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Nondisclosure of HIV Infection to Sex Partners and Alcohol's Role: A Russian Experience

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Abstract

Nondisclosure of one's HIV infection to sexual partners obviates safer sex negotiations and thus jeopardizes HIV transmission prevention. The role of alcohol use in the disclosure decision process is largely unexplored. This study assessed the association between alcohol use and recent nondisclosure of HIV serostatus to sex partners by HIV-infected risky drinkers in St. Petersburg, Russia. Approximately half (317/605; 52.4 %) reported not having disclosed their HIV serostatus to all partners since awareness of infection. Using three separate GEE logistic regression models, we found no significant association between alcohol dependence, risky alcohol use (past 30 days), or alcohol use at time of sex (past 30 days) with recent (past 3 months) nondisclosure (AOR [95 %CI] 0.81 [0.55, 1.20], 1.31 [0.79, 2.17], 0.75 [0.54, 1.05], respectively). Alcohol use at time of sex was associated with decreased odds of recent nondisclosure among seroconcordant partners and among casual partners. Factors associated with nondisclosure were relationship with a casual partner, a serodiscordant partner, multiple sex partners, awareness of HIV diagnosis less than 1 year, and a lifetime history of sexually transmitted disease. Nondisclosure of HIV status to sex partners is common among HIV-infected Russians, however alcohol does not appear to be a predictor of recent disclosure.

Keywords

Nondisclosure; Disclosure; HIV; Russia; Alcohol

Introduction

The HIV epidemic in the Russian Federation has been growing at alarming rates affecting almost 1 million Russians [1]. The majority of these individuals (64–82 %) are injection drug users (IDUs) [1–3]. Of the approximately 1.7 million opiate users in Russia [4], more than one-third (37 %) are HIV infected [5].

In addition to HIV transmission by injection drug use, unsafe sex between discordant partners (i.e., an HIV seropositive with a seronegative person) accounts for most other Russian HIV infections. When an HIV-infected person does not disclose his or her status to an uninfected partner, the uninfected partner cannot make a fully informed decision regarding the level of risk he or she is willing to assume and the use of protection he or she might want to choose [6, 7]. Among serodisconcordant couples, nondisclosure is a significant risk factor for seroconversion [8]. In clinical practice, post-test counseling therefore encourages HIV seropositive persons to disclose their status to sex partners, assuming that disclosure reduces HIV transmission by reducing unsafe sex practices. Theory-based interventions reinforcing disclosure to sex partners and safe sex practices have demonstrated reduction of unsafe sex [9].

Nondisclosure to sex partners is common among HIV infected patients. In the USA, disclosure has been recommended since 1987 [10] and is mandated by law in many states. Nondisclosure is conceptualized in some studies as a trait-based phenomenon on an individual level (i.e., the individual HIV infected person is the unit of observation), and in others on a partner level (i.e., disclosure status with each sex partner is the unit of observation) [11].

Reported individual-level prevalence of nondisclosure ranges from 26 to 46 % of HIV infected individuals [6, 7, 12–15]. Rates of nondisclosure vary widely among populations in other countries [16], but tend to be high even among individuals in care and on ART (67–78 % in South Africa [17, 18], 30 % in South America [19] and 23 % in Southeast Asia [20]). A recent study from St. Petersburg, Russia, analyzed non-disclosure for each sex partner

among 70 HIV-infected IDUs who knew of their serostatus and reported that they had not disclosed it to 27 % of their sex partners [21]. Due to varying definitions of the outcome measure (e.g., disclosure within past 6 or 12 months, to last partner, to each or certain partners), prevalence of nondisclosure to sex partners is difficult to interpret across study populations.

Russia has among the highest rates of alcohol consumption and alcohol-attributable mortality in the world [22]. Unhealthy alcohol use is common among hospitalized HIV-infected patients in St. Petersburg [23], and increased alcohol use among HIV-infected individuals has been well documented in the USA and elsewhere [24, 25]. Several studies conducted in the USA did not observe a significant association between alcohol use and disclosure, although alcohol was not the focus of those analyses [6, 13, 26]. In spite of the burden of alcohol use in Russia, no published data exist on the role of alcohol use on nondisclosure of HIV serostatus in Russia. Because alcohol is disinhibiting and associated with riskier sex practices, we hypothesized that risky alcohol use and alcohol dependence would be associated with nondisclosure among HIV-infected Russians.

The aim of this study was to explore the extent to which Russian HIV-infected risky drinkers fail to disclose their serostatus to sex partners and to evaluate whether alcohol use is associated with recent nondisclosure.

Methods

Study Design and Participants

This is a cross-sectional analysis of participants enrolled in the HERMITAGE (HIV Evolution in Russia—Mitigating Infection Transmission and Alcoholism in a Growing Epidemic) study in St. Petersburg, a randomized controlled secondary HIV prevention trial to reduce high-risk sexual activity among HIV-infected risky drinkers. Both the Institutional Review Boards of Boston Medical Center and St Petersburg Pavlov State Medical University approved this study.

From October 2007 to April 2010, we recruited 700 HIV-infected risky drinkers who had reported unprotected sex in the previous 6 months from 4 HIV care and addiction treatment sites, as well as at a needle exchange program which referred to the treatment sites. Research associates approached potential participants, assessed eligibility, offered participation, obtained informed consent and conducted the assessments.

Inclusion criteria were the following: age 18 years or older; HIV infection; reported anal or vaginal sex without a condom in the past 6 months; and reported risky drinking levels in the past 6 months as defined by the US National Institute on Alcohol Abuse and Alcoholism (NIAAA) (Men: >4 drinks/day or >14 drinks/week; Women: >3 drinks/day or >7 drinks/week), provision of contact information, a stable address within 150 km of St. Petersburg, and the ability to provide informed consent. Exclusion criteria were anticipated incarceration or trying to conceive.

Of 921 people screened for eligibility, 221 were excluded: 189 were deemed ineligible (of those, 110 did not meet the alcohol related criteria and 134 did not meet the sex risk criteria, 30 were unable to provide contact information, 17 had pending legal issues, four were in ongoing efforts to conceive, and in two HIV infection could not be confirmed), 31 declined to participate, and one was too ill to participate. In total, 700 subjects were enrolled in the HERMITAGE study and randomized; 605 reported recent sexual activity in the past 3 months and were included in this analysis.

Data Collection

Baseline data were collected in three steps, a face-to-face interview with a research associate and a self-administered questionnaire for particularly sensitive questions (including nondisclosure and depressive symptoms). In addition, a medical chart review was performed for subjects recruited from medical settings to extract CD4 cell counts. Interviews were conducted in Russian. Participants were compensated 200 rubles, the equivalent of approximately seven U.S. dollars, for the baseline assessment.

Measures

Outcome Measures

We assessed any nondisclosure of HIV serostatus to all sex partners since HIV diagnosis by asking the single item “Thinking about all of the times that you’ve had sex since learning that you are HIV positive, did you tell all of those people before you had sex with them that you have HIV?” (any nondisclosure). We measured any recent nondisclosure of HIV serostatus to the sex partner by asking the single item “In the past 3 months, did you and your partner talk about your having HIV?” (recent nondisclosure). Recent nondisclosure was the primary outcome evaluated in the regression analyses.

Independent Variables

Three measures of alcohol use were evaluated in the analyses: alcohol dependence, risky alcohol use (past 30 days), and alcohol use at time of sex (past 30 days). Alcohol dependence was evaluated using the composite international diagnostic interview (CIDI) [27]. Risky alcohol use in the past 30 days was assessed by 30 day timeline follow back [28] and defined by NIAAA criteria. Alcohol use at time of sex in the past 30 days was defined as any alcohol consumption before or while having sex with any partner at any time in the last 30 days by a single item question.

Covariate Measures

Potential confounders included the demographic variables gender, age, and marital status at time of inclusion into the study. Based on our literature review of potential confounders of nondisclosure, we included having a serodiscordant partnership or a main partner as covariates. Serodiscordance was defined as the partner being HIV negative or having a serostatus unknown to the study subject, and seroconcordance as the partner being HIV positive. A main or regular partner was defined as “someone who the subject has an ongoing relationship with and who he or she has sex with often-like a spouse, lover, or boyfriend or girlfriend”. More than one sex partner could be identified as a main or regular partner. A non-main or casual partner was identified as a sex partner who is not a main partner. We also included clinical variables such as time since first positive HIV test, any lifetime injection drug use, drug use during sex with any partner, depressive symptoms (Beck’s depression inventory [BDI-II]) [29], HIV stigma (assessed by the abbreviated Berger HIV Stigma Scale) [30], reported lifetime history of any sexually transmitted diseases (STDs) other than HIV, number of sex partners in the past 3 months, CD4 cell count, and any lifetime history of ART treatment.

Data Analyses

We analyzed any nondisclosure by person and recent nondisclosure by partnership. To maintain the same study sample for analyses of any and recent nondisclosure, we included only participants who reported sexual activity in the past 3 months ($N = 605$) in all analyses. We used descriptive statistics to characterize the cohort demographics and to estimate the prevalence of any nondisclosure. Generalized estimating equations (GEE) logistic regression

models were used to evaluate the association between alcohol, the main independent variable, and recent nondisclosure of HIV serostatus for each reported partner. Separate models were fit for each alcohol variable (alcohol dependence, risky alcohol use in the past 30 days, and alcohol use at time of sex). The GEE approach was used to adjust for the correlation due to analyzing repeated measures from the same subject (one for each of up to five different sex partners). An independence working correlation structure was used and empirical standard errors were reported for all analyses. To minimize the potential for collinearity, we assessed the correlation between pairs of independent variables and covariates and verified that no pair of variables included in the regression models was highly correlated (i.e., $r > 0.40$). All regression models were adjusted for demographics (gender, age, current marital status), serodiscordance (yes vs. no), partner status (main vs. non-main), time since first positive HIV test (dichotomized as < 12 months vs. ≥ 12 months), any lifetime injection drug use, drug use during sex with any partner in the past 3 months, depressive symptoms, HIV stigma, any lifetime STD, number of sex partners in the past 3 months (dichotomized as one vs. two or more), any lifetime history of ART treatment, and CD4 cell count. The BDI-II (Cronbach's $\alpha = 0.90$) was dichotomized as ≤13 vs. ≥14, i.e. no vs. any depressive symptoms. The Berger HIV Stigma Scale (Cronbach's $\alpha = 0.77$) was dichotomized at the median. CD4 cell count was categorized as: <350 cells/mm^3; ≥350 cells/mm^3; missing. The latter category was added due to a large proportion of missing values for CD4 cell count (30.2 % of the sample). To evaluate possible effect modification, secondary analyses were conducted stratifying separately by serodiscordance (yes vs. no) and partner type (main vs. non-main partner).

The recent disclosure item "in the past 3 months, did you and your partner talk about your having HIV?" does not exclude the possibility of the disclosure process having taken place in the more distant past. In order to address this potential misclassification, we performed a sub-analysis of the regression models restricted to a cohort excluding those who responded to have always disclosed to all partners but not having talked about HIV with any partner in the last 3 months.

All analyses were conducted using two-sided tests and a significance level of 0.05. Analyses were performed using SAS software (version 9.1; SAS Institute, Cary, NC).

Results

The cohort demographics are shown in Table 1. Approximately half of all 605 participants (52.4, 95 % CI 48.4, 56.4 %) had not disclosed their HIV serostatus to all sex partners since HIV diagnosis (Table 2). The 605 participants for the past 3 months reported a total of 958 sex partners. Participants had not discussed their having HIV in the previous 3 months with 48.9 % (95 % CI 45.7, 52.0 %) of these individuals. Nondisclosure was more commonly reported in discordant compared to concordant partnerships and casual compared to non-casual partnerships (Table 2).

In the overall models, we were unable to detect an association between any alcohol use variables and the outcome of recent nondisclosure (Table 3). In the models stratified by seroconcordant versus serodisconcordant partners and main versus non-main partners, alcohol use at time of sex was associated with decreased odds of recent nondisclosure among seroconcordant partners (AOR 0.33; 95 % CI 0.17, 0.62; $P < 0.01$) and among casual partners (AOR 0.60; 95 % CI 0.36, 0.98; $P = 0.04$) (Table 4).

All overall models for each alcohol variable showed significant associations between the following covariates and the outcome of recent nondisclosure: a serodiscordant partner, a

main partner, having more than one sex partner, having known the HIV diagnosis for less than a year, and a lifetime history of STDs (Table 3).

When stratifying by partner status, these associations persisted among both main and non-main partners in all models for each alcohol variable. When stratifying by seroconcordance, these associations persisted among serodisconcordant sex partners, but not among seroconcordant partners (data not shown). No other covariates showed a significant association in any of the models.

Examination of our cohort for a potential misclassification of participants who responded to have always disclosed to all partners but not having talked about HIV with any partner in the last 3 months excluded 61 unique participants. The remaining 544 participants had a total of 853 sexual partnerships. Findings for the different models with regard to alcohol use did not substantially differ in this reduced cohort in comparison to the primary analysis (data not shown).

Discussion

Disclosure of HIV positive serostatus to sexual partners is considered an important public health goal to prevent new infections [31]. Disclosure can motivate sex partners to make informed choices and change behavior through negotiation of safer sex practices [16]. It might also prompt partner testing and counseling [16].

As recommended in the literature [32], we present Russian data measuring nondisclosure both by person and by partnership. The proportion of 52.4 % of participants in our study not disclosing to all sex partners since diagnosis is higher than observed in most studies outside Sub-Saharan Africa [6, 7, 12–15, 17–20]. On a partnership level, we observed that participants did not disclose to 48.9 % of their sex partners.

HIV serostatus disclosure to sex partners has been found to have multiple influences, including intrapersonal aspects (e.g., injection drug use) along with factors that can be categorized as interpersonal (e.g., partnership type), sociocultural (e.g., HIV associated stigma), or situational factors (e.g., perceived serostatus of partner, drug or alcohol use at time of sex) [33].

We did not find a significant association for alcohol-related intrapersonal aspects, specifically alcohol dependence or risky alcohol use on nondisclosure in the Russian cohort. Although not central to their analyses, previous studies have examined the role of alcohol abuse (≥2 positive answers on the CAGE [cut down/annoyed/guilty/eye opener] questionnaire, a screening test for alcohol problems) [13] and binge drinking [6, 26] on disclosure without finding an association.

Of note, an alcohol-related situational factor, drinking at time of sex, was associated with decreased odds of nondisclosure to casual and seroconcordant partners. This seems to conflict with findings from a smaller South African study, which found that “heavy alcohol use before sex” was associated with nondisclosure to steady partners [18]. This seeming paradox may be understood as heavy drinking in the South African study might conceivably affect disclosure in both a positive and negative manner. It could impair one’s perception of the negative consequences of sex without disclosure and increase nondisclosure. Unhealthy alcohol use and its disinhibitory effects could also explain this study’s findings, as alcohol use at time of sex with casual and seroconcordant partners may disinhibit a conversation on HIV infection.

Social cognitive theory holds that behavior, such as disclosure, is determined in part by outcome expectations and that individuals are less likely to engage in behaviors which they believe will have negative consequences. Following this rationale, alcohol use and the associated "alcohol myopia" might lead to restriction in cognition while inebriated, with amplification of immediate positive behavior cues, such as the prospect of sexual intercourse, and less avoidance of behavior with perceived potential long-term negative consequences [34]. An HIV-infected individual might anticipate negative reactions from a sex partner upon disclosing one's HIV infection. However, alcohol use in the context of a sexual encounter might disinhibit one's hesitation to disclose, transiently mitigate the perception of a potential negative reaction to disclosure (e.g., the partner not agreeing to have sex), and thus be more likely to consider disclosing one's HIV infection.

Even though this is a comparatively large study on alcohol and disclosure, specific alcohol effects might nonetheless be difficult to detect, given the highly prevalent risky alcohol use in the HERMITAGE population. At-risk drinking is common in Russia [35–37]. A study from Russia indicates that frequent, heavy spirit drinking (>80 g each time, ≥weekly) was widespread amongst men during the transition from communism to a market economy (12–17 % in 1994–2004) [38]. A recent study found 13 % of working age males to be hazardous drinkers [39], while in the extreme case of another study, up to 75 % of male workers classified as harmful or hazardous drinkers using alcohol use disorders identification test (AUDIT) criteria [40].

Nondisclosure behavior has been known to relate to partnership type and perceived serostatus of the sex partner. We therefore examined nondisclosure events by partnership and confirmed previous findings that nondisclosure is less likely to happen with a regular, steady, main partner than with a casual partner [26, 41–43].

In a casual partnership, it might be challenging to build up intimacy as a defining feature of the relationship. Intimacy is the result of a recursive, interactive process in which one individual discloses and the other responds. The expected responses determine the discloser's perceptions whether he or she is understood, valued, and cared for by the other. This in turn influences further disclosure and whether the relationship continues, develops, or terminates [7].

Likewise, we confirmed that individuals in a possibly more intimate relationship with only one partner are more than three times more likely to disclose than those with multiple partners [6, 13]. As noted in previous studies, the likelihood of nondisclosure increases with the number of sex partners [18, 44–47]. Other aspects reflecting intimacy, such as being married and reporting partner or spousal support, are also associated with disclosure [13, 18] and with safer sex [32]. On the other hand, sex without disclosure is more common in nonexclusive than in exclusive partnerships [7].

As has been reported from other countries [42, 46, 48], including Russia [21], these partner-level analyses indicate that nondisclosure is more common with serodiscordant sex partners. HIV-infected individuals may be more likely to disclose to a partner who they know is already HIV infected, assuming a lower chance of rejection than someone who is not infected [32, 49]. The Russian study by Grau et al. [21] also reported associations of disclosure with having a partner who is an IDU and with longer injection time, but not with main versus casual partners or with time since diagnosis; the absence of these latter findings may be due to the smaller number of subjects ($N = 70$) and sex partners ($N = 106$) studied.

We confirmed associations of several determinants with nondisclosure beyond partnership that had been reported in other country settings but not yet in Russia, such as recent awareness of HIV diagnosis. Disclosure is a process, and many HIV infected persons tend to

wait until they trust that disclosure will help them cope with the disease. Accordingly, several studies found associations of length of time since diagnosis with disclosure [45, 50, 51].

This study's finding of higher odds of nondisclosure in serodiscordant partnerships and casual partnerships might be attributable to limited access for Russian HIV patients to appropriate HIV-related behavioral counseling. The Russian health system has established excellent routine HIV testing in various settings. For IDUs, HIV testing is offered within the narcology system, a standard former Soviet Union (FSU) modality. However, many HIV infected IDUs, even those in treatment within the narcology system, are not counseled or enrolled in HIV care [52, 53].

The increased odds of nondisclosure among those with a recent diagnosis of HIV infection (i.e., less than 1 year) suggests another missed prevention opportunity. This finding suggests benefit from linking HIV patients to HIV care as soon as they are diagnosed, care that includes behavioral counseling. Counseling interventions for HIV infected persons, when delivered by multiple sources, have been shown to provide an effective means of increasing disclosure to sexual partners in a study where disclosure to HIV-negative partners was associated with safer sexual practices [54]. Our results suggest that HIV prevention interventions focusing on disclosure should target serodiscordant dyads and promote partner testing to make the partners' serostatus known. Patients should be asked about their sexual partnerships, and those who report casual partners should be counseled to consider disclosing their serostatus and practice safe sex.

Russian health professionals should promote testing and referral of sex partners, and counsel those tested. These efforts should be concentrated in most-at-risk groups, a strategy that is an essential part of comprehensive HIV prevention to protect the entire population in a concentrated epidemic [55].

Limitations

Our study is subject to the biases usually associated with survey studies, such as recall and social desirability biases. The NIAAA definition of risky alcohol use was developed in a US context, but is nonetheless used in this study as it has been a reasonable construct to use in other countries. The wording of our study instrument did not allow establishing temporal patterns of disclosure and alcohol use during sex. The wording of the instrument measuring recent nondisclosure on a partnership level does not capture disclosure that occurred longer than 3 months ago. This did result in some potential misclassification; however our analysis on the subset without this potential misclassification supported the overall findings.

Conclusions

Russia is at the point of transition of its HIV epidemic concentrated in IDUs to the general population [56]. Avoiding the scenario of a generalized epidemic requires both prevention and treatment among at-risk populations and bridge populations.

Given the fact that the majority of this Russian HIV-infected population did not disclose HIV serostatus to all sexual partners, counseling of HIV-infected persons about HIV disclosure to all sex partners should become standard practice, and assessment of partnership types including casual partnerships and those with HIV-negative partners merits consideration.

Despite our hypothesis that alcohol use might be implicated in non-disclosure of one's HIV infection, this was not found to be the case. It is time to actively advocate for the addition of

behavioral interventions addressing disclosure and safe sex as well as evidence-based addiction treatment and harm reduction strategies as a comprehensive approach addressing the HIV crisis in Russia.

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Table 1

HIV-infected Russian risky drinkers' demographic and clinical characteristics: overall and for subgroups with any nondisclosure and recent nondisclosure

	Overall (*N* = 605)	**Any non-disclosure (*N* = 317)**	**Recent nondisclosure (*N* = 544)**
Demographics			
Age mean (SD)	29.9 (5.06)	29.9 (5.17)	29.9 (5.14)
Male	358 (59.2 %)	175 (55.2 %)	317 (58.3 %)
Married or with partner	235 (38.9 %)	105 (33.1 %)	217 (39.9 %)
Independent variables			
Alcohol dependence	388 (64.1 %)	201 (63.4 %)	350 (64.3 %)
Risky alcohol use[a]	505 (83.5 %)	262 (82.7 %)	452 (83.1 %)
Alcohol use at time of sex[a]	290 (48.2 %)	149 (47.3 %)	229 (42.3 %)
Covariates			
Drug use during sex[a]	183 (30.3 %)	105 (33.1 %)	165 (30.4 %)
Time since HIV diagnosis-less than 1 year	148 (24.6 %)	61 (19.4 %)	136 (25.1 %)
Ever been on ART	143 (23.6 %)	89 (28.1 %)	129 (23.7 %)
Current CD4 < 350[b]	187 (30.9 %)	98 (30.9 %)	169 (31.1 %)
Lifetime history of injection drug use	508 (84.0 %)	278 (87.7 %)	453 (83.3 %)
Multiple (>1) sex partners-past 3 months	189 (31.2 %)	130 (41.0 %)	164 (30.2 %)
Lifetime history of sexually transmitted disease	283 (46.8 %)	177 (55.8 %)	262 (48.2 %)
No or mild depressive symptoms (BDI < 20)	360 (59.5 %)	179 (56.5 %)	327 (60.1 %)
No Depressive Symptoms (BDI ≤ 13)	216 (35.7%)	102 (32.2%)	197 (36.2%)
Stigma mean score (SD)[c] (min–max)	23.5 (4.47) [10–36]	23.8 (4.54) [10–36]	23.5 (4.43) [10–36]

[a] In the past 30 days

[b] CD4 counts were missing for 87 participants (30.2 %)

[c] Higher scores indicate higher degree of stigma

Table 2

Nondisclosure prevalence by individuals and with sex partner; nondisclosure prevalence with sex partner stratified by partnership type

	N[a]	Percentage (95 % CI)[b]
Nondisclosure on person-level		
Any nondisclosure (by individual)	605 participants	52.4 (48.4–56.4)
Nondisclosure on partnership-level		
Recent nondisclosure (by sex partner)	958 partners	48.9 (44.9–52.8)
Nondisclosure on partnership-level: HIV seroconcordant versus discordant partner		
Recent nondisclosure to concordant partner	343 concordant partners	20.4 (16.1–25.4)
Recent nondisclosure to discordant partner	610 discordant partners	64.8 (60.1–69.1)
Nondisclosure on partnership-level: main versus casual partner		
Recent nondisclosure to main partner	466 main partners	33.0 (28.5–37.9)
Recent nondisclosure to casual partner	486 casual partners	64.2 (58.3–69.7)

[a] Represents number of observations included in analyses. Note that participants on average had more than one sexual partner, so that more partnerships than participants were included in the partnership analyses

[b] Obtained using GEE estimation for analyses by sex partner

Table 3

Separate GEE logistic regression models to evaluate the associations between measures of alcohol use and recent nondisclosure of HIV status to sex partners ($N = 958$)

	Model 1		Model 2		Model 3	
	AOR (95 % CI)	***P* value**	**AOR (95 % CI)**	***P* value**	**AOR (95 % CI)**	***P* value**
Main independent variables						
Alcohol dependence	0.81 (0.55, 1.20)	0.29	–	–	–	–
Risky alcohol use past 30 days	–	–	1.31 (0.79, 2.17)	0.30	–	–
Drinking at time of sex past 30 days	–	–	–	–	0.75 (0.54, 1.05)	0.10
Covariates						
Female	0.85 (0.57, 1.28)	0.44	0.89 (0.59, 1.34)	0.57	0.85 (0.57, 1.29)	0.45
Age	0.98 (0.94, 1.02)	0.39	0.98 (0.94, 1.02)	0.38	0.98 (0.94, 1.02)	0.36
Injection drug use (lifetime)	1.35 (0.69, 2.65)	0.38	1.4 (0.7, 2.78)	0.34	1.35 (0.68, 2.67)	0.39
Married or living with partner	1.13 (0.75, 1.70)	0.56	1.12 (0.74, 1.68)	0.59	1.14 (0.76, 1.71)	0.54
Serodiscordant partner	5.87 (4.02, 8.57)	<0.001	5.89 (4.04, 8.60)	<0.001	5.88 (4.02, 8.58)	<0.001
Main partner	0.37 (0.25, 0.56)	<0.001	0.38 (0.26, 0.57)	<0.001	0.4 (0.27, 0.6)	<0.001
Multiple sex partners (in the past 3 months)	1.56 (1.02, 2.38)	0.04	1.53 (1.00, 2.34)	0.05	1.55 (1.02, 2.37)	0.04
Drug use during sex (in the past 30 days)	0.96 (0.65, 1.44)	0.85	0.97 (0.65, 1.44)	0.88	1.02 (0.68, 1.54)	0.92
Time since HIV diagnosis less than 1 year	2.62 (1.68, 4.07)	<0.001	2.67 (1.72, 4.14)	<0.001	2.68 (1.73, 4.15)	<0.001
Ever been on ART	0.95 (0.61, 1.50)	0.84	0.99 (0.63, 1.54)	0.95	1.00 (0.64, 1.56)	0.99
Current CD4 350 and above	1.25 (0.8, 1.96)	0.32	1.26 (0.8, 1.97)	0.32	1.27 (0.81, 1.99)	0.31
Reported lifetime history of sexually transmitted diseases	1.81 (1.23, 2.67)	0.003	1.75 (1.18, 2.59)	0.005	1.87 (1.27, 2.76)	0.002
Depression (BDI > 13)	1.02 (0.69, 1.51)	0.92	0.96 (0.65, 1.42)	0.84	0.96 (0.65, 1.42)	0.85
Stigma (Score ≥ 24)	1.11 (0.76, 1.62)	0.60	1.1 (0.75, 1.61)	0.63	1.10 (0.75, 1.62)	0.62

Main independent variables alcohol dependence (model 1), risky alcohol use in the past 30 days (model 2), and drinking at time of sex (model 3) adjusted for covariates: Demographics, serodiscordance, partner status, time since HIV diagnosis, lifetime IDU, drug use during sex, depressive symptoms, HIV stigma, any lifetime STD, multiple sex partners, lifetime history of ART, and CD4 cell count

Table 4

Adjusted odds ratios (AOR) for the associations between alcohol use and recent nondisclosure of HIV status to sex partners, stratified by partner type

Independent variable	Seroconcordant partners only (*N* = 343) AOR (95 % CI)	*P* value	Serodiscordant partners only (*N* = 610) AOR (95 % CI)	*P* value	Main partners only (*N* = 466) AOR (95 % CI)	*P* value	Casual partners only (*N* = 486) AOR (95 % CI)	*P* value
Alcohol dependence	0.77 (0.40, 1.5)	0.45	0.84 (0.52, 1.34)	0.46	0.88 (0.56, 1.38)	0.56	0.83 (0.46, 1.5)	0.54
Risky alcohol use past 30 days	1.21 (0.51, 2.89)	0.66	1.51 (0.85, 2.66)	0.16	1.46 (0.77, 2.8)	0.25	1.03 (0.46, 2.29)	0.95
Alcohol use at time of sex past 30 days	0.33 (0.17, 0.62)	<.001	0.86 (0.57, 1.3)	0.48	0.87 (0.57, 1.34)	0.54	0.6 (0.36, 0.98)	0.04

Covariates included gender, age, and marital status at time of inclusion into the study, time since first positive HIV test, any lifetime injection drug use, drug use during sex with any partner, depressive symptoms (Beck's depression inventory [BDI-II]), HIV stigma (abbreviated Berger HIV Stigma Scale), lifetime history of any sexually transmitted diseases, multiple sex partners in the past 3 months, CD4 cell count, and any lifetime history of ART treatment