and 49.4% reported at least one unsafe sexual behavior, mainly inconsistent condom use. The majority of the patients (86.8%) disclosed their HIV infection status to their partner(s); and 23.8% stated that their partner was also HIV infected. Nearly one third of the patients perceived that their partner(s) may have sex with other people.

Stratified analyses suggested different patterns of sexual practices between women and men. In general, men seemed more likely to be sexually active than women (68% versus 60%). Men were also more likely to have new partner(s) (38.1% versus 19.5%, P=0.002) and to believe that their partner(s) may have sex with other people (35.3% versus 25%, P=0.07). However, after excluding MSM patients from the analysis, there were no significant gender differences in sexual behaviors.

Factors associated with high-risk behaviors

Results from bivariate analyses suggested that younger patients (<40 years) were more likely to engage in unsafe sexual behaviors than older patients (P=0.04). Patients having HIV-negative or HIV-unknown partner(s) were less likely to report any unsafe sexual behavior compared with those with HIV positive partner(s) (45% versus 59%, OR=0.59, P=0.04). The perceived partner's behavior (i.e., partner(s) may have sex with other people) appeared to be associated with any unsafe behaviors (OR=2.06, P=0.002). Non-Hispanic blacks (27%), patients having HIV-negative or HIV-unknown partner(s) (16%), and patients who perceived that their partner(s) may have sex with other people (30%) were more likely to withhold their HIV infection status from their sexual partner(s). Although sexual behaviors did not significantly vary by HIV viral load status, among 172 patients with a detectable viral load (>75 copies/ml), 50% reported at least one unsafe sexual behavior, and 14% did not disclose HIV infection status to their partner(s).

In multivariate analyses stratified by sex and adjusted for both patients' and partners' characteristics, factors associated with high-risk behaviors varied between women and men patients (Table 3 and Table 4). However, the perceived partners' behavior (i.e., partners may have sex with other people) was strongly associated with non-disclosure of HIV infection status (aOR=9.45,P=0.01 for women; and aOR=12.1, P<0.0001 for men) in both sexes. Among women, younger patients (<40 years) were more likely to have any unsafe sexual behavior (aOR=6.82, P=0.03) compared with those >=50 years, while women who had a history of any AIDS complication were less likely to declare any unsafe sexual behavior (aOR=0.36, P=0.04). Among men, patients having HIV-negative or HIV-unknown partner(s) were less likely to report any unsafe sexual behavior (aOR=0.46, P=0.02), but

patients who perceived that their partner(s) may have sex with other people were more likely to engage in an unsafe sexual behavior (aOR=2.59, P=0.001). Non-Hispanic black men and those having HIV negative or HIV unknown partner(s) were more likely to report non-disclosure of HIV infection status to their partner(s) (aOR=4.51, P=0.01; and aOR=5.02, P=0.04, respectively).

UAI among MSM patients

In a subgroup analysis focusing on 178 sexually active MSM patients, 73.6% (N=131) reported practice of anal sex and 33.1% (N=59) engaged in UAI in the last 12 months. Although MSM patients seemed less likely to have UAI with HIV-negative or HIV-unknown partner(s) than with HIV-positive partner(s) (30% versus 41%), 11 MSM patients with a detectable HIV viral load had UAI with HIV-negative or HIV-unknown partners. In the multivariate analysis (Table 4), the only variable significantly associated with UAI was the perceived partners' behavior (i.e., partners may have sex with other people) (aOR=2.00, 95% CI=1.02, 3.90, P=0.04).

Discussion

In our study nearly two thirds of PLWHA have been sexually active in the last 12 months. High-risk sexual behaviors – including having unprotected sex – are also commonly reported, but very few PLWHA continue to use injection drugs or share needles with other people.[5–9,31–37] As the recent HIV epidemiology shows that sexual transmission of HIV accounts for nearly 90% of all diagnosed HIV cases, identifying patterns of and factors associated with high-risk sexual behaviors among PLWHA is essential to prevent secondary HIV transmission in the community.[41]

The most significant correlates of HIV transmission risk behaviors identified in our study are partners' characteristics including HIV infection status and the perceived partners' behavior (i.e., partner may have sex with other people) among both women and men. PLWHA are less likely to engage in unsafe sexual behaviors with HIV-negative or HIV-unknown partner(s) and are willing to adopt safer sex practices to prevent from infecting their sexual partners. Some PLWHA, however, continue practicing high-risk behaviors, regardless of their partners' HIV infection status. We also find that the perception about partners' sexual behavior is an independent risk factor for high-risk behaviors. Previous research has unanimously reported that some MSM patients still engage in HIV transmission risk behaviors, but the reasons are not clearly understood in MSM population.[5,7–9,30–32,35,36] Our study shows that the partners' behavior (i.e., having sex with other people) is the only variable significantly associated with UAI among MSM patients. These findings suggest that individuals' behaviors may be influenced by their partners' characteristics and may explain why some PLWHA continue high-risk behaviors.

Previous research has supported our findings that some PLWHA do not practice safer sex with an HIV-infected partner or with a casual or a non-committed partner.[7–9,17,18,30–32,35] The consequences of these behaviors result in a major public health problem due to the increased risks of acquiring new STDs and transmitting HIV to uninfected partners. Including partners' information in risk assessment will help us to better understand

individual's risk profiles and plan appropriate HIV prevention intervention strategies. For PLWHA who have HIV-negative or HIV-unknown partners, it is necessary to reinforce the importance of safer sex practices, but more intensive risk-reduction counseling may be needed for PLWHA with non-committed partners. For those having HIV-infected partners, intervention should also focus on reducing the risks of getting or transmitting STDs.

In our study about 15% of HIV patients do not reveal the HIV infection to all of their sexual partners including HIV-negative or HIV-unknown partners. Black men are more likely to withhold their HIV infection status compared to white men. As our study participants mainly live in small cities or rural areas, non-disclosure of HIV infection could be due to HIV-related social stigma, fear, embarrassment, lack of social support, and culture issues, especially for black people.[38–40,42,43] Meanwhile people are more likely to withhold their HIV infection if they think their partner(s) may have sex with other people, implying that PLWHA may selectively disclose their HIV infection status to sexual partners based on their own perception. It is necessary to identify different barriers for HIV disclosure among subgroups of PLWHA (e.g., minority people, people with non-committed partners) in order to design culturally appropriate approaches to improve HIV disclosure to all partners.

Having unprotected sex with at risk partners and non-disclosure of HIV infection status to sexual partners raise a concern that HIV could be transmitted to other people in the community, therefore, partner services should be available to PLWHA at the clinical settings in order to identify exposed or possibly infected partners and to link those partners to preventive services. However, the implementation of partner services or behavioral interventions conducted by clinicians during routine clinical care remains a challenge due to some clinical and logistic barriers.[26–29] Partner services are usually handled by trained health department specialists as clinicians may not be able to conduct detailed interviews to collect all partners' information and to initiate partner notification. Health department specialists may also have better outcomes in identifying and notifying sexual partners than clinicians.[12] In order to improve HIV prevention efforts, it is important to expand collaboration with community HIV prevention partners or the local health departments to integrate on-site partner services and behavioral interventions at the clinical settings.

Similar to previous research, we observe different risk factors associated with high-risk sexual behaviors between women and men in our study.[7,33–35] Younger women (<40 years) and women without a history of AIDS seem more likely to report any unsafe sexual behavior than older women or women with a history of AIDS, but this association is not observed among HIV-infected men. These results could be due to the fact that younger or healthier women may be more sexually active than their counterparts. Sexual behaviors of HIV-infected women are unlikely affected by their reproductive needs as very few women indicate that they are planning to get pregnant. Conversely, partner's HIV status is not significantly associated with unsafe sexual behaviors among women. It is possible that some HIV-infected women may not be able to adopt safer sex practices including consistent condom use with their male partners due to fear or the lack of power to negotiate safer sex.[44,45] As nearly 25% of PLWHA in the US are women older than 13 years, tailored interventions should be developed to promote safer sex practices for HIV-infected women.[46] Interestingly, although the incidence and the prevalence of HIV infection are

disproportionally higher in minority populations, high-risk behaviors seem not differ by race-ethnicity. [47] In our study, we do not observe more high-risk behaviors (except non-disclosure of HIV infection) among minority patients and MSM do not show increased risks of high-risk behaviors compared with heterosexual men. These results could be due to the unique social environment and population characteristics in our study area that differ from previous study populations, as our study participants are mainly older (>=40 years), non-Hispanic whites, and living in small urbanized cities or rural areas.[5,7–9,30–32]

Study limitations

There are several limitations to our study. We have designed our survey based on the CDC's recommendations.[12] Although important behavioral elements are included in our risk assessment, some information (e.g., number of sexual partners, types of partners, and non-injection drug use) are not completely collected due to time constraints in clinical care. Therefore, HIV transmission risk profiles may not be fully captured. Second, due to small cell sizes, we are unable to assess factors associated with IDU and STD and to conduct detailed analyses to examine high-risk behaviors stratified by partners' characteristics and by HIV viral load. Some variables seem related to high-risk behaviors but we did not have sufficient statistical power to detect the associations. Third, as this is a cross-sectional study, the temporal relationship between variables cannot be determined. Studies with large populations or longitudinal studies are needed to solve these limitations.

In conclusion, PLWHA are commonly sexually active in the HAART era and some people continue practicing HIV transmission risk behaviors. The behaviors of PLWHA may be influenced by their partners' characteristics. Considering that the behaviors are not static, tailored HIV prevention intervention strategies should be provided to PLWHA in order to reinforce safer sex practices, and on-site partner services should be available to identify at risk partners. In real-world practice HIV/STD prevention interventions and public health strategies should be integrated into HIV care to facilitate HIV prevention efforts.

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Table 1

Characteristics of 516 HIV patients participating in the risk assessment at five HIV outpatient clinics in south central Pennsylvania, 2007–2008

Characteristics	Women (%)	Men (%)	Total (%)
Demographics			
Sex	153 (29.7)	363 (70.3)	516 (100)
Age *			
<30	9 (5.9)	20 (5.5)	29 (5.6)
30–39	38 (24.8)	50 (13.8)	88 (17.0)
40–49	58 (37.9)	158 (43.5)	216 (41.9)
>=50	48 (31.4)	135 (37.2)	183 (35.5)
Race-ethnicity *			
Hispanic	24 (15.7)	35 (9.6)	59 (11.4)
Non-Hispanic black	33 (21.6)	55 (15.1)	88 (17.1)
Non-Hispanic white	96 (62.7)	272 (74.9)	368 (71.3)
Other	0	1 (0.3)	1 (0.2)
Clinical characteristics			
HIV transmission risk category**			
MSM	---	256 (70.5)	256 (49.6)
MSM/IDU	---	9 (2.5)	9 (1.7)
IDU	23 (15.0)	31 (8.5)	54 (10.5)
Heterosexual contact	121 (79.1)	49 (13.5)	170 (32.9)
Other/unknown	9 (5.9)	18 (5.0)	27 (5.2)
History of any AIDS complications			
Yes	80 (52.3)	214 (58.9)	294 (57.0)
No	73 (47.7)	149 (41.1)	222 (43.0)
HIV viral load			
Undetectable (<=75 copies/ml)	83 (54.3)	231 (63.6)	314 (60.8)
Detectable (>75 copies/ml)	60 (39.2)	112 (30.8)	172 (33.3)
Unknown	10 (6.5)	20 (5.5)	30 (5.8)
Length of HIV diagnosis†			
<1 year	6 (6.7)	22 (6.1)	28 (3.9)
1–9 years	38 (42.2)	99 (27.3)	137 (24.8)
>=10 years	46 (30.1)	109 (30.0)	155 (30.0)
Unknown	63 (41.2)	133 (36.6)	196 (38.0)

Abbreviations: HIV: human immunodeficiency virus; MSM: men who have sex with men; IDU: injection drug use; AIDS: acquired immunodeficiency syndromes; %: percentage.

* The distributions were statistically different (P<0.05) between women and men.

** HIV transmission risk category was defined based on the categories used in CDC's HIV Surveillance.

[†]The year of HIV diagnosis was available or recorded for 320 patients.

Table 2

Results of the risk assessment among 516 HIV patients in south central Pennsylvania, 2007–2008

Risk assessment questions	Women (%) N=153	Men (%) N=363	Total (%) N=516
General information in the last 12 months			
Pregnancy (answer="Yes")			
Can you or your partner become pregnant?	30 (19.6)	28 (7.7)	58 (11.2)
Do you or your partner plan on pregnancy?	3 (2.0)	2 (0.6)	5 (1.0)
Have had any STD symptoms	8 (5.2)	9 (2.5)	17 (3.3)
Have used injection drugs	1 (0.6)	5 (1.4)	6 (1.2)
Have shared needles	0	1 (0.3)	1 (0.2)
Have been sexually active			
Yes	92 (60.1)	247 (68.0)	339 (65.7)
No	61 (39.9)	116 (32.0)	177 (34.3)
Sexual practices in the last 12 months among 339 sexually active patients *			
Have had new partner(s) **	17 (19.5)	91 (38.1)	108 (33.1)
Have had any unsafe sexual behaviors	50 (54.4)	115 (47.5)	165 (49.4)
Inconsistent condom use	44 (47.8)	94 (38.2)	138 (40.8)
Sex under the influence of alcohol or drugs	12 (13.3)	45 (18.3)	57 (17.0)
Exchange of sex for money	2 (2.3)	6 (2.5)	8 (2.4)
Partner(s) know you have HIV	81 (88.0)	209 (86.4)	290 (86.8)
Partner(s) have HIV	17 (18.7)	63 (25.7)	80 (23.8)
Partner(s) have sex with other people (Yes or uncertain)	23 (25.0)	86 (35.3)	109 (32.4)
Oral sex			
Yes, insertive	---	144 (58.8)	144 (42.9)
Yes	47 (51.6)	52 (21.2)	99 (29.5)
No	44 (48.3)	49 (20.0)	93 (27.7)
Vaginal sex			
Yes	83 (90.2)	74 (30.6)	157 (47.0)
No	9 (9.8)	168 (69.4)	177 (53.0)
Anal sex			
Yes, insertive	---	105 (43.0)	105 (31.4)
Yes	8 (8.9)	34 (13.9)	42 (12.6)
No	82 (91.1)	105 (43.0)	187 (56.0)

Abbreviations: HIV: human immunodeficiency virus; STD: sexually transmitted diseases; %: percentage.

* Missing responses to some questions were excluded from the analysis.

** $P<0.05$, but there were no significant differences in sexual practices between women and men after excluding men who have sex with men.

Table 3

Factors associated with high-risk behaviors among 92 sexually active HIV-infected women in south central Pennsylvania, 2007–2008, multivariate analysis

Characteristics	Any unsafe sexual behavior aOR (95% CI)	Non-disclosure of HIV infection status to sexual partner(s) aOR (95% CI)
Demographics		
Age (vs. >=50 years)		
<40	6.82 (1.14, 40.8)*	0.13 (0.02, 1.06)
40–49	5.15 (0.85, 31.1)	0.21 (0.03, 1.58)
Race-ethnicity (vs. Non-Hispanic white)		
Non-Hispanic black	1.82 (0.53, 6.32)	3.18 (0.53, 19.1)
Hispanic	0.77 (0.19, 3.13)	2.38 (0.16, 34.8)
HIV-related clinical information		
HIV transmission risk category (vs. Heterosexual/Other)		
IDU	4.71 (0.97, 22.9)	---†
Length of HIV infection (vs. >=10 years)		
<10 year	0.34 (0.09, 1.23)	1.27 (0.17, 9.54)
Unknown	0.71 (0.23, 2.22)	1.27 (0.18, 9.19)
History of any AIDS complications (vs. No)		
Yes	0.36 (0.13, 0.99)*	1.66 (0.32, 8.63)
HIV viral load (vs. Undetectable)		
Detectable (>75 copies/ml)	0.87 (0.33, 2.31)	1.96 (0.36, 10.6)
Partners' characteristics		
Partner(s) have HIV (vs. Yes)		
No/Not sure	0.57 (0.15, 2.17)	2.07 (0.17, 25.6)
Partner(s) may have sex with other people(vs. No)		
Yes or uncertain	1.86 (0.54, 6.38)	9.45 (1.64, 54.2)*

Abbreviations: HIV: human immunodeficiency virus; IDU: injection drug use; AIDS: acquired immunodeficiency syndromes; aOR: adjusted odds ratio; CI: confidence interval.

Any unsafe sexual behavior included inconsistent condom use, sex under the influence of alcohol or drugs, or exchange of sex for money.

Non-disclosure of HIV infection was determined if the patients answered "No" to "partner(s) know you have HIV".

*P<0.05

†HIV transmission risk category was not included in the model due to a small sample size.

Table 4

Factors associated with high-risk behaviors among 247 sexually active HIV-infected men in south central Pennsylvania, 2007–2008, multivariate analysis

Characteristics	Any unsafe sexual behavior aOR (95% CI)	Non-disclosure of HIV infection status to sexual partner(s) aOR (95% CI)	UAI among 178 MSM aOR (95% CI)
Demographics			
Age (vs. >=50 years)			
<40	2.10 (0.90, 4.89)	0.61 (0.16, 2.40)	1.20 (0.44, 3.25)
40–49	0.86 (0.46, 1.62)	1.14 (0.42, 3.08)	0.66 (0.29, 1.47)
Race-ethnicity (vs. Non-Hispanic white)			
Non-Hispanic black	1.09 (0.49, 2.39)	4.51 (1.41, 14.5)*	0.35 (0.09, 1.38)
Hispanic	0.80 (0.32, 2.01)	0.72 (0.12, 4.30)	0.97 (0.26, 3.69)
HIV-related clinical information			
HIV transmission risk category (vs. Heterosexual/Other)			
MSM/MSM IDU	1.14 (0.52, 2.52)	0.91 (0.22, 3.67)	---
IDU	1.71 (0.56, 5.27)	1.34 (0.21, 8.78)	---
Length of HIV infection (vs. >=10 years)			
<10 year	0.80 (0.39, 1.65)	1.60 (0.53, 4.88)	1.06 (0.45, 2.49)
Unknown	0.94 (0.48, 1.86)	1.25 (0.40, 3.91)	0.56 (0.24, 1.31)
History of any AIDS complications (vs. No)			
Yes	0.94 (0.54, 1.66)	0.78 (0.31, 1.93)	0.95 (0.47, 1.91)
HIV viral load (vs. Undetectable)			
Detectable (>75 copies/ml)	0.96 (0.53, 1.74)	1.10 (0.43, 2.80)	0.91 (0.43, 1.93)
Partners' characteristics			
Partner(s) have HIV (vs. Yes)			
No/Not sure	0.46 (0.25, 0.87)*	5.02 (1.09, 23.2)*	0.54 (0.26, 1.13)
Partner(s) may have sex with other people(vs. No)			
Yes or uncertain	2.59 (1.44, 4.66)*	12.1 (4.35, 33.7)*	2.00 (1.02, 3.90)*

Abbreviations: HIV: human immunodeficiency virus; MSM: men who have sex with men; IDU: injection drug use; AIDS: acquired immunodeficiency syndromes; UAI: unprotected anal intercourse; aOR: adjusted odds ratio; CI: confidence interval.

Any unsafe sexual behavior included inconsistent condom use, sex under the influence of alcohol or drugs, or exchange of sex for money.

Non-disclosure of HIV infection was determined if the patients answered "No" to "partner(s) know you have HIV".

UAI was defined as having anal sex without consistent condom use in the last 12 months.

*P<0.05