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Alcohol use and its association with HIV risk behaviors among a cohort of patients attending HIV clinical care in Tanzania, Kenya, and Namibia

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Abstract

This article describes the frequency of alcohol use among HIV-positive patients attending clinical care in sub-Saharan Africa and explores the association between alcohol use, medication adherence, and sexual risk behavior. Data from 3538 patients attending an HIV clinic in Kenya, Tanzania, or Namibia were captured through interview and medical record abstraction. Participants were categorized into three drinking categories: nondrinkers, nonharmful drinkers, and harmful/likely dependent drinkers. A proportional odds model was used to identify correlates associated with categories of alcohol use. Overall, 20% of participants reported alcohol use in the past 6 months; 15% were categorized as nonharmful drinkers and 5% as harmful/likely dependent drinkers. Participants who reported missing a dose of their HIV medications [adjusted odds ratio (AOR): 2.04, 95% confidence interval (CI): 1.67, 2.49]; inconsistent condom use (AOR: 1.49, 95% CI: 1.23, 1.79); exchanging sex for food, money, gifts, or a place to stay (AOR: 1.57, 95% CI: 1.06, 2.32); and having a sexually transmitted infection symptom (AOR: 1.40, 95% CI: 1.10,

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1.77) were more likely to be categorized in the higher risk drinking categories. This research highlights the need to integrate alcohol screening and counseling into the adherence and risk reduction counseling offered to HIV-positive patients as part of their routine care. Moreover, given the numerous intersections between alcohol and HIV, policies that focus on reducing alcohol consumption and alcohol-related risk behavior should be integrated into HIV prevention, care, and treatment strategies.

Keywords

alcohol use; HIV/AIDS; HIV risk behavior; sub-Saharan Africa

Introduction

Sub-Saharan Africa (SSA) continues to bear the burden of the global HIV/AIDS pandemic. Accounting for just 12% of the world's population, SSA contains 68% of the global population of people living with HIV (PLHIV) and 70% of all new HIV infections (Joint United Nations Programme on HIV/AIDS [UNAIDS], 2011). However, there is increasing evidence that HIV incidence is beginning to decline with models from 22 countries in SSA, indicating that incidence has decreased by more than 25% since 2001 (UNAIDS, 2011). Optimizing and expanding HIV prevention, care, and treatment efforts is essential in order to continue this positive trend.

Many countries in SSA with high HIV prevalence also report high levels of hazardous alcohol consumption (Fritz, Morojele, & Kalichman, 2010; World Health Organization [WHO], 2011). In Namibia, for example, 25% of men and 21% of women are categorized as heavy episodic drinkers. In Tanzania, 20% of men reported consuming alcohol five or more days per week (WHO, 2004). Alcohol use has been associated with both HIV incidence (Geis et al., 2011; Ruzagira et al., 2011; Seeley et al., 2012) and prevalence (Fisher, Bang, & Kapiga, 2007; Hahn, Woolf-King, & Muyindike, 2011) along with sexual risk-taking behaviors that can lead to HIV transmission and acquisition including multiple sex partners (Scott-Sheldon et al., 2012; Weiser et al., 2006), unprotected sex (Shuper, Joharchi, Iriving, & Rehm, 2009; Weiser et al., 2006), coercive sex (Woolf-King & Maisto, 2011), and transactional sex (Weiser et al., 2006; Woolf-King & Maisto, 2011).

Alcohol use also has negative implications for the health of PLHIV including increased levels of depression (Ghebremichael et al., 2009; Nakimuli-Mpungu, Musisi, Katabira, Nachega, & Bass, 2011), accelerated HIV disease progression (Baum et al., 2010; Ghebremichael et al., 2009), decreased survival (Braithwaite et al., 2007), and severe hepatotoxicity among patients on antiretroviral treatment (ART) (Barve et al., 2010). Among patients not yet on ART, heavy alcohol consumption has been associated with a lower CD4 cell count (Baum et al., 2010; Hahn & Samet, 2010; Samet et al., 2007) and shorter time to CD4 count less than 200 cells/mm^3, the typical threshold for an AIDS diagnosis (Baum et al., 2010). For patients on ART, studies indicate that regular drinkers are more likely to have a detectable viral load even after adjusting for adherence (Shacham,

Agbebi, Stamm, & Overton, 2011; Wu, Metzger, Lynch, & Douglas, 2011), suggesting that alcohol use may impact the metabolism of ART (Hahn & Samet, 2010; Samet et al., 2007).

Alcohol use can lead to poor self-care behaviors including lack of engagement in medical care and nonadherence to ART. Researchers in both domestic and international settings have found that heavy drinkers are less likely to report initiating ART (Chander, Lau, & Moore, 2006; Conen et al., 2009; Martinez et al., 2008) and alcohol use has been consistently associated with poor ART adherence (Chander et al., 2006; Do et al., 2010; Hahn et al., 2011; Hendershot, Stoner, Pantalone, & Simoni, 2009). Studies that have examined the relationship between alcohol use and ART adherence have identified both a dose–response relationship with adherence decreasing as levels of alcohol use increase (Braithwaite et al., 2005; Chander et al., 2006) and a temporal association with lower adherence following episodes of alcohol use (Braithwaite et al., 2005).

There are also clear gender differences in the relationship between alcohol use, sexual risk behavior, and HIV medication adherence. Men are more likely to report alcohol use, to drink alcohol more frequently, and to be identified as harmful, hazardous, or likely dependent drinkers than women (Kalichman, Simbayi, Kaufman, Cain, & Jooste, 2007). Men's alcohol use is associated with sexual risk behavior, including unprotected sex and sex with casual partners (Kalichman et al., 2007). Men are also less likely to be adherent to their HIV medications than women, and alcohol use is a main reason why men report nonadherence (Braitstein et al., 2008; Keiser et al., 2008). In contrast, women are more likely to report drinking alcohol with their sex partners (Kalichman et al., 2007). Women's alcohol use places them at a greater risk for experiencing gender-based violence (Browne & Wechsberg, 2010; Pitpitan et al., 2013) and for engaging in transactional sex (Kalichman et al., 2007). These gender differences highlight the different role that alcohol plays in promoting HIV risk behavior between men and women.

Despite the well-known dangers of alcohol use among PLHIV, the frequency of alcohol use among PLHIV attending clinical care in SSA is unclear as most studies have been conducted in the United States or other high-resource settings (Hahn et al., 2011). Since alcohol use has been shown to be a significant determinant of both medication adherence and sexual risk behavior in these high-resource settings, it is essential to examine the relationship between these variables in SSA where both HIV prevalence and alcohol consumption rates are high. In the current study, we describe the frequency of alcohol use among a large, multicountry, clinic-based sample of HIV-positive patients attending HIV clinical care in Kenya, Namibia, and Tanzania. In order to capture a more comprehensive understanding of alcohol use and its relationship with adherence and sexual risk behavior, we examined multiple constructs of drinking including frequency, quantity, and severity. The findings from this study will help inform the development of more effective and feasible HIV prevention strategies for PLHIV attending clinical care in these settings.

Methods

Study population and design

Data presented are from the baseline assessment of a cluster-randomized controlled trial conducted in Kenya, Tanzania, and Namibia. The primary objective of the study was to examine the feasibility and effectiveness of integrating HIV prevention services into routine HIV clinical care in these countries. All three countries have generalized HIV epidemics with prevalence rates of 6.2%, 5.7%, and 13.5%, respectively (Kenya National AIDS Control Council, 2012; Republic of Namibia Ministry of Health and Social Services, 2012; Tanzania Commission for AIDS, 2012). In each country, six clinics were paired on key characteristics (e.g., patient volume, provider/patient ratio, services offered) and then randomly assigned to either an intervention or control arm.

At each of the 18 study clinics, a representative sample of approximately 200 sexually active patients was enrolled between October 2009 and April 2010 as part of an evaluation cohort to assess the effectiveness of the clinic-level intervention (Kidder et al., 2013). To be eligible, participants had to have an HIV-positive diagnosis, have received care at the project clinic at least twice prior to enrolment, be at least 18 years of age, report sexual activity within the past 3 months, and plan to attend the clinic for at least 1 year. Women who knew they were pregnant at the time of enrollment and male partners of women pregnant at time of enrollment were excluded from the study.

Participants provided written informed consent to complete three interviews during the study (at baseline and 6- and 12-months postintervention), allow data to be abstracted from their medical charts, and to provide contact information for participant tracking during the follow-up period. This article presents results from the baseline interviews. The protocol for this study was approved by the Institutional Review Board at the Centers for Disease Control and Prevention and ethics review committees in each country and at all collaborating organizations.

Measures

Outcome measures—The WHO's 10-item Alcohol Use Disorders Identification Test (AUDIT) (Babor, Higgins-Biddle, Saunders, & Monteiro, 2001) was used to categorize participants into three drinking categories: nondrinkers (AUDIT= 0), nonharmful drinkers (AUDIT= 1–7), and harmful/likely dependent drinkers (AUDIT ≥ 8). Participants were categorized as "binge drinkers" if they reported having six or more drinks during one occasion in the past 6 months. Participants were asked to report all types of alcohol use including both traditional brews and commercial alcohols. The AUDIT has been widely used and validated in a variety of settings throughout SSA (Kalichman, Simbayi, Jooste, Cain, & Cherry, 2006; Luchters, et al., 2011; Nakimuli-Mpungu et al., 2012; Peltzer & Ramlagan, 2009; Zetola et al., 2012).

Independent measures—Sociodemographic variables include age, gender, education, and paid work in the past 6 months. To assess HIV medication adherence, participants were asked to name all their HIV medications including antiretrovirals (ARVs) and drugs to

prevent opportunistic infections. Participants were then asked if they had missed a dose of each named medication in the past 30 days. Sexually transmitted infection (STI) symptoms were assessed by asking participants if they experienced one or more of the following symptoms in the past 6 months: abnormal discharge from the penis or vagina, sores in the genital area, or (for female patients only) lower abdominal pain. Participants were also asked if their health care provider discussed alcohol use with them during one of their clinic visits in the past 6 months.

To assess sexual risk behavior, participants were asked to name up to five partners with whom they had vaginal sex with in the past 3 months. For each named partner, participants were asked to classify the partner into one of three types: spouse (married or cohabitating partner), regular (a nonmarital, noncohabitating partner with whom participant has an ongoing relationship), or casual (a sexual partner with whom the participant has no ongoing relationship). Participants were asked if they had disclosed their HIV status to each named partner and if they knew that partner's HIV status. For participants who reported more than one partner in the past 6 months, HIV status disclosure was restricted to the spouse or most recent main partner. If the participant did not report either a spouse or main partner, disclosure to non–main partner was used. Participants were dichotomized into two categories: those who knew their partner's HIV status (partner was reported as either HIV-positive or HIV-negative) and those who did not know their partner's HIV status (participants who reported that their partner had not been tested; those who did not know if partner had been tested; and those whose partner had been tested but they did not know the partner's status). Consistent condom use was examined for each named partner and was defined as using a condom at every reported sexual encounter in the past 3 months. Finally, participants were asked whether they had exchanged sex for a place to stay, money, food, or gifts in the past 6 months.

Health status variables abstracted from patients' medical records include length of time since diagnosis, most recent CD4 count and date of test, and ART regimen (if any).

Data analysis

Descriptive statistics were computed for variables of interest overall and by gender. Gender differences were examined using the SAS GLIMMIX (SAS Institute, 2008) procedure with gender as the dependent variable and clinic as a random effect to control for correlation within clinic. A proportional odds model was used to explore the relationships of variables of interest with categories of alcohol use. Univariate and multiple proportional odds regression models were fit using PROC GLIMMIX (SAS Institute, 2008), with categories of alcohol use as the dependent variable and a random intercept for clinic, to account for within-clinic correlation. For each variable, we first tested the proportional odds assumption that the relationship between any two pairs of outcome groups was proportional (i.e., the null being that the odds were proportional across possible cutpoints applied to the three-level variable to create two categories and the alternative being that they were not proportional). For variables that met this assumption, one overall adjusted odds ratio (AOR) is presented. This odds ratio represents the odds of being in a higher risk category for drinking for the indicated group compared to the reference group. For variables that failed to meet this

assumption, AORs are presented for two dichotomous variables: (1) any drinking versus no drinking and (2) being categorized as a “harmful or likely dependent drinker” versus “nondrinker or nonharmful drinker.” To assess the relationship of binge drinking with variables of interest, mixed model univariate and multiple logistic regression models were fit using PROC GLIMMIX (SAS Institute, 2008) with a random intercept for clinic. For both models, all variables were entered into the model simultaneously, and associations were considered significant with a p value less than .05.

Results

A total of 3538 HIV-positive patients were enrolled. Table 1 presents a summary of participants’ characteristics, both overall and stratified by gender. The average age of participants was 37.2 years with male participants significantly older than female participants (40.8 years vs. 34.6 years, $p < .0001$). Most participants (61%) reported being married or cohabitating and most had completed a primary education or lower (63%). Only 44% reported receiving any paid work during the past 6 months, with men significantly more likely to report this than women (55% vs. 37%, $p < .0001$). The majority of participants (69%) had learned of their HIV diagnosis within the past 3 years. The mean CD4 count for the sample was 373 cells/mm^3 and was significantly higher for women than men (412 vs. 319 cells/mm^3, $p < .0001$). Most participants (64%) were on ARV medications with men more likely to be on ARVs than women (72% vs. 59%, $p < .0001$).

Patient characteristics associated with categories of reported alcohol use

Overall, 20% of participants reported alcohol use in the past 6 months. Of these participants, 15% were categorized as nonharmful drinkers and 5% were categorized as harmful or likely dependent drinkers. Table 2 presents participant characteristics associated with categories of reported alcohol use. Men were more likely to be categorized in the higher risk drinking categories than women [AOR: 2.20, 95% confidence interval (CI): 1.83, 2.63]. Participants who were not currently taking ARV medications (AOR: 1.37, 95% CI: 1.13, 1.67) or who reported missing a dose of their HIV medications (AOR: 2.04, 95% CI: 1.67, 2.49) were also more likely to be categorized in the higher risk drinking categories.

Similarly, participants who reported high-risk behaviors including inconsistent condom use (AOR: 1.49, 95% CI: 1.23, 1.79); exchanging sex for food, money, gifts, or a place to stay (AOR: 1.57, 95% CI: 1.06, 2.32); and having an STI symptom (AOR: 1.40, 95% CI: 1.10, 1.77) were more likely to be categorized in the higher risk drinking categories. Additionally, participants who reported either multiple sex partners or casual sex partners in the past 90 days were significantly more likely to report any drinking in the past 90 days (AOR: 2.38, 95% CI: 1.66, 3.40; AOR: 1.54, 95% CI: 1.15, 2.06, respectively).

Patient characteristics associated with binge drinking

Overall, 5% of participants reported binge drinking in the past 30 days (Table 3). Participants from Kenya (AOR: 2.58, 95% CI: 1.38, 4.83) and Namibia (AOR: 4.46, 95% CI: 2.34, 8.52) were more likely to report binge drinking than participants from Tanzania. Other patient characteristics associated with binge drinking include being male (AOR: 2.30,

95% CI: 1.57, 3.38) and being diagnosed with HIV within the past year (AOR: 2.03, 95% CI: 1.22, 3.37). Binge drinking was also associated with missing an HIV medication dose (AOR: 2.11, 95% CI: 1.40, 3.17) and several high-risk behaviors including having multiple sex partners (AOR: 2.72, 95% CI: 1.54, 4.80), inconsistent condom use (AOR: 1.81, 95% CI: 1.25, 2.70), and reporting an STI symptom (AOR: 1.64, 95% CI: 1.03, 2.61).

Frequency of provider discussions with patients about their alcohol use

Overall, 79% of participants had discussed alcohol use with a health care provider in the past 6 months. Of these participants, 90% reported reducing their alcohol use as a result of this discussion ($p < .0001$). Participants categorized as harmful or likely dependent drinkers were more likely to report having this discussion with their provider (AOR: 1.42, 95% CI: 1.14, 1.77).

Discussion

To our knowledge, this is one of the first studies to report the frequency of self-reported alcohol use among a large, multicountry, clinic-based sample of HIV-positive patients attending care in three SSA countries. Overall, 20% of the participants reported alcohol use in the past 6 months and 5% reported binge drinking. Fifteen percent were categorized as nonharmful drinkers and 5% as harmful or likely dependent drinkers. These frequencies are consistent with other studies of PLHIV attending clinical care conducted in Nigeria (Farley et al., 2010), South Africa (Myer et al., 2008), and Uganda (Hahn, Maier, Byakika-Tusiime, Oyugi, & Bangsberg, 2007) but lower than frequencies observed among the general population in SSA (WHO, 2004, 2011).

While ART has been clearly shown to reduce HIV incidence within serodiscordant couples (Cohen et al., 2011), the success of ART in achieving sustained reductions in viral load, and thus a reduction in infectiousness, depends upon long-term retention in care and medication adherence, two things inhibited by alcohol use. In this study, an association was observed between alcohol use and HIV medication nonadherence, with participants reporting incomplete adherence more likely to be categorized in the higher risk drinking categories. Participants who reported high-risk sexual behaviors were also more likely to be categorized in the higher risk drinking categories. These findings suggest that heavy alcohol use may impede the success of treatment as prevention efforts by increasing HIV risk behavior and decreasing HIV medication adherence.

In this baseline study, 79% of participants reported their provider had discussed alcohol use with them in the past 6 months and the vast majority of these participants (90%) reported that they changed their drinking behavior as a result of these discussions. While provider-delivered alcohol reduction counseling has been shown to lead to a reduction in alcohol use among patients (Papas et al., 2011; Strauss et al., 2009), current screening activities are inadequate (Myer et al., 2008) and patients continue to perceive alcohol use to be low risk (Shacham, Hoffer, & Overton, 2011). As a result, it is possible that many patients with dangerous drinking behaviors are missed, particularly if the patient does not have an obvious comorbidity (Conigliaro, Gordon, McGinnis, Rabeneck & Justice, 2003). Failure to identify

these patients can lead to suboptimal management of HIV including treatment failure (Chander et al., 2006).

Many factors limit alcohol use screening including limited time, the social acceptability of alcohol use, and lack of training (Conigliaro et al., 2003; Shacham et al., 2011). However, given alcohol's association with poor medication adherence and continued high-risk sexual behavior, it is essential that providers routinely screen their patients for current alcohol use and provide alcohol reduction counseling to those who report current use. Using lay counselors to assist health care providers in providing risk reduction counseling should be considered in settings where providers have limited time to provide in-depth counseling (Peltzer, Tabane, Matseke, & Simbayi, 2010). Patients reporting high-risk drinking behaviors should be referred to substance-abuse treatment programs, where available.

Individual-level counseling strategies must be accompanied by community- and structural-level interventions, given the widespread availability of alcohol throughout SSA (Kalichman, 2007). These interventions can focus on changing the social norms around alcohol use (Kalichman et al., 2013) as well as changing legal and policy frameworks around alcohol use and substance-abuse treatment.

The results of this analysis should be interpreted in light of a number of limitations. All behavioral outcomes were based on patient self-report. These behaviors are influenced by social and cultural norms and are thus subject to a social desirability bias. Biomarker testing found that 15% of those starting ART in Uganda who reported no alcohol consumption had in fact engaged in heavy alcohol consumption in the past month (Hahn et al., 2010). Future studies on ART adherence and sexual risk behavior among PLHIV in SSA should consider using a biological marker to determine alcohol consumption (Hahn et al., 2011). Finally, the generalizability of these findings to PLHIV not enrolled in HIV clinical care and/or to PLHIV in nongeneralized epidemics may be limited.

Nevertheless, taken together with the results of other studies (Hahn et al., 2011; Woolf-King & Maisto, 2011), this research highlights the need to integrate alcohol screening and counseling into the adherence and risk reduction counseling offered to PLHIV as part of their routine care. Further operational research, ideally with biomarkers, is needed to determine the best models for screening patients for alcohol use and delivering targeted alcohol reduction counseling to patients reporting current alcohol use. Brief screening tools have been developed for use in high-resource settings and could potentially be adapted for use in low-resource settings (Kalichman et al., 2007). Moreover, given the numerous intersections between alcohol and HIV, policies and interventions that focus on reducing alcohol consumption and alcohol-related risk behavior should be integrated into HIV prevention, care, and treatment strategies (Fritz et al., 2010; Hahn et al., 2011).

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Table 1

Characteristics of PLHIV attending HIV clinical care in Namibia, Tanzania, and Kenya, study participants (*n*, %).

	Overall (*N* = 3538)	Male (*n* = 1484)	Female (*n* = 2054)	*p* value
Age (mean, SD)	37.2 (8.4)	40.8 (8.6)	34.6 (7.2)	<0.0001
Country				
Namibia	1186 (33.5)	514 (34.6)	672 (32.7)	0.5139
Tanzania	1196 (33.8)	479 (32.3)	717 (34.9)	
Kenya	1156 (32.7)	491 (33.1)	665 (32.4)	
Current marital status				
Single/never married	781 (22.1)	268 (18.1)	513 (25.0)	<0.0001
Married/cohabitating as if married	2171 (61.4)	1031 (69.5)	1140 (55.6)	
Divorced/separated/widowed	584 (16.5)	185 (12.5)	399 (19.4)	
Highest level of education completed				
None	340 (9.6)	148 (10.0)	192 (9.4)	
Primary	1890 (53.5)	787 (53.1)	1103 (53.8)	
Secondary	1215 (34.4)	502 (33.9)	713 (34.8)	
More than secondary	88 (2.5)	45 (3.0)	43 (2.1)	0.2542
Paid work in the last 6 months				
No	1967 (55.7)	667 (45.0)	1300 (63.4)	
Yes	1566 (44.3)	815 (55.0)	751 (36.6)	<0.0001
Currently on anti-retroviral medications				
No	1266 (35.8)	418 (28.2)	848 (41.3)	
Yes	2271 (64.2)	1066 (71.8)	1205 (58.7)	<0.0001
Time since HIV diagnosis				
<1 year	925 (26.2)	406 (27.4)	519 (25.3)	
1 to 2 years	807 (22.8)	331 (22.3)	476 (23.2)	
2 to <3 years	723 (20.5)	311 (21.0)	412 (20.1)	
≥3 years	1081 (30.6)	434 (29.3)	647 (31.5)	0.2253
CD4 count (mean, SD)	373.4 (237.5)	319.3 (204.6)	412.3 (251.5)	<0.0001

Note: Counts may not add to the total due to missing data.

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Table 2

Patient characteristics associated with categories of reported alcohol use.

	Alcohol category			AOR (95% CI)[a]	
	Nondrinker	**Nonharmful drinker**	**Harmful or likely dependent drinker**	**Any drinking versus none**	**Harmful or likely dependent versus nondrinker or nonharmful drinker**
Country					
Kenya	986 (85.4)	101 (8.8)	68 (5.9)	0.99 (0.63, 1.55)	2.71 (1.47, 5.01)
Namibia	813 (69.0)	275 (23.3)	90 (7.6)	2.84 (1.81, 4.45)	3.76 (2.01, 7.04)
Tanzania	1028 (86.0)	142 (11.9)	26 (2.2)		ref
Gender					
Female	1728 (84.4)	244 (11.9)	76 (3.7)		ref
Male	1099 (74.2)	274 (18.5)	108 (7.3)		2.20 (1.83, 2.63)
Age, mean (SD)	37.3 (8.5)	37.3 (8.3)	35.5 (7.8)		1.00 (0.99, 1.01)
Education					
No school	292 (85.9)	40 (11.8)	8 (2.4)		ref
Primary school	1555 (82.4)	263 (13.9)	69 (3.7)	1.90 (1.30, 2.80)	1.83 (0.78, 4.29)
Secondary school	914 (75.6)	196 (16.2)	99 (8.2)	2.25 (1.51, 3.36)	3.93 (1.68, 9.17)
More than secondary	61 (69.3)	19 (21.6)	8 (9.1)	4.55 (2.43, 8.52)	4.49 (1.46, 13.79)
Any paid work, past 6 months					
No	1604 (81.9)	273 (13.9)	82 (4.2)		ref
Yes	1218 (77.8)	245 (15.7)	102 (6.5)		1.12 (0.94, 1.33)
Time since HIV diagnosis					
< 1 years	747 (80.8)	111 (12.0)	66 (7.1)	0.99 (0.76, 1.30)	2.07(1.32, 3.25)
1 to < 2 years	644 (79.9)	119 (14.8)	43 (5.3)	1.17 (0.90, 1.52)	1.50 (0.93, 2.41)
2 to < 3 years	579 (80.3)	110 (15.3)	32 (4.4)	1.08 (0.83, 1.40)	1.26 (0.76, 2.07)
≥3 years	856 (79.6)	177 (16.5)	43 (4.0)		ref
On ARVs					
No	964 (76.5)	212 (16.8)	85 (6.8)		1.37 (1.13, 1.67)
Yes	1862 (82.1)	306 (13.5)	99 (4.4)		ref
Missed a dose of HIV medication					
Not on HIV medications	270 (64.6)	106 (25.4)	42 (10.1)		1.85 (1.40, 2.44)
Yes	382 (70.5)	105 (19.4)	55 (10.2)		2.04 (1.67, 2.49)

	Alcohol category			AOR (95% CI)[a]	
	Nondrinker	**Nonharmful drinker**	**Harmful or likely dependent drinker**	**Any drinking versus none**	**Harmful or likely dependent versus nondrinker or nonharmful drinker**
No	2174 (84.7)	307 (12.0)	87 (3.4)		ref
CD4 count, mean (SD)	372.5 (237.5)	381.0 (240.0)	368.9 (235.0)		1.00 (1.00, 1.00)
Sex partner type[b]					
Multiple partners	109 (58.9)	38 (20.5)	38 (20.5)	2.38 (1.66, 3.40)	5.21 (3.32, 8.17)
Casual partner only	318 (76.4)	68 (16.4)	30 (7.2)	1.54 (1.15, 2.06)	2.19 (1.38, 3.47)
Main partner only	2392 (81.9)	412 (14.1)	116 (4.0)		ref
Disclosed HIV status to partner[b]					
No	517 (75.5)	105 (15.3)	63 (9.2)		1.26 (0.98, 1.61)
Yes	2297 (81.2)	412 (14.6)	121 (4.3)		ref
Has a partner with unknown HIV status[b]					
No	1863 (81.4)	332 (14.5)	94 (4.1)		ref
Yes	957 (77.9)	182 (14.8)	90 (7.3)		1.13 (0.91, 1.40)
Consistent condom use with partner[b]					
Sometimes/ never	593 (77.7)	108 (14.2)	62 (8.1)		1.49 (1.23, 1.79)
Always	2008 (81.6)	347 (14.1)	106 (4.3)		ref
Sex exchange (past 6 months)[c]					
No	2735 (80.3)	502 (14.7)	169 (5.0)		ref
Yes	87 (75.0)	15 (12.9)	14 (12.1)		1.57 (1.06, 2.32)
Any STI symptoms (past 6 months)[d]					
No	2522 (80.6)	458 (14.6)	148 (4.7)		ref
Yes	302 (76.1)	59 (14.9)	36 (9.1)		1.40 (1.10, 1.77)
Provider discussed alcohol use with participant					
No	623 (85.1)	81 (11.1)	28 (3.8)		ref
Yes	2201 (78.9)	435 (15.6)	155 (5.6)		1.42 (1.14, 1.77)

[a] Odds ratio estimates are adjusted for all other variables in the model.

[b] Participants could name up to five sex partners.

[c] Includes exchanging sex for any of the following: place to stay, money, food, or gifts.

[d] Includes any of the following symptoms: discharge from the penis or vagina, sores in the genital area, or (for female patients only) abdominal pain.

Table 3

Patient characteristics associated with binge drinking.

	N (%) reporting	Univariate regression models		Multiple regression model	
Variable	**Binge drinking**	**OR (95% CI)**	***p* value**	**AOR (95% CI)**	***p* value**
Country					
Kenya	62 (5.4)	2.69 (1.40, 5.15)	<0.0001	2.58 (1.38, 4.83)	<.0001
Namibia	104 (8.8)	4.50 (2.39, 8.47)		4.46 (2.34, 8.52)	
Tanzania	26 (2.2)	ref		ref	
Gender					
Female	80 (3.9)	ref	<0.0001	ref	<.0001
Male	112 (7.6)	1.95 (1.44, 2.62)		2.30 (1.57, 3.38)	
Age (1-year increase)		0.99 (0.98, 1.01)	0.32	1.00 (0.98, 1.01)	0.68
Education					
None	13 (3.8)	ref	<0.0001	ref	0.0002
Primary	71 (3.8)	0.92 (0.50, 1.70)		1.66 (0.72, 3.80)	
Secondary	95 (7.8)	1.49 (0.81, 2.74)		2.76 (1.20, 6.33)	
More than secondary	13 (14.8)	3.82 (1.64, 8.90)		6.67 (2.30, 19.3)	
Any paid work, past 6 months					
No	91 (4.6)	ref	0.52	ref	0.88
Yes	101 (6.5)	1.11 (0.81, 1.53)		0.97 (0.67, 1.40)	
Time since diagnosis					
<1 year	67 (7.3)	2.50 (1.67, 3.75)	0.0001	2.03 (1.22, 3.37)	0.03
1 to <2 years	44 (5.5)	1.78 (1.15, 2.75)		1.66 (1.00, 2.77)	
2 to <3 years	34 (4.7)	1.39 (0.87, 2.20)		1.19 (0.70, 2.05)	
>3 years	47 (4.4)	ref		ref	
On ARVs					
No	93 (7.4)	1.76 (1.31, 2.36)	0.0002	1.28 (0.85, 1.94)	0.24
Yes	99 (4.4)	ref		ref	
Missed a dose of HIV medication					
Not on any HIV medications	50 (11.9)	2.92 (1.95, 4.37)	<0.0001	1.99 (1.14, 3.50)	0.0005
Yes	46 (8.5)	2.28 (1.57, 3.31)		2.11 (1.40, 3.17)	

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Variable	*N* (%) reporting Binge drinking	Univariate regression models OR (95% CI)	*p* value	Multiple regression model AOR (95% CI)	*p* value
No	96 (3.7)	ref		ref	
CD4 (100 point increase)		1.00 (1.00, 1.00)	0.64	1.00 (1.00, 1.00)	1
Sex partner type[a]					
Multiple partners	29 (15.5)	3.96 (2.53, 6.19)	<0.0001	2.72 (1.54, 4.80)	0.002
Casual partner only	28 (6.7)	1.87 (1.21, 2.88)		1.58 (0.91, 2.72)	
Main partner only	135 (4.6)	ref		ref	
Disclosed HIV status to partner[a]					
No	58 (8.5)	2.27 (1.63, 3.17)	<0.0001	1.14 (0.68, 1.89)	0.63
Yes	134 (4.7)	ref		ref	
Has a partner with unknown HIV status[a]					
No	103 (4.5)	ref	<0.0001	ref	0.26
Yes	88 (7.1)	1.82 (1.35, 2.46)		1.29 (0.83, 2.02)	
Inconsistent condom use with partner[a]					
No	106 (4.3)	ref	<0.0001	ref	0.002
Yes	61 (8.0)	2.33 (1.64, 3.23)		1.81 (1.25, 2.70)	
Sex exchange (past 6 months)[b]					
No	181 (5.3)	ref	0.22	ref	0.67
Yes	9 (7.8)	1.57 (0.77, 3.19)		1.20 (0.53, 2.70)	
Any STI symptoms (past 6 months)[c]					
No	160 (5.1)	ref	0.03	ref	0.04
Yes	32 (8.0)	1.59 (1.06, 2.38)		1.64 (1.03, 2.61)	
Provider discussed alcohol use with participant					
No	49 (6.6)	ref	0.04	ref	0.12
Yes	142 (5.1)	0.69 (0.49, 0.98)		0.72 (0.48, 1.09)	

[a] Participants could name up to five sex partners.

[b] Includes exchanging sex for a place to stay, money, food, or gifts.

[c] Includes any of the following symptoms: discharge from the penis or vagina, sores in the genital area, or (for female patients only) abdominal pain.