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Hazardous Alcohol Consumption and Alcohol-related Problems are Associated with Unknown and HIV-Positive status in Fishing Communities in Uganda

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Abstract

In Uganda, alcohol consumption is associated with higher HIV prevalence. However, research is needed to better understand how different patterns of alcohol consumption and alcohol-related problems may drive this association. We examined how hazardous alcohol use and alcohol-related problems such as psychological, physical, and social harms are associated with HIV status in fishing communities in Uganda. 300 (132 male, 168 female) residents of fishing communities in Uganda (75 participants from each of the following occupational groups: fishmongers, alcohol sellers, commercial sex workers (CSW), and fishermen) completed a cross-sectional interviewer-assisted computerized interview. Measures included sociodemographics, HIV testing history. Prior 12-month hazardous alcohol consumption patterns and alcohol-related problems were assessed with the AUDIT and AUDADIS. 19.7%, 57.3%, and 23.0% of the sample reported being HIV positive, being HIV negative from a test within the prior 12 months, and not knowing their HIV status respectively. 18.7% reported the co-occurrence of hazardous alcohol consumption patterns and alcohol-related problems. 7.7% reported either hazardous alcohol consumption patterns or alcohol-related problems. Compared to non-drinkers, those with co-occurring hazardous consumption and alcohol-related problems had greater odds of being HIV positive (adjOR 2.75, 95% CI 1.17-6.43) and of unknown HIV status (adjOR 3.35, 95% CI 1.52-7.42). Reporting only hazardous consumption levels, only alcohol-related problems, or low-risk drinking, did not increase the odds of being HIV positive or of unknown status. Among those not HIV positive, those with co-occurring hazardous consumption and alcohol-related problems had greater odds of never having had an HIV test (adjOR 3.78, 95% CI 1.63-8.68). The co-occurrence of hazardous alcohol use and alcohol related problems appears to be a prominent risk factor for HIV infection, not knowing one's HIV status, and never testing for HIV in this setting.

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Keywords

HIV; alcohol dependence; alcohol use disorders; alcohol-related problems; hazardous alcohol use; sub-Saharan Africa; fishing communities; HIV testing

Introduction

In Ugandan fishing villages HIV prevalence is exceptionally high with 22-40% of the population being HIV-infected (Chang et al., 2016; Kiwanuka et al., 2013; Opio, Muyonga, & Mulumba, 2013). Alcohol use also occurs at high rates in this setting (Asiki et al., 2011; Tumwesigye et al., 2012). Research among fisherfolk has found alcohol consumption to be associated with HIV infection as well as risky sexual behaviors (Asiki, et al., 2011; Kiwanuka et al., 2017; Seeley et al., 2012; Ssekandi et al., 2012). Moreover, qualitative research suggests alcohol is commonly exchanged between fishermen and commercial sex workers (CSWs) and used during sex, heightening risk for unprotected sex while intoxicated (Sileo, Kintu, Chanes-Mora, & Kiene, 2016). The primary pathway in which alcohol is theorized to increase risk for HIV is through its effect on cognitive functioning and judgment, reducing one's ability to use condoms and perception of risk when drinking (Dingle and Oei, 1997; Kiene, Simbayi, Abrams, & Cloete, 2016; Steele and Josephs, 1990).

It is well established in the broader literature in sub-Saharan Africa that individuals who drink in general, and who drink during sex, are more likely to engage in unprotected sex and to be HIV-infected than those who abstain or drink at a lesser rate (Kiene, Lule, Sileo, Silmi, & Wanyenze, 2017; Kiene et al., 2008; Kiene and Subramanian, 2013; Woolf-King and Maisto, 2011). However, there is less research that specifically examines the effect of different patterns of alcohol consumption and associated consequences on risk of HIV infection (Kalichman, Simbayi, Jooste, & Cain, 2007; Simbayi et al., 2007).

Alcohol-related problems encompass negative effects resulting from alcohol consumption including consequences of alcohol consumption such as psychological, social, or physical harms as well as symptoms of an alcohol use disorder including dependence (Babor and Robaina, 2016). Alcohol dependence, in which a person is physically or psychologically dependent on alcohol, is classified as an alcohol use disorder (National Institute of Alcohol Abuse and Alcoholism, 2016), and is defined as a cluster of cognitive, behavioral, and psychological symptoms experienced within the prior 12 months (Babor and Higgins-Biddle, 2001; World Health Organization, 2016). However, alcohol use can cause potential harm with or without the presence of dependence. Hazardous drinking (also referred to as risky, problem, and heavy drinking) is a pattern of alcohol consumption which poses significant risk of harmful consequences to an individual's health as well as negative social consequences (Babor and Higgins-Biddle, 2001). The effect of alcohol on unprotected sex and HIV infection often only exists, or is more pronounced, with hazardous drinking compared to lower risk consumption (Baliunas, Rehm, Irving, & Shuper, 2010; Kiene, et al., 2008; Shuper, Joharchi, Irving, & Rehm, 2009). While hazardous drinking is correlated with alcohol dependence (Caetano, Tam, Greenfield, Cherpitel, & Midanik, 1997; Dawson, 1994), and an association between alcohol dependence and risky sexual behavior has been

reported (Cavazos-Rehg et al., 2007; Krupitsky et al., 2005), studies are needed that further characterize how hazardous alcohol use and, more broadly, alcohol-related problems, independently and jointly are associated with HIV status. Few studies (Tumwesigye et al., 2012) in Ugandan fishing communities in particular have examined alcohol use in relation to HIV outcomes beyond categorical and dichotomous alcohol variables (any/high vs. none/low) (Asiki, et al., 2011; Seeley, et al., 2012; Ssekandi, et al., 2012). Thus, the purpose of the present study was to examine how alcohol consumption patterns and experiencing problems related to alcohol-use such as psychological, physical, and social harms, and symptoms of dependence are associated with HIV status in fishing communities in Uganda. In addition, we explored how these factors are associated with an individual's history of HIV testing among those who did not report being HIV positive, specifically examining associations with having never tested for HIV. We focus on the highest HIV risk groups in these communities: fishermen, fishmongers, alcohol sellers, and CSWs.

Methods

We conducted a cross-sectional study in three fishing communities: Kasenyi, Bugiri, and Bussi Island in Wakiso District, Uganda in collaboration with the Wakiso Integrated Rural Development Association (WIRDA). The district is experiencing population growth increasingly composed of men in search of employment and women engaged in the sale of alcohol and sex. There are approximately 20 fishing villages in Wakiso District, each with a population between about 1,000 and 7,000. The population in these villages is largely comprised of fishermen, fishmongers (individuals who sell fish), commercial sex workers (CSW), alcohol-sellers, food vendors, and shopkeepers. The Ugandan Ministry of Health considers fishermen and CSWs most-at-risk populations for HIV (Uganda Ministry of Health, 2016). In addition, we included alcohol-sellers and fishmongers as high-risk occupational groups based on prior studies demonstrating females in these occupations engage in high-risk sexual behavior, including transactional sex (Lubega et al., 2015; MacPherson et al., 2012; Sileo, Kintu, & Kiene, 2018). Like fishermen, fishmongers are mobile, and have access to large influxes of cash, which may increase their likelihood of engaging in sex with CSWs and sex under the influence of alcohol (Sileo, Kintu, et al., 2016).

Using quota-based snowball sampling, we recruited equal numbers of participants from each of the four high-risk groups (fishermen, fishmongers, alcohol sellers, CSW) at each site. We worked in collaboration with WIRDA, a resident community mobilizer, and the Beach Management Unit (BMU) for community mobilization and participant recruitment. BMUs are an elected group of local leaders representing the interests of the community. In addition, each occupational group (e.g., fishermen, fishmongers, alcohol sellers, CSWs) has a group leader who is chosen by the group members and they represent the interests of their respective occupation in the community. The research staff provided a half-day sensitization seminar to BMU members and group leaders to inform them of the importance of confidentiality in the recruitment process. WIRDA and the community mobilizer worked with the local BMU to identify the occupational group leaders and then the group leaders identified and recruited members of their respective groups. Through word-of-mouth referrals, participants also referred other potential participants from their occupational

group. In addition to being a member of one of the target occupational groups, eligible participants were at least 18 years of age. Potential participants were referred to a research assistant who was seated in a private area within the community (e.g., community center structure).

After obtaining written informed consent, a research assistant conducted a one-on-one interviewer-administered questionnaire interview (<1 hr.) in the local language of Luganda using computer-assisted personal interviewing (CAPI) software. We used CAPI to eliminate errors in following the questionnaire skip patterns. Participants received 10,000 Shillings (~\$4) for completing the questionnaire. Study procedures were approved by institutional review boards at Brown University and the University of Connecticut Health Center and in the U.S. and the National HIV/AIDS Research Committee in Uganda. The study was also approved by the Uganda National Council for Science and Technology.

We collected sociodemographic information, participants' HIV testing history and test results. Those who reported not knowing their HIV status, or having previously tested HIV negative but that their most recent HIV test was more than 1 year ago, were considered to be unknown HIV status.

We assessed alcohol consumption patterns and alcohol-related problems using the 10-item Alcohol Use Disorders Identification test (AUDIT) (Babor, Higgins-Biddle, Saunders, & Monteiro, 2001) and the alcohol module of the Alcohol Use Disorder and Associated Disabilities Interview Schedule (AUDADIS) (Grant, Dawson, & Hasin, 2001). We also asked participants if they had ever met a new sex partner at a drinking establishment (y/n).

The AUDIT assesses potential hazardous alcohol use, dependence symptoms, and harmful alcohol use. A number of studies have found that the AUDIT broadly assesses two factors: (hazardous) consumption and alcohol-related problems (Babor and Robaina, 2016; Peng, Wilsnack, Kristjanson, Benson, & Wilsnack, 2012). The first three items of the AUDIT, which assess typical frequency of alcohol consumption, quantity of alcohol consumed, and frequency of heavy drinking within the prior 12 months, were summed and scores ≥ 4 for men and ≥ 3 for women were classified as a pattern of potentially hazardous drinking consistent with previous studies in sub-Saharan Africa (Asiimwe et al., 2015; Peng, et al., 2012). The remaining seven AUDIT items, which assess alcohol-related problems including: experiencing psychological, physical, or social harms resulting from drinking and symptoms of alcohol dependence, were summed and scores ≥ 3 were classified as reflecting potential alcohol-related problems.

The alcohol module of the AUDADIS assesses the Diagnostic and Statistical Manual of Mental Disorders (DSM-IV) (American Psychiatric Association, 1994) criteria for alcohol use disorders and its reliability has been studied extensively in high, middle, and lower-income country settings (Chatterji et al., 1997; Grant, Harford, Dawson, Chou, & Pickering, 1995; Ustun et al., 1997). The AUDADIS instrument assesses the following seven alcohol-related problems/dependence criteria: a) tolerance, b) desire to reduce alcohol use or unsuccessful attempts to reduce use, c) drinking more or longer than intended, d) bad after effects when alcohol was wearing off, e) having given up important activities to drink, f)

continued drinking despite experiencing physical or psychological problems from drinking, g) spending a lot of time to obtain alcohol, drinking, or recovering from ill effects of drinking. The AUDADIS diagnostic criterion for alcohol-related problems/dependence is meeting three or more of the seven criteria during the prior 12 months (Grant, et al., 2001).

Since we were interested in examining effects of alcohol consumption patterns and alcohol-related problems, we used the following categories derived from the AUDIT and AUDADIS: a) co-occurring hazardous drinking and alcohol-related problems; b) hazardous drinking in the absence of alcohol-related problems; c) alcohol-related problems in the absence of hazardous drinking; d) low-risk alcohol use (reported drinking but did not meet criterion for hazardous alcohol use or alcohol-related problems); and e) alcohol abstinence. The criterion for classification as having potential *hazardous alcohol consumption* patterns was scoring 4 for men and 3 for women on the hazardous drinking sub-scale of the AUDIT. Participants were classified as experiencing potential alcohol-related problems if they met the criteria described above for alcohol-related problems on the AUDIT or the AUDADIS. For analysis, we collapsed categories b and c into one category due to small cell sizes.

Data were analyzed using SPSS version 24. For the primary research question, factors associated with reported HIV status (positive, unknown, negative), we used multinomial logistic modeling to model the relationship between the independent variables (e.g., alcohol consumption/alcohol related problems) and HIV status. HIV negative status was treated as the reference group to which HIV positive and unknown HIV status were each compared. In addition, using logistic regression, we examined factors associated with having never had an HIV test compared to those who reported having ever tested with their most recent results being HIV negative. Since we were interested in how those who never tested differed from those who previously tested with negative results, this analysis excluded participants who reported testing HIV positive (n=59). For this analysis, the low-risk and abstainer categories of the alcohol consumption/alcohol-related problems variable were collapsed because only two participants were in the low-risk category. For each analysis, we first ran bivariate models followed by multivariable models including predictors with a *p* value of 0.20 in bivariate models. We chose the predictors in final models by performing backward selection with a *p* value criterion of 0.10 for removal from the model using a Wald Chi-square test.

Results

Participants were 300 (132 male, 168 female) residents of fishing communities on Lake Victoria in Uganda. We report the sample characteristics and descriptive statistics by occupational group in Table 1.

Factors associated with being HIV positive and of unknown status

As reported in Table 2, in multinomial bivariate logistic models the following variables were identified as factors associated with reporting being HIV positive at a $p < 0.20$ statistical significance level: female gender, being unmarried, older age, less education, occupational group, reporting hazardous levels of alcohol consumption in combination with reporting experiencing alcohol-related problems, and having ever met a sex partner at a drinking establishment. Male gender, lower income, occupational group, reporting hazardous levels

of alcohol consumption in combination with reporting experiencing alcohol-related problems, and having ever met a sex partner at a drinking establishment were associated with having unknown HIV status. In the multinomial multivariable logistic model only the hazardous drinking/alcohol-related problems variable, having met a sex partner at a drinking establishment, and occupational group remained in the model. Specifically, compared to fishmongers, alcohol sellers and CSW had more than three times greater odds of being HIV positive. However, occupational group was not associated with being of unknown HIV status. Compared to those who did not drink, only those who reported hazardous levels of alcohol consumption in combination with reporting experiencing alcohol-related problems, had greater odds of being HIV positive and greater odds of being of unknown HIV status. There was no significant increase in odds of being HIV positive or of unknown status for those with hazardous patterns of alcohol consumption in the absence of alcohol-related problems and vice versa or for those who reported low-risk drinking, however, the cell sizes for these categories were small. Having met a sex partner at a drinking establishment was associated with greater odds of being HIV positive but a lower odds of being of unknown HIV status. However, the latter association was marginally significant ($p < 0.06$). In the multivariable model, gender was no longer statistically significant and we did not find evidence of confounding by gender, thus, we removed gender from the final model.

Factors associated with never vs. ever having tested for HIV among those not HIV positive

As shown in Table 3, in both the bivariate and multivariable models, compared to non-drinkers/low-risk drinkers, those having both hazardous alcohol consumption patterns and reporting alcohol-related problems had nearly four times greater odds of having never tested for HIV among those not known to be HIV positive. There was a marginally significant positive association with male gender, whereas, higher income, was a marginally significant protective factor for having never had an HIV test.

Discussion

This research extends the previous literature linking alcohol consumption to HIV infection and sexual risk in Ugandan fishing communities (Asiki, et al., 2011; Kiwanuka, et al., 2017; Seeley, et al., 2012; Ssekandi, et al., 2012) by examining both patterns of alcohol consumption and alcohol-related problems in these associations. Our study suggests the association between alcohol and HIV risk may be driven by the co-occurrence of potentially hazardous levels of alcohol consumption and alcohol-related problems, such as dependence symptoms and harms from alcohol use, rather than by lower-risk drinking behavior or only either hazardous use or alcohol-related problems. These findings are consistent with the findings on higher AUDIT scores, which indicate increasing severity of potential alcohol use disorder, being associated with high-risk sexual behavior in fishing communities (Tumwesigye, et al., 2012), but extends this literature to associations with HIV status. We also found that having met a new sex partner in an alcohol establishment was independently associated with being HIV positive. This association may be partially explained by the context in which hazardous drinking occurs, such as in alcohol establishments with CSWs or before/during sex (Sileo, Kintu, et al., 2016), which has been shown to drive risk behavior independent of alcohol use quantity or frequency (Kalichman, et al., 2007).

In understanding factors associated with never having tested for HIV among those not reporting that they were HIV positive, we found that the co-occurrence of hazardous alcohol consumption and alcohol-related problems was associated with never testing. Reporting only hazardous consumption or only alcohol problems was not associated with never testing. Our findings extend those of prior studies in sub-Saharan Africa which have shown associations between levels of alcohol consumption and having never tested for HIV (Bengtson, L'Engle, Mwarogo, & King'ola, 2014; Fatch et al., 2013). Given the dramatic increase in access to HIV testing in Uganda in the last decade through provider-initiated HIV testing and other routine testing approaches (Uganda AIDS Commission, 2016), those who have never tested for HIV may be failing to access medical care in general or opting out of routine HIV testing. A number of studies have demonstrated that individuals with alcohol use disorders may have less access to, or avoid, medical care in general (Rehm et al., 2015; Town, Naimi, Mokdad, & Brewer, 2006). It is possible that some of the individuals in our study who had never tested for HIV were living with undiagnosed HIV infection and that the co-occurrence of hazardous consumption and alcohol-related problems could be associated with undiagnosed HIV infection. While our data cannot speak to this, future research should investigate this potential association.

More than a third of individuals aware of their HIV positive status reported co-occurring hazardous alcohol use and alcohol-related problems, which is of great concern since high-risk alcohol use is associated with poor antiretroviral adherence and poor treatment outcomes (Kahler et al., 2016; Sileo, Simbayi, Abrams, Cloete, & Kiene, 2016). Furthermore, we note that rates of hazardous alcohol use and alcohol-related problems were no different between individuals who had never tested for HIV and those who reported being HIV positive (analysis not shown).

This study was cross-sectional and used snowball sampling of specific high-risk populations in fishing communities, limiting both our ability to infer causation as well as the generalizability of the findings to other settings or populations. Another limitation is that because we used community members to refer potential participants, we did not capture data on participation rates other than that all potential participants who presented to the research assistant agreed to participate. There were small numbers of participants in the "low risk" (n=8) and "hazardous drinking only or alcohol problems only" (n=23) drinking categories and thus conclusions about findings for these categories should be interpreted with caution. Furthermore, these small cell sizes may have limited our ability to detect differences between abstainers and individuals in these categories. In addition, under reporting of alcohol consumption and alcohol-related problems may have occurred. The use of biological measures over self-reported for HIV status and alcohol use would have strengthened the study. Studies on the biomarker phosphatidylethanol (PEth), for example, have demonstrated self-reported alcohol use is commonly under-reported among HIV-infected individuals in Uganda (Asiimwe, et al., 2015).

Conclusion

Evidence for the link between the co-occurrence of hazardous alcohol consumption and alcohol-related problems and HIV infection among fisherfolk suggests there is great need for

alcohol reduction interventions for individuals living with HIV in this setting. Furthermore, since individuals with co-occurring hazardous alcohol use and alcohol-related problems are also less likely to know their HIV status, screening and interventions for alcohol use disorders are needed with fisherfolk in general, and might be optimized by expanding HIV testing and services to hard to reach fisherfolk who drink.

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Table 1.

Sample descriptive statistics by occupational group

	Fisherman n=75	Fishmongers n=75	Alcohol sellers n=75	CSWs n=75	Overall N=300
Age (mean)	31.62	34.70	32.86	26.28	31.36
% female	0% (0)	36.0% (27)	88.0% (66)	100% (75)	56.0% (168)
Married	65.3% (49)	74.7% (56)	30.7% (23)	1.3% (1)	43.0% (129)
Education					
Some secondary or >	36.0% (27)	50.7% (38)	26.7% (20)	21.3% (16)	33.7% (101)
Primary or <	64.0% (48)	49.3% (37)	73.3% (55)	78.7% (59)	66.3% (199)
Monthly income					
\$120	42.7% (32)	42.7% (32)	9.3% (7)	28.0% (21)	30.7% (92)
\$61-\$119	25.3% (19)	24.0% (18)	9.3% (7)	29.3% (22)	22.0% (66)
\$25-\$60	17.3% (13)	21.3 (16)	25.3% (19)	21.3% (16)	21.3% (64)
< \$25	14.7% (1)	12% (9)	56.0% (42)	21.3% (16)	26.0% (78)
HIV status					
HIV positive	14.7% (11)	8.0% (6)	26.7% (20)	29.3% (22)	19.7% (59)
HIV negative, tested 1 year ago	56.0% (42)	68.0% (51)	53.3% (40)	54.7% (41)	57.3% (172)
Tested neg. > 1 year ago	12.0% (9)	10.7% (8)	8.0% (6)	6.7% (5)	9.3% (28)
Never tested	17.3% (13)	13.3% (10)	12.0% (9)	9.3% (7)	13.0% (39)
Drinking patterns/consequences					
Hazardous drinking ^a and alcohol problems ^b	20.0% (15)	13.3% (10)	24.0% (18)	17.3% (13)	18.7% (56)
Hazardous drinking ^a only	4.0% (3)	1.3% (1)	5.3% (4)	5.3% (4)	4.0% (12)
Alcohol problems ^b only	5.3% (4)	2.7% (2)	2.7% (2)	4.0% (3)	3.7% (11)
Low-risk drinking ^c	2.7% (2)	1.3% (1)	5.3% (4)	1.3% (1)	2.7% (8)
No drinking	68.0% (51)	84.0% (63)	61.3% (46)	70.7% (53)	71.0% (213)
Ever met new sex partner at a drinking establishment	21.3% (16)	14.7% (11)	29.3% (22)	20.0% (15)	21.3% (64)

Note: CSW: Commercial sex worker;

^aHazardous drinking: a sum score of 4 for men and 3 for women on the first three items (hazardous alcohol use items) of the Alcohol Use Disorders Identification Test (AUDIT);

^balcohol problems: a sum score of 3 on the seven items assessing alcohol dependence and alcohol related problems/harms of the AUDIT or meeting criteria for an alcohol use disorder on the Alcohol Use Disorder and Associated Disabilities Interview Schedule (AUDADIS).

^cLow-risk drinking: not meeting criteria for hazardous drinking or alcohol problems as defined above. Income in Ugandan Shillings was converted to USD equivalents.

Table 2.

Multinomial bivariate and multivariable logistic regression models predicting HIV status (n=300)

	% (n) HIV positive	OR (95% CI)	p value	Adj OR (95% CI)	p value
HIV-positive					
Gender					
Male	12.8% (17)	0.54 (0.28-1.02)	0.056		
Female (ref.)	25.0% (42)				
Marital status					
Married	12.4% (16)	0.46 (0.24-0.88)	0.019		
Unmarried (ref.)	25.1% (43)				
Age					
40	20.8% (10)	1.68 (0.70-4.02)	0.247		
30-39	25.5% (28)	1.99 (1.03-3.83)	0.040		
18-29 (ref.)	14.8% (21)				
Education					
Some secondary or >	13.9% (14)	0.57 (0.29-1.11)	0.099		
Primary or < (ref.)	22.6% (45)				
Monthly income					
\$120	19.6% (18)	0.98 (0.43-2.24)	0.965		
\$61-\$119	18.2% (12)	0.84 (0.34-2.05)	0.698		
\$25-\$60	25.0% (16)	1.37 (0.58-3.25)	0.473		
< \$25 (ref.)	16.7% (13)				
Occupational group					
CSW	29.3% (22)	4.56 (1.69-12.30)	0.003	4.48 (1.63-12.36)	0.003
Alcohol sellers	26.7% (20)	4.25 (1.56-11.57)	0.005	2.92 (1.02-8.72)	0.046
Fishermen	14.7% (11)	2.34 (0.80-6.87)	0.122	2.03 (0.67-6.10)	0.209
Fishmongers (ref.)	8.0% (6)				
Drinking patterns/consequences					
Hazardous drinking ^a and alcohol problems ^b	38.2% (21)	3.27 (1.47-7.29)	0.004	2.75 (1.17-6.43)	0.020
Alcohol problems ^b only or hazardous drinking ^a only	21.7% (5)	1.65 (0.55-5.02)	0.374	1.32 (0.42-4.18)	0.641
Low risk drinking ^c	12.5% (1)	0.79 (0.09-7.02)	0.836	0.59 (0.06-5.55)	0.440
No drinking (ref.)	15.0% (32)				
Ever met new sex partner at a drinking establishment					
Yes	34.4% (22)	2.41 (1.26-4.61)	0.008	1.98(1.01-3.98)	0.048
No (Ref.)	15.7% (37)				
	% (n) unknown HIV status	OR (95% CI)	p value	Adj OR (95% CI)	p value
Unknown HIV status					
Gender					
Male	31.1% (41)	1.94 (1.10-3.42)	0.022		
Female (ref.)	15.5% (26)				

	% (n) HIV positive	OR (95% CI)	p value	Adj OR (95% CI)	p value
Marital status					
Married	27.9% (36)	1.35 (0.77-2.36)	0.298		
Unmarried (ref.)	18.1% (31)				
Age					
40	27.1% (13)	1.39 (0.64-3.03)	0.412		
30-39	20.9% (23)	1.04 (0.56-1.95)	0.903		
18-29 (ref.)	23.2% (33)				
Education					
Some secondary or >	25.7% (26)	1.10 (0.62-1.96)	0.746		
Primary or < (ref.)	21.6% (43)				
Monthly income					
\$120	20.7% (19)	0.52 (0.25-1.06)	0.073		
\$61-\$119	16.7% (11)	0.38 (0.17-0.88)	0.023		
\$25-\$60	20.3% (13)	0.56 (0.25-1.25)	0.156		
< \$25 (ref.)	33.3% (26)				
Occupational group					
CSW	16.0% (12)	0.83 (0.36-1.92)	0.662	0.81 (0.35-1.90)	0.630
Alcohol sellers	20.0% (15)	1.06 (0.48-2.37)	0.882	1.06 (0.47-2.44)	0.883
Fishermen	32.0% (24)	1.70 (0.81-3.56)	0.159	1.66 (0.78-3.54)	0.190
Fishmongers (ref.)	24.0% (18)				
Drinking patterns/consequences					
Hazardous drinking ^a and alcohol problems ^b	32.1% (18)	2.87 (1.36-6.08)	0.006	3.35 (1.52-7.42)	0.003
Alcohol problems ^b only or hazardous drinking ^a only	13.0% (3)	0.72 (0.19-2.66)	0.620	0.78 (0.21-2.95)	0.713
Low risk drinking ^c	25.0% (2)	1.15 (0.22-6.12)	0.871	1.43 (0.25-8.05)	0.688
No drinking (ref.)	21.6% (46)				
Ever met new sex partner at a drinking establishment					
Yes	12.5% (8)	0.53 (0.23-1.22)	0.135	0.42 (0.18-1.01)	0.053
No (Ref.)	25.0% (59)				

Note: The multinomial model compares the outcome categories of HIV positive and unknown HIV status to HIV negative status. Unknown HIV status includes those who reported never having tested or having tested negative > 1 year ago without a more recent HIV test. OR: Odds ratio; Adj OR: Adjusted odds ratio from multivariate model; CI: confidence interval; CSW: Commercial sex worker; CSW;

^aHazardous drinking: a sum score of 4 for men and 3 for women on the first three questions (hazardous alcohol use) of the Alcohol Use Disorders Identification Test (AUDIT);

^balcohol problems: a sum score of 3 on the seven items assessing alcohol dependence and alcohol related problems/harms of the AUDIT or meeting criteria for an alcohol use disorder on the Alcohol Use Disorder and Associated Disabilities Interview Schedule (AUDADIS);

^cLow-risk drinking: not meeting criteria for hazardous drinking or alcohol problems as defined above. Income in Ugandan Shillings was converted to USD equivalents.

Table 3.

Bivariate and multivariable logistic regression models predicting having never had an HIV test among those not reporting being HIV positive (n=241)

	% (n) never tested among those not HIV positive	OR (95% CI)	p value	Adj OR (95% CI)	p value
Gender					
Male	20.9% (24)	1.95 (0.97-3.94)	0.062	2.09 (0.95-4.60)	0.067
Female (ref.)	11.9% (15)				
Marital status					
Married	15.9% (18)	0.97 (0.49-1.92)	0.920		
Unmarried (ref.)	16.4% (21)				
Age					
40	15.8% (6)	0.95 (0.35-2.56)	0.914		
30-39	15.9% (13)	0.95 (0.44-2.04)	0.898		
18-29 (ref.)	16.5% (20)				
Education					
Some secondary or >	17.2% (15)	1.13 (0.56-2.29)	0.737		
Primary or < (ref.)	15.6% (24)				
Monthly income					
\$120	17.6% (13)	0.78 (0.34-1.80)	0.555	0.55 (0.021-1.42)	0.219
\$61-\$119	9.3% (5)	0.37 (0.13-1.11)	0.076	0.32 (0.10-1.01)	0.052
\$25-\$60	14.6% (7)	0.62 (0.23-1.68)	0.350	0.54 (0.19-1.55)	0.256
< \$25 (ref.)	21.5% (14)				
Occupational group					
CSW	13.2% (7)	0.90 (0.32-2.54)	0.839		
Alcohol sellers	16.4% (9)	1.15 (0.43-3.07)	0.774		
Fishermen	20.3% (13)	1.50 (0.61-3.72)	0.377		
Fishmongers (ref.)	14.5% (10)				
Drinking patterns/consequences					
Hazardous drinking and alcohol problems	37.1% (13)	4.14 (1.84-9.29)	0.001	3.78 (1.63-8.68)	0.002
Alcohol problems only or hazardous drinking only	11.1% (2)	0.87 (0.26-3.89)	0.484	0.90 (0.46-4.49)	0.522
Low risk drinking or no drinking (ref.)	12.7% (24)				
Ever met new sex partner at a drinking establishment					
Yes	16.7% (7)	1.04 (0.43-2.56)	0.925		
No (Ref.)	16.1% (32)				

OR: Odds ratio; Adj OR: Adjusted odds ratio from multivariate model; CI: confidence interval; CSW: Commercial sex worker; CSW. Drinking patterns/consequences categories defined in text and in Table 2. Income in Ugandan Shillings converted to USD equivalents. Calculation of percentage never tested excludes from the denominator those known to be HIV positive.