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Alcohol and HIV Sexual Risk Behaviors among Injection Drug Users

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Abstract

We analyzed data from 6,341 injection drug users (IDUs) entering detoxification or methadone maintenance treatment in New York City between 1990 and 2004 to test the hypothesis that alcohol use and intoxication is associated with increased HIV sexual risk behaviors. Two types of associations were assessed: 1) a **global association** (i.e., the relationship between HIV sexual risk behaviors during the six months prior to the interview and at-risk drinking in that period, defined as more than 14 drinks per week for males or 7 drinks per week for females), and 2) an **event-specific association** (i.e., the relationship between HIV sexual risk behaviors during the most recent sex episode and alcohol intoxication during that episode). Sexual risk behaviors included multiple sex partners and engaging in unprotected sex. After adjusting for the effects of other variables, at-risk-drinkers were more likely to report multiple sex partners and engaging in unprotected sex with casual sex partners (both global associations). IDUs who reported both they and their casual partners were intoxicated during the most recent sex episode were more likely to engage in unprotected sex (an event-specific association). We also observed two significant interactions. Among IDUs who did not inject cocaine, moderate-drinkers were more likely to report multiple partners. Among self-reported HIV seropositive IDUs, when both primary partners were intoxicated during the most recent sex episode they were more likely to engage in unprotected sex. These observations indicate both global and event-specific associations of alcohol and HIV sexual-risk behaviors.

Keywords

Alcohol; HIV; sexual risk behaviors

1.Introduction

Drug users are at a greater risk of HIV infection than the general population (Centers for Disease Control and Prevention, CDC, 2004; CDC, 2003; Deren et al., 2004; Holmberg, 1996). The increased risk due to sharing contaminated needles and other injection equipment among injection drug users (IDUs) seems more obvious and has been well documented (CDC, 1982; Fauci, 1986). Moreover, after accounting for injection risk, sexual risk behaviors have been found to be related to HIV infection (Strathdee et al., 2001), and IDUs with sexual risk behaviors have a higher likelihood of HIV infection (Kral et al., 2001). However, the

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prominence of injection risk has often led to neglecting the risk of sexual transmission among IDUs (Strathdee and Sherman, 2003).

Alcohol consumption has also been associated with increased sexual risk (Bryant, 2006; Parker et al. 1994; Stall et al., 1986), as well as injection risk behaviors (Saxon and Calsyn, 1992). Results from the General Social Survey indicate that among respondents who consume alcohol, the percentage of those who engage in sexual risk behavior is at least twice that of the respondents who do not drink (Anderson and Dahlberg, 1992). Further, a quarter of those who report getting drunk have multiple sex partners, compared to 8% of those who do not report getting drunk. Similarly, data from the HIV Cost and Service Utilization Study show that among those infected with HIV, 35% (among heterosexuals) to 53% (among MSM) had used alcohol with sex (Beckett et al., 2003). Among crack users and injectors recruited from 22 U.S. cities, Booth et al. (2000) found that alcohol consumption is associated with increased unprotected sex.

The above findings reflect the overall associations (also known as “global associations”) of patterns of alcohol consumption and general levels of sexual risk behaviors. Studies of alcohol use during a specific event and its association with sexual risk behaviors during that event (also known as “event-specific associations”) have produced conflicting results. Leigh and Stall (1993) have suggested that the discrepancies in the reported association of alcohol and sexual risk behaviors are the result of methodological differences. These include type of partner (e.g., primary vs. casual) and type of association between predictor and outcome variables (e.g., general pattern of drinking and sexual risk behaviors vs. intoxication and sexual risk behavior on a specific occasion). Furthermore, although event-specific analysis represents an improvement over global associations, they may still be confounded with other variables, such as personality differences. Therefore, the most useful studies in regard to the association of alcohol and sexual risk use a within-subject design that allows them to compare event-specific sexual risk in the presence vs. absence of alcohol in the same individuals (Halpern-Felsher et al., 1996; Leigh and Stall, 1993).

In one such study, Weinhardt et al. (2001) reported that whereas heavy-drinkers in their study were *generally* more likely to engage in sexual risk behaviors, they were no more likely to engage in unprotected sex on a *specific* occasion when they were intoxicated, compared to when they were sober. Gold et al. (1992) found that the level of intoxication reported on two different sexual encounters was associated with whether the respondent had engaged in unprotected sex during those encounters. Graves and Leigh (1995) found no significant relationship between intoxication and unprotected sex when they compared the proportion of unprotected sexual encounters under the influence of alcohol vs. those without alcohol, even though they noted a global association between heavy-drinking and unprotected sex. In a probability sample of the adult household population of a county in the San Francisco Bay Area, Temple and Leigh (1992) reported that drinking at the most recent reported sex encounter was either not related to unprotected sex (among women) or was associated with a decreased likelihood of unprotected sex (among men). On the other hand, Stein et al. (2001) found that among hazardously drinking IDUs days on which drinking occurred were more likely to be days on which unprotected sex took place. Cook et al. (2006), using a between-subject design event-specific study found that intoxication was associated with unprotected sex among HIV seropositive, but not HIV seronegative men. Finally, in a meta-analysis of event-specific studies, Leigh (2002) reported a slight increase in unprotected sex associated with drinking, but noted that increased likelihood of unprotected sex was observed only when alcohol use was in conjunction with a first sexual encounter.

Cooper (2002) and Halpern-Felsher et al. (1996) have also reviewed and summarized the results of event-specific studies, concluding that methodological differences across studies account

for much of the inconsistent findings. Both reviews indicate that while the majority of the event-specific studies do not find a significant relationship between drinking and unprotected sex, those that find such a relationship are of first sexual encounters. They also emphasize the importance of the type of partner in the outcome of the study. La Brie et al. (2005) have found that alcohol is associated with unprotected sex with a casual partner, but not with a primary partner. An additional factor that is critical to the outcome of the studies is the definition of alcohol use. In order to ascertain the appropriateness of comparing the results of different studies, one should keep in mind the disparate definitions of alcohol use in event-specific studies. Both drinking and intoxication have been used in these studies. However, they may not be associated similarly with sexual risk. For example, only intoxication may produce disinhibition or sufficient expectancy cues that are associated with sexual risk-taking.

This report examines data from an ongoing study of HIV risk behaviors conducted among IDUs entering detoxification or methadone maintenance treatment in New York City between 1990 and 2004. The aim of this paper is to assess the prevalence of HIV sexual risk behaviors and the relation of these risks to alcohol consumption. Both global and event-specific associations of alcohol and sexual risk behaviors are examined.

2. Methods

2.1. Design and recruitment

The Risk Factors Study has, since 1990, measured HIV infection and risk behaviors among drug users entering the Methadone Maintenance and Detoxification Treatment Programs of the Beth Israel Medical Center. Self-reported risk behaviors and serological data from cross-sectional samples of admissions to the programs are collected in order to identify and monitor trends in HIV risk behaviors, incidence and prevalence in this population. The programs are the largest drug treatment programs in New York City, each year admitting up to 7,000 drug users.

Newly admitted Detoxification and MMTP clients who were at least 18 years of age, had used drugs within the six months prior to the interview, and had not participated in the study in the previous 12 months were eligible to participate. Only IDUs were included in the present paper. In order to recruit participants from the Detoxification program, the interviewer visited the general admission wards of the program and identified patients admitted within the previous three days from the intake records. All eligible patients present on the ward were solicited for participation in the study. Some patients were unavailable for participation due to appointments scheduled by hospital staff. Among patients approached and eligible, willingness to participate was over 95%. Almost half those who refused were feeling too sick from drug withdrawal.

In order to recruit participants from the Methadone Maintenance Treatment Program (MMTP), the interviewer reviewed the list of IDUs scheduled for intake at the central intake facility. Each applicant to the Beth Israel MMTP system was required to attend intake sessions at the central facility before being assigned to a clinic convenient to his/her home. The program intake process included numerous appointments with MMTP staff that stretched over several hours, interspersed with long waiting periods. Throughout the day the interviewer approached all listed IDUs in the waiting room to ask if they would participate in the study. Over 80% of eligible MMTP patients approached agreed to participate in the study. Primary reasons for study participation refusal included having other commitments or fatigue due to the time-consuming intake process.

After providing informed consent, study recruits were individually interviewed in private by a trained interviewer. A structured questionnaire was administered as part of the interview. Pretest counseling was provided and a separate informed consent for HIV testing was obtained.

HIV testing was conducted using replicate enzyme-linked immunosorbent assay with Western blot confirmation.

2.2. Measures

The questionnaire items assessed sociodemographic, drug use, frequency of injection, alcohol use, HIV sexual risk behaviors, and self-reported HIV seropositivity.

2.2.1. Global Measures—All global measures were based on behaviors occurring during the six month period prior to interview. Global measure of alcohol use was assessed as number of drinks in a typical week in the six month period and was analyzed as an ordinal variable. According to the National Institute on Alcohol Abuse and Alcoholism (NIAAA) guidelines for physicians, men who drink more than four standard drinks in a day (or more than 14 per week) and women who drink more than two in a day (or more than seven drinks per week) are at increased risk for alcohol-related problems (Dawson et al., 2005; NIAAA, 2004). We used the above criteria to classify males who had more than 14 drinks and women who had more than seven drinks per week as at-risk-drinkers. Those who had no drinks in a typical week were classified as non-drinkers. The remaining respondents were grouped as moderate-drinkers. Sexual behavior was assessed regarding number of opposite sex partners, frequency of sexual activity and amount of unprotected sex, each separately by partner type (i.e., primary, casual, and commercial). Primary partner was defined as a regular steady partner of the opposite sex, commercial client as a person of the opposite sex who exchanged drugs, money, or other goods for sex, and casual partner as an opposite sex partner other than a primary partner or commercial client. Analyses of sexual activity and risk with commercial clients were confined to women, because among those with opposite sex clients women comprise the overwhelming majority of commercial sex workers and because this is more consistent with the measurement of commercial sex in other studies. Both drug use and sexual activity were measured on a seven-point frequency scale ranging from “less than once a month” to “10 or more times a day, almost every day”. Risky sex was assessed by the proportion of times condoms/female condoms were used during sexual activity on a five-point frequency scale ranging from “never” to “always”. Because this range of data produced sparse cells in the multivariate analyses, we analyzed drug use and sexual risk behaviors as dichotomous variables, indicating whether or not risk had occurred.

2.2.2 Event-Specific Measures—Alcohol intoxication was assessed for the most recent sex episode (“Were you or your opposite sex partner high on alcohol during last sex?”) and data were collected only during some years (1995-2000); thus the corresponding analyses pertain only to the participants who were asked the questions. Alcohol intoxication was analyzed as an ordinal variable, indicating whether both partners (i.e., respondent and his/her sex partner), only one partner, or none were intoxicated during the most recent sex episode. HIV sexual risk during the most recent sex episode was also assessed by asking whether a condom had been used during the event.

2.3. Statistical analyses

To test the differences across levels of alcohol use in regard to engaging in unprotected sex with primary, casual, or commercial partners we included only those who reported any sexual activity with the respective partner type. To test the differences across levels of alcohol use in regard to multiple partners we included the total sample.

We used the chi-square test to assess the overall differences in categorical variables, the Cochran-Armitage test for trend to analyze binomial outcomes across ordinal explanatory variables, and the Jonckheere-Terpstra test for the analysis of ordinal outcomes across ordinal explanatory variables. To further examine the association between alcohol consumption and

intoxication with the risk behaviors we used multivariate logistic regression. We modeled the relationship between a single sex risk behavior as the dependent variable and the alcohol use or intoxication as the explanatory variable to obtain adjusted odds ratios (AOR) and 95% confidence intervals (95% CI) controlling for all theoretically important covariates. Gender, age, and race/ethnicity comprised the demographic variables that were included. Drug use variables were crack cocaine use, injected heroin, injected cocaine, and injected speedball, as well as daily injection. Additionally, because one's HIV status, if known, may be expected to influence risk behaviors, we included self-reported HIV seropositivity, reported prior to any HIV blood tests in our study. Interactions of each of the covariates with the alcohol use and intoxication were also examined to detect any modification of the relationship between alcohol and sexual risk behavior by one or more of the covariates. All analyses were carried out using SAS software, version 9 (SAS Institute, Inc., 2003).

3. Results

3.1. Sample characteristics

We recruited 6,341 IDUs from the Detoxification program and MMTP. Detoxification program recruits comprised 77% of the sample, with the remaining 23% coming from the MMTP. Overall, study participants were 82% male, 48% Hispanic, and 25% African-American. Average age of respondents was 37 years. Almost all IDUs (99.7%) injected one or more of the following drugs: heroin (89% of all IDUs), cocaine (48% of all IDUs), and the combination of the two (58% of all IDUs). Alcohol consumption was prevalent. Almost half of the respondents (3107 or 49%) had at least one drink in a "typical week." Over one third (2213 or 35%) were at-risk-drinkers.

Among MMTP respondents heroin injection was more prevalent (97%) than among Detoxification program participants (87%), whereas cocaine or speedball injection was less prevalent (26% and 36% vs. 54%, and 64% respectively). Proportions of IDUs who injected daily were similar across programs (79% in both programs). At-risk-drinkers were more prevalent (40%) among Detoxification program recruits than among MMTP respondents (18%).

Multiple sex partners in the six months prior to the interview were reported by 28% of the sample. Fifty-seven percent of the sample had sex with a primary partner (7% did so less than monthly, 17% less than weekly, and 33% at least weekly). Among those who engaged in sex with a primary partner, 55% reported never using a condom, 8% reported using condoms on fewer than a quarter of the occasions, 4% reported using them about half of the time, 7% reported using them most of the time, and 26% reported always using condoms in the six months period prior to the interview. Twenty-four percent of the sample reported sex with a casual partner (9% reported a frequency less than monthly, 9% less than weekly, and 7% at least weekly). Among those who engaged in sex with a casual partner, 25% reported never using a condom, 7% on fewer than a quarter of the occasions, 6% about half of the time, 10% most of the time, and 51% reported always using condoms. Women who reported sex with a commercial client comprised 15% percent of the women in the total sample. Two percent of women reported engaging in commercial sex less than monthly, 3% less than weekly, and 10% at least weekly. Among women who engaged in sex with a commercial client, 6% reported never using a condom, 18% on fewer than a quarter of the occasions, 7% about half of the time, 13% most of the time, and 54% reported always using condoms. Half of all respondents reported at least one episode of unprotected sex during the past six months. Comparisons of demographic and drug use characteristics of the sample across levels of alcohol use are presented, respectively, in Tables 1 and 2.

3.2. Global associations of alcohol with sexual activity and sexual risk behaviors

The proportion of at-risk-drinkers with multiple partners was higher than that for moderate-drinkers and non-drinkers (Cochran-Armitage $Z=9.89$, $p < .0001$; Table 2). Higher proportions of at-risk-drinkers engaged in sex with casual sex partners, compared to moderate-drinkers and non-drinkers; Cochran-Armitage $Z=9.12$, $p < .0001$). Among those who reported sex with casual partners, higher proportions of at-risk-drinkers engaged in unprotected sex with casual sex partners (compared to moderate-drinkers and non-drinkers; Jonckheere-Terpstra $Z=5.22$, $p < .0001$). Among women, a greater proportion of at-risk-drinkers and moderate-drinkers, compared to non-drinkers, engaged in sex with a commercial client (Cochran-Armitage $Z=3.9$, $p < .0001$). There were no significant differences across alcohol use levels in the proportions who engaged in unprotected sex with a commercial client. No significant difference across alcohol use levels were detected in proportions who engaged in sexual activity or unprotected sex with a primary partner.

Multivariate models were fit for reporting multiple partners and unprotected sex outcome variables and their association with alcohol use. As described above, demographic characteristics, drug use variables, and self-reported HIV seropositivity were included as covariates and interactions of each of the covariates with alcohol use were also examined. Table 3 presents all the significant effects for each of the sexual risk behaviors examined. After adjusting for the effect of other variables in multivariate logistic analyses, at-risk-drinking, compared to non-drinking, was associated with significantly increased likelihood of reporting multiple partners among cocaine injectors and non-cocaine injectors. Moderate-drinking was associated with increased likelihood of reporting multiple partners only among non-cocaine injectors.

Among those who reported sex with a casual partner, after adjusting for the effects of other covariates, at-risk-drinking was associated with significantly increased likelihood of unprotected sex. Alcohol use was not associated with unprotected sex with a primary partner or with a commercial client.

3.3. Event-specific associations of alcohol with sexual risk behaviors

Before reporting the associations with sexual risk behaviors, it is worth noting that being intoxicated during the most recent sex episode was strongly associated with at-risk-drinking. Percentage of IDUs who indicated that both they and their partners were intoxicated during the most recent sex episode was higher among at-risk-drinkers reporting sex with primary partners (27% vs. 9% of moderate-drinkers and 2% of non-drinkers; Jonckheere-Terpstra $Z=24.23$, $p < .0001$) and casual partners (49% vs. 15% of moderate-drinkers and 3% of non-drinkers; Jonckheere-Terpstra $Z=16.28$, $p < .0001$).

The association of intoxication during last sex episode and engaging in sexual risk behaviors during that episode varied by partner type. Among IDUs who reported both they and their casual partner were intoxicated last time they had sex ($n=235$) a greater proportion (44%) engaged in unprotected sex, compared to 38% of IDUs reporting only one partner being intoxicated ($n=182$) and 34% of IDUs reporting no intoxication ($n=510$; Jonckheere-Terpstra $Z=2.58$, $p < .01$). No significant difference in engaging in unprotected sex with a primary partner was detected across alcohol intoxication levels. Proportions of IDUs who engaged in unprotected sex during their most recent sex episode with their primary partners ranged from 66% to 64%.

Multivariate models were fit for unprotected sex during the most recent sex episode and alcohol intoxication. As with multivariate analyses of global associations, we controlled for the effects of gender, age, race/ethnicity, injected heroin, injected cocaine, and injected speedball, crack

cocaine use, daily injection of drugs, and self-reported HIV seropositivity, and examined the interactions of each of the covariates with alcohol intoxication. Table 4 presents all the significant effects for each of the sexual risk behaviors examined.

After adjusting for the effect of other variables in multivariate logistic analyses, there was an increased likelihood of engaging in unprotected sex when both self-reported HIV seropositive IDUs and their primary partners were intoxicated during their most recent sex episode, compared to no intoxication. No such association was found among IDUs not reporting HIV seropositivity or among IDUs who reported only one partner being intoxicated.

After adjusting for the effects of other covariates, IDUs who reported both they and their casual sex partners were intoxicated during the last sex episode had an increased likelihood of engaging in unprotected sex, compared to IDUs reporting no intoxication. No such effect was associated with IDUs who reported only one partner being intoxicated.

4. Discussion

These results indicate global and event-specific associations between alcohol and HIV sexual risk behaviors among injection drug users. At-risk-drinkers were more likely to report multiple partners and engaging in unprotected sex with casual partners. Among moderate-drinkers, however, only those who were not cocaine injectors were more likely to report multiple partners. The observed difference between at-risk-drinking and moderate-drinking cocaine injectors may reflect the increase in sexual risk behaviors associated with both alcohol and cocaine. Results of our univariate logistic analysis indicated a significantly increased odds ratio of reporting multiple partners among cocaine injectors. The increase in risk behavior associated with moderate-drinking may be overshadowed by the elevated risk already present among cocaine-injectors, whereas the increase associated with at-risk-drinking is apparently large enough to be observed even in presence of the elevated risk related to cocaine injection. Other studies have reported that cocaine injection is associated with increased sexual risk behaviors (De et al., 2007), probably due to its stimulant effects (Volkow et al., 2007).

In addition to these global associations that are consistent with those reported by others (e.g., Booth et al., 2000; Parker et al., 1994; Stein et al., 2005), showing an overall relationship between drinking and sexual risk-taking, we also found evidence for event-specific associations, which have not been consistently reported. In our study, engaging in unprotected sex with a casual partner at the most recent sex episode was associated with both partners being intoxicated. Engaging in unprotected sex with a primary partner at the most recent sex episode was associated with both partners being intoxicated only among IDUs who reported HIV seropositivity. Two observations regarding these event-specific findings are of particular interest. First, the association of alcohol intoxication and unprotected sex during the last sex episode is observed when both partners are intoxicated, but not when only one partner is. Second, alcohol intoxication during the last sex episode is associated differently with unprotected sex with a primary vs. a casual partner.

Regarding the first observation, we hypothesize that when only one partner is intoxicated the decrease in the likelihood of using a condom may be less than when both partners are intoxicated. For instance, alcohol intoxication may lead to reduced perception of risk (Fromme et al., 1997). It is plausible, for partners who use a condom when they are sober, that when either partner is sober the perception of risk by that partner is sufficient for using a condom. On the other hand, when both partners are intoxicated the reduced perception of risk in both partners might lead to failure to use a condom.

Regarding the second observation, the different association of alcohol intoxication with unprotected sex with a primary partner vs. a casual partner may reflect different vulnerabilities

to situational factors. Condom use with a casual partner may be more susceptible to situational influences whereas among primary partners it may more closely relate to habitual use of condoms. In support of this explanation, we observed that 79% of those who reported unprotected sex with a primary partner during their most recent sex episode also reported *never* using condoms with their primary partners in the previous six months. In comparison, only 59% of those reporting unprotected sex with a casual partner during the last sex episode also reported never using condoms with their casual partners in the previous six months. Among self-reported HIV seropositives condom use may reflect a more recent protective strategy in face of perception of actual increased risk, rather than previous habitual patterns of condom use. Hence, alcohol intoxication, leading to a reduced perception of risk of HIV transmission, may decrease the condom use.

Several other studies have reported no significant relationship between alcohol use and sexual risk (see Cooper, 2002). These different findings may reflect dissimilar methods (e.g., within-subject *vs.* between-subject analysis, as discussed in the Introduction section), diverse populations (e.g., IDUs entering treatment *vs.* young adults with or without a history of substance use), discrepant measures (e.g., alcohol use *vs.* intoxication), and choice of outcome variable (e.g., unprotected sex with primary *vs.* casual partner).

For instance, Graves and Leigh (1995), studied a nationally representative sample of young adults in the United States and found no significant difference in condom use with non-primary partners when under the influence of alcohol *vs.* when sober during the previous year. However, that study differs from ours in the type of design (within-group analysis of the association reported above), type of alcohol measure (influence of alcohol rather than intoxication), and period for which sexual risk event is measured (one year). In another study, Santelli et al. (2001) examined a nationally representative sample of young adults in the United States and found no association between condom use during the last intercourse and consumption of alcohol and other substances on that occasion. In addition to the differences listed above, because alcohol and substance use were conflated in that study, the association between alcohol and condom use cannot be reliably assessed. In other words, a positive response on this item (i.e., reporting alcohol and substance use during the last intercourse) could indicate the use of substances while excluding alcohol.

On the other hand, Stein et al. (2001) found that among hazardously drinking IDUs drinking days were associated with days on which unprotected sex occurred. Similarly, Purcell et al. (2006) report that among HIV seropositive IDUs, alcohol or drug use during sex is significantly correlated with unprotected sex with HIV seropositive main partners.

Clearly, the relation between alcohol and sexual risk behaviors is complex and, judging from the range of findings from other studies, may be both mediated and modified by a host of factors. Findings of global associations of alcohol and sexual risk, for instance, could represent the effect of a mediating variable, or reflect a “third variable” (such as personality traits; Weinhardt and Carey, 2000) that accounts for both alcohol consumption and risk behavior. Additionally, demographic attributes such as age and gender, concurrent use of other drugs, perception of sex partner’s “riskiness”, and awareness of one’s own HIV seropositivity may modify the putative association of alcohol and sexual risk behaviors. Moreover, our classifications of at-risk-drinking *vs.* moderate-drinking are based on simple endorsements of items that measure quantity and frequency of alcohol use, rather than reflecting any standard alcohol screening tool, such as Alcohol Use Disorders Identification Test (AUDIT; Saunders et al., 1993). Therefore our classification of respondents’ alcohol use level may not correspond to a similar classification using AUDIT.

In spite of these concerns, and although we cannot rule out other factors that may mediate these associations, our findings warrant attention in their own right. Higher prevalence rates of at-risk-drinking (Beckett et al., 2003; Campbell et al., 2006) and intoxication (Matos et al., 2004) have been reported among drug users. At-risk-drinkers constituted 35% of the respondents in our study. And 45% of those who engaged in sex with a casual partner during their most recent sex episode reported that either they or their partners were intoxicated. Finally, we found both global and event-specific associations of alcohol and sexual risk after controlling for the potentially modifying effects of demographic (age, gender, race/ethnicity) and drug use variables (injection drugs, crack cocaine use, and daily injection), as well as self-reported HIV serostatus. Results of our multivariate logistic analyses indicate an independent effect of alcohol regarding multiple partners and unprotected sex with a casual partner (both global and event-specific).

Our findings are subject to the limitations of cross-sectional studies that prevent us from inferring a causal relationship between alcohol and risk behaviors. However, insofar as HIV prevention programs for heroin and cocaine users already address risk behaviors other than alcohol consumption, it is advisable to include components that specifically address alcohol use and abuse.

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Table 1
Sociodemographics and drug use among non-drinkers, moderate-drinkers and at-risk-drinkers

	Non-drinkers n (%)	Moderate-drinkers n (%)	At-risk-drinkers n (%)
Total	3234 (100)	894 (100)	2213 (100)
Avg. Age (SD) ***	37 (9)	37 (8)	38 (8)
Gender ***			
Male	2540 (79)	796 (89)	1885 (85)
Race/ethnicity			
African-American	615 (19)	242 (27)	729 (33)
Hispanic	1651 (51)	412 (46)	986 (45)
White	964 (30)	239 (27)	496 (22)
Injected heroin ***	2882 (89)	815 (91)	1962 (89)
Injected cocaine ***	1373 (43)	453 (51)	1244 (56)
Injected speedball ***	1692 (52)	546 (61)	1421 (64)
Daily injection ***	2628 (81)	718 (80)	1670 (75)
Reported HIV seropositivity ***	374 (16)	90 (15)	229 (12)

Note: Percentages may not add up to 100% as a result of rounding

p < .001

Table 2
Sexual activity and associated risk behavior during the past 6 months

		Non-drinkers n=3234 n (%)	Moderate drinkers n=894 n (%)	At-risk drinkers n=2213 n (%)
Multiple partners ***#		734 (23)	269 (30)	771 (35)
Any sex with primary partner(s)		1869 (58)	517 (58)	1239 (56)
Among those w/primary partner(s)				
Unprotected sex	≥weekly	862 (46)	200 (39)	554 (44)
	< weekly	265 (14)	95 (18)	181 (15)
	< monthly	238 (13)	82 (16)	186 (15)
	never	504 (27)	140 (27)	318 (26)
Any sex with casual partner(s) ***		629 (19)	229 (26)	670 (30)
Among those w/casual partner(s) ***				
Unprotected sex	≥weekly	59 (9)	11 (5)	80 (12)
	< weekly	58 (9)	33 (14)	90 (13)
	< monthly	146 (23)	59 (26)	213 (32)
	never	366 (58)	126 (55)	287 (43)
Among females only ***		n=694	n=98	n=328
Any sex with clients(s) ***		77 (12)	17 (21)	66 (22)
Among those w/clients				
Unprotected sex	≥weekly	9 (12)	2 (12)	7 (11)
	< weekly	16 (21)	4 (24)	17 (26)
	< monthly	5 (6)	2 (12)	10 (15)
	never	47 (61)	9 (53)	32 (48)

Note: Percentages may not add up to 100% as a result of rounding

p < .001

The comparison group for those reporting multiple partners (i.e., reporting two or more sexual partners) consists of IDUs who either reported no sexual partner or only one partner

Table 3

Multivariate adjusted odds ratios (AOR) with 95% confidence intervals (CI) of the global associations of alcohol use and sexual risk behaviors by partner types

Levels of Alcohol Use/Interactions terms	AOR (95% CI) Sexual Risk Behavior (Partner Type)
	Multiples Partners
Non-drinking (Ref)	NA
Moderate-drinking	NA
At-risk-drinking	NA
Interaction terms	
Among non-cocaine injectors	
Non-drinking (Ref)	1.0
Moderate-drinking	1.7 (1.4-2.2) ***
At-risk-drinking	1.7 (1.4-2.0) ***
Among cocaine injectors	
Non-drinking (Ref)	1.0
Moderate-drinking	1.0 (0.8-1.3)
At-risk-drinking	1.4 (1.2-1.7) ***
	Unprotected sex (Primary Partner)
Non-drinking (Ref)	1.0
Moderate-drinking	1.1 (0.8-1.3)
At-risk-drinking	1.1 (0.9-1.3)
	Unprotected sex (Casual Partner)
Non-drinking (Ref)	1.0
Moderate-drinking	1.1 (0.8-1.5)
At-risk-drinking	1.8 (1.4-2.2) ***
	Unprotected sex (Commercial Client)
Non-drinking (Ref)	1.0
Moderate-drinking	1.3 (0.4-4.0)
At-risk-drinking	1.8 (0.9-3.8)

p < .001

Table 4

Multivariate adjusted odds ratios (AOR) with 95% confidence intervals (CI) of the event-specific associations of alcohol intoxication and sexual risk behaviors across partner types

Levels of Intoxication/Interactions terms	AOR (95% CI) Sexual Risk Behavior (Partner Type)
	Unprotected sex (Primary Partner)
No Intoxication (Ref)	NA
One partner intoxicated	NA
Both partners intoxicated	NA
Interaction terms	
Among IDUs with no self-reported HIV ⁺ status	
No Intoxication (Ref)	1.0
One partner intoxicated	1.0 (0.8-1.3)
Both partners intoxicated	0.8 (0.6-1.1)
Among IDUs with self-reported HIV ⁺ status	
No Intoxication (Ref)	1.0
One partner intoxicated	1.2 (0.6-2.5)
Both partners intoxicated	2.6 (1.3-5.3)**
	Unprotected sex (Casual Partner)
No Intoxication (Ref)	1.0
One partner intoxicated	1.2 (0.8-1.7)
Both partners intoxicated	1.5 (1.1-2.1)*

*
p < .05

**
p < .01