Alcohol Use and Sexual Risk Behavior Among Human Immunodeficiency Virus–Positive Persons

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Background: This study was undertaken to determine if alcohol use is associated with sexual risk taking among human immunodeficiency virus (HIV)–infected persons.

Methods: Cross-sectional interviews of 262 HIV-infected patients in the Brown University AIDS Program were performed. Factors associated with any sexual activity, unsafe sexual activity, and a 4-fold typology of sexual risk were examined. Alcohol measures included drinking days, drinks per drinking day, binge drinking, and hazardous alcohol use.

Results: The sample was 58% male and 40% white; 67% of patients were self-identified as heterosexual, and 48% drank alcohol. Nearly two thirds of patients reported sexual activity in the past 6 months, with 38% reporting unprotected sex during that period. All measures of alcohol use were significantly associated with any sexual activity and with unsafe sexual behavior. As an example, controlling for age, HIV transmission risk, marital status, and HIV clinical indicators, hazardous drinkers were 5.64 times more likely to report unprotected sex and have multiple partners ($p < 0.01$) than were those not drinking at hazardous levels.

Conclusions: A high proportion of HIV-infected persons were sexually active and having unsafe sex. Alcohol, at all levels of use, was associated with increased sexual risk taking.

Key Words: Alcohol, HIV Sexual Risk.

ALCOHOL USE MAY influence high-risk sexual behavior in a variety of populations (Graves and Leigh, 1995; Woods et al., 1996; Strunin, 1999). Alcohol use is commonly associated with unprotected sexual relations among populations at particular risk for human immunodeficiency virus (HIV), contributing to risky sexual behavior among men who have sex with men (Penkower et al., 1991), drug users (Stein et al., 2000; Stein et al., 2001), young adults (Seage et al., 1998), and men seeking mental health and prevention services (Kalichman et al., 1997). Among people living with HIV infection, unsafe sexual behavior remains prevalent as documented by both self-report and laboratory tests for sexually transmitted infections (Avants et al., 2000; Erbelding et al., 2000; Kalichman et al., 1999; Kalichman et al., 2000).

Despite these associations, relatively little work has been done concerning the relationship between alcohol and high-risk sex among HIV-seropositive persons, despite the fact that both alcohol problems and unsafe sexual behaviors

are highly prevalent (Bing et al., 1995). Kalichman (1999) reported that nearly one half of HIV-infected men and one quarter of HIV-infected women who reported unsafe sex indicated using alcohol before sex and that high-risk sex was associated with alcohol use. Murphy et al. (2001) found that frequent alcohol use was associated with unprotected sex as well as with higher levels of depression. Alcohol consumption has also been linked to unsafe sexual behaviors in HIV-infected women (Clark et al., 1997). In summary, although a relationship between alcohol use and unsafe sexual practices has been documented, these reports for HIV-positive cohorts included only limited measures of alcohol use, and they did not comprehensively control for clinical and psychosocial variables previously correlated with unsafe sex.

It is important to understand the factors contributing to unprotected sex among HIV- infected persons. As persons live longer and feel better in response to medical therapy, they may increase their sexual activity. If unsafe sexual practices continue, the spread of HIV and resistant strains remains a concern (Little et al., 2002). For the HIV-infected person, unsafe sex can lead to superinfection with different viral strains.

In this study, we examined the factors associated with any sexual activity, unsafe sexual activity, and a 4-fold typology of sex risk in a cohort of HIV-seropositive persons. We hypothesized that alcohol use was associated with increased sexual activity as well as unsafe sexual activity after controlling for sociodemographic, substance use, mental health, relationship, and clinical factors.

MATERIALS AND METHODS

Recruitment

Between February 2001 and June 2004, research staff approached consecutive patients awaiting their medical visit at the two Brown University AIDS Program clinical sites and informed them about a Lifespan Institutional Review Board–approved 12-month randomized trial of a supportive psychoeducational telephone intervention for HIV-infected patients. All participants received four research assessments; in addition, participants in the intervention arm of the study received 12 telephone contacts. Interested HIV-infected patients were screened to assess full eligibility for the study; eligibility criteria included 18 years of age or older, English or Spanish speaking, regular access to a telephone, no plans to leave the area in the next 12 months, and competency to sign an informed consent form and participate in the research interview. If the patient qualified for the study, he or she was invited for an individual face-to-face baseline interview. During this interview, after providing informed consent, participants were asked about HIV-related medical experiences, depression, substance use, and social relationships. Medical records were reviewed for laboratory study results including T-cell count and HIV RNA level within 3 months of the interview date. Baseline data were used for this study.

In total, 511 HIV-infected patients were approached for participation. Of the 511 patients, 180 refused, 6 spoke languages other than English or Spanish, 40 did not have telephones, 6 had plans to move, and 17 were cognitively impaired (research assistant's decision at the time of consent), resulting in the 262 patients included in this analysis. Patients who refused were not significantly different from enrollees in ethnicity, age, or gender. Participants were compensated with cash at the completion of interviews.

Variables

Outcome Variables. Participants were asked to report the number of males and females with whom they had had sex in the past 6 months; any sexual activity was coded 1, and no sexual activity was coded 0. Unsafe sex was coded 1 if participants reported any vaginal or anal intercourse without using a latex condom. In addition, we constructed a four-category indicator of sex risk scored as follows: 0, no sexual activity; 1, condom-protected sex only; 2, unprotected sex with a single partner; and 3, any unprotected sex and multiple sex partners. This typology was meant to capture increasing HIV transmission risk from a public health standpoint.

Other Variables. Indicators of alcohol use were derived from the Treatment Services Review (McLellan et al., 1992a). Participants were asked how many days in the past 6 months they had drunk any alcohol, the number of drinks per drinking day, and the number of days on which they had had five or more drinks (three or more for women). Hazardous drinking was scored 1 if the participant reported 1 or more binge drinking episodes or if the participant exceeded an average of 14 drinks (7 drinks for women) per week (National Institute on Alcohol Abuse and Alcoholism, 1995). Other correlates included age, gender, race/ethnicity, sexual orientation, having a romantic partner or spouse, transmission risk group (ever injected, men who have sex with men, and other), self-reported cocaine or heroin use in the last 3 months (McLellan et al., 1992b), the Beck Depression Inventory (Beck et al., 1988), the physical functioning component of the Medical Outcomes Study 36-Item Short Form Health Survey (SF-36) (Ware and Sherbourne, 1992), number of months since HIV infection diagnosis, HIV antiretroviral medication use, T-cell count, and having a viral load that exceeded the threshold for detection. We also constructed an HIV symptom burden index that was a count of 13 HIV-related symptoms that participants said bothered them "moderately" or "severely."

Analytic Methods

We report means for continuous correlates and percentages for categorical correlates comparing participants who were sexually active in the last 6 months with those not sexually active. We used odds ratios to estimate the strength of association between the predictors and sex risk. Continuous correlates were standardized to zero mean and unit variance before estimating the odds ratios. For consistency, we report the likelihood ratio χ^2 statistic and the associated probability. Because some correlates were skewed, we examined appropriate nonparametric statistics such as the Wilcoxon rank sum test to confirm the results. In all cases, nonparametric comparisons yielded consistent statistical conclusions. We used the four-category sexual risk typology in a multinomial logistic regression model to test if sexual risk was associated with alcohol use after adjusting for possible confounders.

RESULTS

Participants were 39.7% white, 23.7% Hispanic, 23.7% African American, and 12.9% other ethnic origins. Most participants (58.4%) were male, and the average age $\pm$ SD was 40.7 ± 8.1 years. Nearly two thirds (166 or 63.4%) of participants said they had been sexually active in the 6 months before baseline, more than one third (99 or 37.8%) said they had had unprotected sex during that period, and one fifth (54 or 20.6%) reported having multiple sex partners.

The likelihood of having had any sex in the last 6 months decreased significantly as age increased (OR = 0.76; LR^2 = 4.29; $p < 0.05$) but was not significantly associated with sex or ethnicity (Table 1). Participants who were married or had a romantic partner were significantly more likely to have sex than were those without partners (OR = 3.34; LR^2 = 17.92; $p < 0.001$). Having any sex was not associated significantly with Beck Depression Inventory scores, the physical functioning component of the SF-36, duration of HIV infection, HIV symptom burden, or having a detectable viral load. However, the likelihood of having sex was positively associated with having a higher T-cell count (OR = 1.32; LR^2 = 4.22; $p < 0.05$). Participants who were taking anti-HIV medications were less likely to be sexually active than were those not currently taking anti-HIV medications (OR = 0.58; LR^2 = 4.19; $p < 0.05$). HIV transmission risk group was not associated significantly with being sexually active. Neither cocaine use nor heroin use was significantly associated with being sexually active, but the likelihood of having any sex was associated with any alcohol use (OR = 1.95; LR^2 = 6.63; $p < 0.05$), number of alcohol use days (OR = 1.48; LR^2 = 6.74; $p < 0.01$), number of drinks per drinking day (OR = 1.62; LR^2 = 9.79; $p < 0.01$), number of binge drinking days (OR = 1.49; LR^2 = 8.44; $p < 0.01$), and hazardous drinking (OR = 2.90; LR^2 = 11.98; $p < 0.0001$).

Among sexually active participants, younger participants were more likely to engage in unprotected sex (OR = 0.61; LR^2 = 9.78; $p < 0.01$) (Table 2). Unsafe sex was not associated significantly with gender or ethnicity. In addition, having unprotected sex was associated significantly (LR^2 = 8.26; df = 2; $p < 0.05$) with HIV transmission risk type. Specifically, men who had sex with men were estimated to be about 2.8 (z = 2.43; $p < 0.05$) times more likely than those who had ever injected and about 3.0 (z = 2.53; $p < 0.05$) times more likely than those with other HIV

Table 1. Any Sex by Background Characteristics and Selected Criteria

	Any sex				
	No (*n* = 96)		Yes (*n* = 166)		OR[a]
Mean age (SD)	42.03 (±7.06)		39.89 (±8.57)		0.76*
Gender, no. (%)					
Male	56	(36.6)	97	(63.4)	1.00
Female	40	(36.7)	69	(63.3)	1.00
Ethnicity, no. (%)					
White	36	(34.6)	68	(65.4)	1.67
African American	23	(37.1)	39	(62.9)	1.51
Hispanic	21	(33.9)	41	(66.1)	1.74
Other	16	(47.1)	18	(52.95)	1.00
With partner, no. (%)					
Yes	19	(20.2)	75	(79.8)	3.34**
No	77	(45.8)	91	(54.2)	1.00
Mean BDI score (SD)	17.51 (±12.38)		16.60 (±11.19)		0.92
Mean SF-36 physical function (SD)	49.22 (±10.52)		50.46 (±8.64)		1.14
Mean no. of months HIV positive (SD)	94.85 (±75.24)		87.42 (±72.28)		0.90
Mean symptom burden (SD)	3.10 (±2.45)		3.16 (±2.61)		1.02
Mean T-cell count/mm^3 (SD)	323.0 (±277.4)		403.6 (±328.7)		1.32*
Detectable viral load, no. (%)					
Yes	57	(36.8)	98	(63.2)	1.02
No	39	(37.1)	66	(62.9)	1.00
On HIV medications, no. (%)					
Yes	66	(41.5)	93	(58.5)	0.58*
No	30	(29.1)	73	(70.8)	1.00
Risk category, no. (%)					
Ever injected	46	(41.4)	65	(58.6)	0.79
Men who have sex with men	20	(29.9)	47	(70.2)	1.31
Other	30	(35.7)	54	(64.3)	1.00
Any cocaine use, no. (%)					
Yes	20	(31.3)	44	(68.8)	1.37
No	76	(38.8)	122	(61.6)	1.00
Any heroin use, no. (%)					
Yes	4	(20.0)	16	(80.0)	2.45
No	92	(38.8)	150	(62.0)	1.00
Any alcohol use, no. (%)					
Yes	36	(28.8)	90	(71.2)	1.95**
No	60	(441.)	76	(55.9)	1.00
Mean no. of drinking days (SD)	9.78 (±25.89)		20.87 (±39.85)		1.48*
Mean no. of drinks/drinking days (SD)	1.47 (±2.74)		2.92 (±4.36)		1.62*
Hazardous drinking, no. (%)					
Yes	15	(20.6)	58	(79.5)	2.90**
No	81	(42.9)	108	(57.1)	1.00

[a] Continuous variables were standardized before estimating ORs.
* $p < 0.05$; ** $p < 0.01$.
BDI, Beck Depression Inventory.

transmission risk to report any unprotected sex. The likelihood of unsafe sex was not associated significantly with depression, but those with higher physical function, as measured by the SF-36, tended to have a higher probability of reporting unsafe sex (OR = 1.40; LR^2 = 3.72; $p < 0.10$). Unsafe sex was inversely associated with duration of HIV infection (OR = 0.61; LR^2 = 8.96; $p < 0.01$) but was not associated significantly with HIV symptom burden or T-cell count. Participants with a detectable viral load were more likely to have unsafe sex (OR = 2.30; LR^2 = 4.37; $p < 0.05$). Having unprotected sex was not associated with receiving anti-HIV medications, HIV infection risk category, cocaine use, or heroin use. A higher probability of unprotected sex was associated with any use of alcohol (OR = 2.30; LR^2 = 6.73; $p < 0.05$), number of alcohol use days (OR = 1.38; LR^2 = 4.25; $p < 0.05$), number of drinks per drinking day (OR = 1.49; LR^2 = 5.87; $p < 0.05$), number of binge drinking days (OR = 1.48; LR^2 = 6.28; $p < 0.05$), and hazardous drinking (OR = 2.66; LR^2 = 8.04; $p < 0.01$).

The association between hazardous drinking (as an example) and sex risk was quite strong using the four-category sex risk typology (Table 3). Hazardous drinkers (79.4%) were more likely to report sexual activity than were those not drinking at hazardous levels (57.1%); they were also slightly less likely to report only condom-protected sex (20.6% vs. 27.5%, respectively). Almost one third (32.9%) of hazardous drinkers reported having both unprotected sex and multiple partners compared with only 8.5% of those not drinking at hazardous levels.

To determine if hazardous drinking was associated with unsafe sexual behavior after adjusting for possible confounders, we estimated a multinomial logistic regression model in which the four-category sex risk typology indicator was the response. All variables that were significantly asso-

Table 2. Unsafe Sex by Background Characteristics and Selected Correlates

	Unsafe sex		
	No (n = 67)	Yes (n = 99)	OR[a]
Mean age (SD)	42.37 (±9.49)	38.21 (±8.57)	0.61**
Gender, no. (%)			
Male	35 (36.1)	62 (63.9)	1.53
Female	320 (46.4)	37 (53.6)	1.00
Ethnicity, no. (%)			
White	20 (29.4)	48 (70.6)	2.40
African American	20 (51.3)	51 (52.0)	0.95
Hispanic	18 (43.9)	23 (56.1)	1.28
Other	9 (50.0)	9 (50.0)	1.00
Multiple sex partners, no. (%)			
Yes	14 (25.9)	40 (74.1)	2.57**
No	53 (47.3)	59 (52.7)	1.00
Mean BDI score (SD)	16.17 (±10.23)	16.87 (±11.82)	1.07
Mean SF-36 physical function (SD)	48.89 (±8.26)	51.52 (±8.77)	1.40
Mean no. of months HIV positive (SD)	107.83 (±64.12)	73.67 (±74.48)	0.61**
Mean symptom burden (SD)	3.23 (±2.45)	3.11 (±2.73)	0.95
Mean T-cell count/mm^3 (SD)	379.3 (±309.1)	420.0 (±341.9)	1.13
Detectable viral load, no. (%)			
Yes	31 (31.6)	67 (68.4)	2.30*
No	34 (51.5)	32 (48.5)	1.00
On HIV medications, no. (%)			
Yes	42 (45.2)	51 (54.8)	0.63
No	25 (34.3)	48 (65.8)	1.00
Risk category, no. (%)			
Ever injected	30 (46.2)	35 (53.9)	1.08
Men who have sex with men	11 (23.4)	36 (76.6)	3.03**
Other	9 (48.2)	11 (51.9)	1.00
Any cocaine use, no. (%)			
Yes	14 (31.8)	30 (68.2)	1.64
No	53 (43.4)	69 (56.6)	1.00
Any heroin use, no. (%)			
Yes	6 (37.5)	10 (62.5)	1.42
No	61 (40.7)	89 (59.3)	1.00
Any alcohol use, no. (%)			
Yes	28 (31.5)	61 (68.5)	2.30**
No	39 (51.3)	37 (48.7)	1.00
Mean no. of drinking days (SD)	13.49 (±33.75)	25.92 (±42.98)	1.38**
Mean no. of drinks/drinking days (SD)	1.99 (±3.35)	3.56 (±4.84)	1.49**
Hazardous drinking, no. (%)			
Yes	15 (25.9)	43 (74.1)	2.66**
No	52 (48.2)	56 (51.9)	1.00

[a] Continuous variables were standardized before estimating ORs.
* $p < 0.05$; ** $p < 0.01$.
BDI, Beck Depression Inventory.

Table 3. Sex Risk Typology by Hazardous Drinking

	Hazardous drinking	
	No	Yes
No sex	81 (42.9)	15 (20.6)
Protected sex only	52 (27.5)	15 (20.6)
Unprotected sex, 1 partner	40 (21.2)	19 (26.0)
Unprotected sex, multiple partners	16 (8.5)	24 (32.9)
Total	189	73

Data are no. (%) of patients.
LR^2 = 27.52; $p < 0.01$.

ciated ($p < 0.05$) with either any sexual activity or any unprotected sex (see Tables 1 and 2) were included as covariates. Covariates included age, ethnicity, physical component from the SF-36, duration (months) of HIV positivity, being married or having a romantic partner, HIV transmission risk indicator, T-cell count, and having a detectable viral load. The adjusted effect of hazardous drinking contributed significantly (LR^2 = 14.98; df = 3; $p <$ 0.01) to the model. Hazardous drinkers were estimated to be 5.64 ($z = 3.73$; $p < 0.01$) times more likely to report unprotected sex and have multiple partners, 2.54 ($z = 2.18$; $p < 0.05$) times more likely to report unprotected sex with one partner, and 2.01 ($z = 1.62$; $p = 0.104$) times more likely to report protected sex than were those not drinking at hazardous levels.

DISCUSSION

Nearly two thirds of HIV-infected patients in our cohort were sexually active, and two thirds of these patients had had unsafe sex in the past 6 months. Alcohol, consumed by approximately one half our cohort, was significantly associated at all levels of use with both increased sexual activity and unsafe sex. The robustness of the association between alcohol use and unsafe sex is supported by the consistency of our findings across all our measures of alcohol intake:

drinking intensity, drinking frequency, hazardous drinking, and binge drinking.

The positive relationship between alcohol consumption and sexual risk behaviors may be explained in several ways. First, our results suggest that drinking may increase a person's total amount of sexual activity. Second, and more speculatively, both alcohol and sex may reduce, at least temporarily, anxiety and depressive symptoms that are common among HIV-infected persons (Critchlow, 1986). Third, alcohol may be a marker of a risk-taking personality; in HIV-infected persons, alcohol and unsafe sex may be additional forms of sensation seeking (Donovan and Jessor, 1991). When we introduced a four-category sex risk typology (not sexually active, safe sex only, unsafe sex with a single partner, and unsafe sex with more than one partner), we found that hazardous drinkers were more than five times as likely to report unprotected sex and have multiple partners than were nonhazardous drinkers, reinforcing this notion of multiple concurrent forms of sensation seeking. Finally, alcohol may simply lower inhibitions, even when individuals are educated about HIV transmission and unsafe sex and, thus, may lessen the guilt or fear about possibly infecting others.

Our data complement the work of Ehrenstein et al. (2004) who studied the role of alcohol in an HIV-seropositive population with past or current alcohol problems. These researchers found that at risk drinking was associated with inconsistent condom use among active injection drug users, men who have sex with men, women, persons with multiple sexual partners, and those with high CD4 T-cell counts or a recent diagnosis of HIV infection. In contrast to Ehrenstein et al. (2004), who reported that alcohol consumption at high rather than moderate levels was associated with inconsistent condom use, we found that alcohol use at any level correlated with sexual risk behavior.

Consistent with the work of Ehrenstein et al. (2004), we found that higher levels of sexual risk taking occurred in persons with a high CD4 T-cell count. Immune function may be a signal of general health (supported by our SF-36 physical symptom reports here) and restored libido. Similarly, we found that younger age was associated with increased unsafe sex. However, unsafe sex was not associated with HIV symptoms or T-cell count.

Boscarino et al. (1995) suggested that alcohol users' beliefs about the effects of alcohol on sexual behavior might affect the characteristics of sexual encounters that involve drinking. Sexual risk taking may be associated with enhanced sexual expectancies when drinking, and these expectancies may differ for primary and secondary partners (Rosengard et al., 2004). The relationship between alcohol and sexual behavior is probably associated with a myriad of personality, situational, and behavioral factors.

Individual level analyses, such as ours, assess the HIV-infected patient's risk factors for unsafe sex but do not take into account the risk characteristics of his or her sexual partner(s), which likely also have an impact on condom use.

Because safer sex depends on behaviors of both members of a couple, couple level analysis may provide a more complete picture of sexual risk within stable relationships. In addition, we did not collect data on the HIV status of the sexual partner(s) of our study participants.

In the era of highly active antiretroviral therapy (HAART), there has been a concern that HIV-positive persons who have a low viral load may feel protected from sexually transmitting HIV and engage in increased sexual risk behavior. However, a recent meta-analysis by Crepaz et al. (2004) suggested that the prevalence of unprotected sex was not higher among persons receiving HAART versus those not receiving HAART nor was it higher among persons with an undetectable viral load. At the univariate level, our findings were different, with those patients having detectable viral loads more likely to have unsafe sex; this association was not confirmed in a multivariate analysis.

Samet et al. (2003) reported that among those patients receiving HAART, any level of alcohol use was associated with higher HIV RNA levels. Because a higher HIV RNA level is an independent predictor of transmission risk, the risk of HIV transmission may be higher among HIV-infected individuals using alcohol. Regardless of the mechanism for this association (the effect of alcohol on adherence, alcohol-related liver toxicity, drug-drug interactions between alcohol and antiretroviral medications, and a direct effect on the immune system), alcohol consumption may lead to increased HIV spread.

This study has several limitations. First, our recruitment of a nonrandomized sample may limit the generalizability of our results. However, our population was quite similar in overall drinking behavior to the HIV Costs and Service Utilization Study cohort, the only nationally representative probability sample of HIV-infected American adults receiving medical care (Bing et al., 1995). Second, we relied on self-report for measuring alcohol use and behavioral variables. To minimize this bias and promote candor, surveys were conducted privately by an interviewer uninvolved with clinical care, and alcohol and sexual behavior questions were embedded in an interview that assessed a variety of psychosocial domains. Nonetheless, sexual risk may have been underreported, particularly because participants were likely aware that inconsistent condom use is associated with the risk of infecting others. Third, we dichotomized the inconsistent condom use variable to reduce potential mixing of true consistent users with those who may have reported generally consistent use but in reality were not 100% consistent. This threshold seemed most consistent with the public health goal of eliminating HIV transmission. Because this analysis was cross-sectional, we do not know if study participants modified their sexual behaviors after learning that they were HIV positive. Fourth, we do not know the timing of alcohol use and sexual risk taking on any individual occasion, because data on individual sexual episodes were not collected. Although we expect that alco-

hol use preceded high-risk sexual episodes, it remains possible that alcohol was sometimes used to "come down" after sexual relations. Alternatively, alcohol use may have had no temporal association with unsafe sexual behavior. Finally, although the results of this study suggest important associations between alcohol use and HIV sexual risk behavior, they do not prove a causal role for the former.

Our study has several implications. Changes in alcohol use have been associated with clinically relevant temporal changes in adherence to anti-HIV therapy and the effectiveness of treatment of HIV infection (Lucas et al., 2002). It is possible that changes in alcohol use, through treatment or self-change, may result in behavioral change and sexual risk reduction. Although the relationship between alcohol consumption and inconsistent condom use among HIV-infected persons is complex, our findings bolster the argument for routine assessment of alcohol use in HIV-infected persons, particularly as a correlate of sexual risk taking. Screening for alcohol use is important and relatively easy to complete, and established alcohol screening tests perform adequately for HIV-infected populations (Samet et al., 2004). Even brief interventions in clinical settings may have meaningful effects (Samet et al., 1996).

Our findings suggest that a multifaceted effort to address alcohol use should be part of treatment of HIV infection. Of course, alcohol treatment may not be effective in changing the sexual risk taking behaviors of the HIV-infected population. Woods et al. (2000), for instance, reported that over a 3.5-year study period there were continued high rates of HIV infection and the reporting of high-risk behaviors among heterosexuals in alcoholism treatment. Thus, better interventions targeting the relationship of HIV sexual risk behavior and alcohol use need to be designed and evaluated. Both alcohol use and sexual risk taking have a dynamic nature. Longitudinal studies will allow the evaluation of how changes in alcohol use are linked to sexual risk taking over time.

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