

Association between intoxication at last sexual intercourse and unprotected sex among men and women in Uganda

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Abstract

Introduction: This study examined the association between intoxication at last sexual intercourse and unprotected sex using data derived from a nationally representative survey conducted in Uganda in 2011.

Methodology: Multivariable logistic regression analyses were used to examine the intoxication-unprotected sex association separately among men and women, adjusted for sociodemographic and behavioral covariates that were also examined as moderators of the association.

Results: Among men, intoxication at last sexual intercourse was almost entirely attributed to their own drinking, while women most frequently reported intoxication among their partners only. Among women, there was a significant association between their partner's intoxication and unprotected sex (adjusted odds ratio (AOR) = 1.36; 95% confidence interval (CI) = 1.07-1.73). Intoxication was associated with unprotected sex among unmarried men (AOR = 2.09; 95%; CI = 1.45-2.84), an association not observed among married men.

Conclusions: The results suggest that the alcohol-unprotected sex link should be incorporated within Ugandan National HIV Prevention Strategy. These interventions should be designed to target unmarried men. Programs that combine alcohol reduction and address structural factors that constrain women's ability to negotiate condom use are also needed.

Key words: Intoxication; alcohol; unprotected sex; Africa; HIV; gender differences

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Introduction

Research conducted over the past two decades has consistently shown that alcohol use is related to high-risk sexual behaviors for human immunodeficiency virus (HIV) and other sexually transmitted diseases [1,2]. Several mechanisms have been suggested to explain the relationship including the physiological effects of alcohol on decision making, expectations regarding alcohol intake and condom use, drinking environments, as well as underlying risk-taking personality factors [3,4,5].

The implications for alcohol use as high-risk behavior for HIV acquisition/transmission are greatest in Sub-Saharan Africa (SSA), a region that remains most heavily affected by HIV; 68% of people living with HIV reside in SSA, a region with only 12% of the world's population [6]. Many countries in SSA also have high rates of risky drinking patterns, including drinking until intoxication and heavy episodic drinking

[7]. The prevalence of heavy episodic drinking, defined as consuming 5 or more drinks on one occasion, among drinkers in Africa is estimated to be 25.1%, more than twice the global average (11.5%) [6].

The majority of evidence supporting the association between alcohol use and high-risk sexual behavior is based on two types of study designs, global association studies that correlate various measures of alcohol use and sexual behaviors (*e.g.* frequency of alcohol use and frequency of unprotected sex during the last year) and situational overlap studies that examine alcohol use in sexual situations without reference to any specific sexual incident [8,2]. However, these study designs cannot determine if alcohol use and high risk sexual behavior occurred on the same specific occasion thereby precluding the inference of temporality of the behaviors. This limitation has been addressed by event-level studies in

which alcohol use and high risk sexual behaviors are linked to a specific occasion or sexual act (*e.g.* alcohol use and unprotected sex during last sexual intercourse) to ensure temporal contiguity of alcohol use and the high risk sexual behavior.

Meta-analyses and systematic reviews of event-level studies on alcohol use and unprotected sex have been mixed, with two of the five reviews finding event-level associations [9-13]. Among event-level studies conducted to date, only four have been conducted in SSA. In the first study [14], 384 men and women procuring free condoms in South Africa were followed for five weeks and instructed to keep diaries describing characteristics of each sexual event during the follow-up period (*e.g.* alcohol use, condom use). In this study, alcohol use prior to sexual intercourse was related to a decrease in condom use (OR = 0.33 – 0.67) in some geographic regions. Similarly, Kiene *et al.* conducted daily phone interviews with 82 HIV positive men and women for 42 days to assess daily sexual behavior and alcohol use [15]. Among those participants drawn from five HIV service organizations in South Africa, drinking alcohol prior to sexual intercourse was significantly related to unprotected sex among both men and women (ORs = 2.92 – 3.81). However, requiring individuals to keep daily records of their drinking patterns and sexual intercourse may sensitize them to the potential hazards of combining intoxication with sexual behavior, thereby leading them to infer the hypotheses of the study [12]. That is, sensitization may lead to changes in the participants' intoxication and sexual behavior during the course of the study that would be inconsistent with the true relationship between these behaviors.

In contrast to the majority of event-level studies conducted worldwide, the remaining two event-level studies conducted in SSA were conducted with data derived from general population surveys. Kiene and Subramanian examined the association between intoxication and unprotected sex combining several East African (*i.e.* Kenya, Mozambique, Rwanda and Tanzania) and several Southern African (*i.e.* Lesotho, Swaziland, Zambia and Zimbabwe) countries [16]. Controlling for other risk factors related to unprotected sex (*e.g.* marital status, education, knowledge that condoms prevent HIV), intoxication prior to last sexual intercourse lowered the odds of condom use only among men residing in Southern African countries (OR = 0.84). Among men residing in East African countries, partner type (casual vs. steady) moderated the association: when the sex event was

with a casual partner, intoxication at last sexual intercourse was associated with higher odds of condom use, (OR = 1.74) whereas there was no association between intoxication and unprotected sex when the sex event was with a steady partner. Using data derived from a national survey conducted in Uganda in 2006, Tumwesigye, Wanyenze, & Greenfield also found positive associations between intoxication (OR = 1.71) prior to last sexual intercourse and unprotected sex among men who reported being intoxicated (OR = 1.71) and among women who reported that their partners were intoxicated (OR = 1.55) [17]. Similar to the Kiene and Subramanian study, these associations were significant when other covariates of unprotected sex were controlled for in the analyses [16].

The present study addresses the dearth of event-level studies on intoxication at last sexual intercourse and unprotected sex conducted in Sub-Saharan African countries, especially those conducted in general population samples. Data were derived from a large nationally representative survey conducted in the Sub-Saharan African country of Uganda, the 2011 Uganda AIDS Indicator Survey (AIS) [18]. Analyses were conducted separately among men and women given sex differences in the association demonstrated in prior event-level research [16,12].

Understanding the intoxication-unprotected sex association may be critical in preventing the transmission of HIV in Uganda, a country characterized by high rates of drinking, risk drinking and HIV infection. In 2010, the prevalence of HIV in Uganda was 7.2%, with HIV/AIDS ranked as the leading cause of disability-adjusted life years (DALYs) in that country [19]. During that time, 14.7% of total DALYs and 17.2% of total deaths in Uganda were attributable to HIV/AIDS. Uganda also has some of the highest rates of heavy episodic drinking among men (33.7%) and women (11.2%) in the world [7]. In 2011, Uganda had the second highest per capital alcohol consumption (11.91 liters) in Africa, ranking twenty-eighth in the world [7]. Given the high prevalences of drinking, risk drinking and HIV in Uganda, we hypothesized that intoxication at last sexual intercourse will be associated with unprotected sex among men and women in that country.

Methodology

Sample

The 2011 Uganda AIS is a nationally representative, population-based HIV serological

cross-sectional survey implemented by the Ugandan Ministry of Health and ICF International and described in detail elsewhere [18]. The survey is funded by the government of Uganda and the U.S. Agency for International Development and its co-sponsors through the partnership fund. The Uganda AIS, designed to obtain national estimates of the prevalence of HIV and syphilis infection as well as information on sociodemographic characteristics, program coverage, and knowledge, attitudes and sexual behaviors related to HIV/AIDS, was fielded between February and September, 2011 [20].

The sampling frame for the 2011 Uganda AIS was the 2002 Population Census, consisting of 49,000 census enumeration area (EAs) provided by the Uganda Bureau of Statistics. An EA is a geographic region consisting of approximately 100 households. The AIS utilized a two-stage stratified sampling design. The first stage entailed selecting 470 EAs from the census sampling frame proportional to size (79 in urban areas and 391 in rural areas). In the second stage, 25 households were selected in each EA. All men and women aged 15-to-59 years who were either a permanent resident of the households in the sample or visitors present in the household on the night before the survey were eligible for interviews. Face-to-face interviews were conducted with 9,588 men and 12,153 women, with corresponding response rates of 96.0% and 98.2%. The overall coverage rate for HIV testing was 96.7% for women and 94.2% for men.

The AIS data collection procedures were approved by the ICF International Review Board in addition to the ethics committee in Uganda responsible for approving human subject research. Informed consent was obtained from respondents by interviewers and recorded by interviewers on personal digital assistants (PDAs).

Measures

Unprotected sex, the dependent variable in the current study, was defined as no condom use at last sexual intercourse. The major exposure variable, intoxication prior to last sexual intercourse, was based on the question: “Were you or your partner drunk at that time?” and responses were: respondent only, partner only, both respondent and partner, or neither. In this study, intoxication at last intercourse was operationalized among men as either the respondent reporting being intoxicated or the respondent reporting that both he and his partner were intoxicated. For women, intoxication was operationalized as either the respondent reporting her partner was intoxicated or

that she and her partner were both intoxicated. Intoxication was defined in this way due to the very low frequency of events when women reported only their own intoxication (0.7%) or when men reported only their partner’s intoxication (0.9%). We included only instances when the respondent reported that they or their partners were intoxicated and excluded instances where respondents reported drinking but not being intoxicated.

Sociodemographic covariates were age (in years), marital status (married/cohabitating vs. unmarried, including divorced and separated), education (primary/no education vs. secondary or higher education), and residence (urban vs. rural). Income was operationalized in Uganda as a wealth index, reflecting inequalities in household characteristics, use of health and other services and health outcomes, that is consistent with expenditure and income measures [18]. This measure was originally scored on a 5-point scale from poorest to richest, but was defined in the present study as a 3-level categorical variable (poor/poorest vs. middle vs. rich/richest income status). Other covariates empirically shown [21,22,18] to be associated with unprotected sex included knowledge that the use of condoms helps prevent the spread of HIV (yes vs. no), relationship to most recent sexual partner, steady (spouse/boyfriend not living together/live-in partner) vs. casual (acquaintance/commercial sex worker), and number of current sex partners excluding spouse (none vs. one or more). Transactional sex, defined as sex in exchange for money, goods or services (yes vs. no), was included in analyses for women only. HIV test results (negative vs. positive) were based on Uganda’s HIV testing guidelines. Laboratory testing of all samples was conducted with HIV immunosorbent assays based on Murex HIV 1.2.0 (Abbott, Abbott Park, USA) antigen with Vironstika HIV Uniform II Plus-O antigen used to confirm sero-status.

Statistical Analyses

Bivariate analyses were conducted to assess differences in the distribution of each study variable between men and women. Chi-square tests were conducted for dichotomous and categorical covariates whereas a t-test was used for the continuous covariate age. Bivariate logistic regression analyses were also conducted to estimate odds ratios of the association between each covariate and unprotected sex, unadjusted by other covariates, separately for men and women.

Multivariable logistic regression analyses were also conducted to examine the association between intoxication at last sexual intercourse (exposure variable) and unprotected sex (dependent variable), separately for each gender, controlling for all sociodemographic and behavioral covariates. All covariates were entered into the initial models as main effects (*e.g.* age, education). In addition, all covariates were examined as effect modifiers of the intoxication-unprotected sex association. That is, all two-way interactions between the intoxication exposure variable and each covariate were also entered into the initial models (intoxication * relationship to sexual partner). Using a backward stepwise elimination procedure, all two-way interactions that were not significant were eliminated from the models. The final models for men and women included all main effects and statistically significant two-way interactions with the exposure variable intoxication. Fit of the logistic models was assessed with the Hosmer-Lemeshow's goodness of fit statistics [23]. Good model fit is demonstrated by Chi-square values that are not significant at $p < 0.05$.

All analyses were conducted with weighted data based on pooled weights derived from the proportion of the total 2011 mid-year population of Uganda with valid HIV results. The analytical sample consisted of 6,915 men (72.1% of the entire male sample) and 8,606 women (70.8% of the entire female sample) with available data on exposure, outcome and covariates. The majority of missing values were attributable to excluding respondents who had never had sex from the analyses (men, $n = 1,562$; women, $n = 1,446$).

Results

There was no overall difference between men and women with respect to reported intoxication at last sexual intercourse (22.9% vs. 22.9%). However, intoxication reported by men was attributed largely to their drinking (16.7%) or drinking by both partners (5.3%) whereas women more frequently reported intoxication by their partner (17.9%) or by both partners (4.3%) (Table 1). Men were more likely to be unmarried, have a secondary or higher education, have sex with a non-spousal, non-cohabitating partner in the last year, to have their last sexual intercourse with a casual partner and were older than women relative to their respective reference groups. Women were more likely than men to engage in unprotected sex at last intercourse (90.8% vs. 86.1%), and more likely to be HIV positive and to be unaware that condoms prevent

HIV. Four percent of the women reported engaging in transactional sex at some time in their lives.

Results from the bivariate logistic regression analyses are shown in columns 1 and 2 of Table 2 for men and women, respectively. Among men, the unadjusted odds of unprotected sex increased with age, was greater among respondents who were intoxicated at last sexual intercourse, those with no schooling/primary educations, those classified with middle or poor/poorest income status, those residing in rural areas, and among respondents who were unaware that condoms prevent HIV. The odds of unprotected sex was also lower among men who were unmarried, men testing positive for HIV, and men who had sex with non-spousal, non-cohabitating partner(s) in the last year and whose relationship to their most recent sexual partner was described as casual. The results of the bivariate logistic regression analyses for women mirrored those observed for men. In addition, the odds of unprotected sex were lower among women who engaged in transactional sex at some time during their lives.

The final multivariable logistic models for unprotected sex, retaining all main effects and significant interaction terms, are shown separately for men and women in Table 2 (columns 3 and 4). Hosmer-Lemeshow chi-square statistics indicated good fit of each of these logistic models (men: $\chi^2 = 18.47$, $df = 8$; women: $p < 0.16$; $\chi^2 = 9.05$, $df = 8$; $p < 0.34$). For men, the intoxication-unprotected sex association was moderated by marital status. That is, the odds of unprotected sex were 2.09 (95%; CI = 1.45-2.84) times greater among men who were intoxicated relative to those who were not intoxicated at last sexual intercourse only among unmarried men, an association not found among men who were married or cohabitating. Among men, the odds of unprotected sex also increased by 2% for each year of age, was greater among respondents with no schooling/primary educations, respondents residing in rural areas, those with middle income status or among the poor/poorest and those who were unaware that condoms could prevent HIV transmission. In contrast, the odds of unprotected sex were lower among men who tested positive for HIV, among men who had sex with non-spousal, non-cohabitating partner(s) in the last 12 months, and among men whose last sexual act occurred with a casual partner.

Table 1. Distribution of sociodemographic and behavioral characteristics among men and women in Uganda

Characteristic	Men % (N)	Women % (N)	P-Value
Intoxication at last sexual intercourse			
Respondent only	16.7 (1171)	0.7 (71)	
Partner only	0.9 (61)	17.9 (1498)	< 0.001
Both respondent and partner	5.3 (363)	4.3 (403)	
Neither	77.1 (5320)	77.1 (6634)	
Condom use at last sexual intercourse			
Yes	13.9 (937)	9.2 (802)	< 0.001
No	86.1 (5978)	90.8 (7804)	
Age (average, in years)	34.2 (0.12)*	30.6 (0.11)*	< 0.001
Marital status			
Married/cohabitating	78.7 (5429)	81.3 (7037)	< 0.001
Unmarried	21.3 (1486)	18.3 (1569)	
Education			
Primary/no education	64.4 (4454)	76.6 (6634)	< 0.001
Secondary or higher	35.6 (2461)	23.4 (1972)	
Residence			
Urban	18.8 (1299)	19.3 (1656)	< 0.395
Rural	81.2 (5616)	80.7 (6956)	
Wealth index			
Poor/poorest	43.3 (2713)	36.4 (3338)	< 0.247
Middle	19.7 (1326)	19.0 (1594)	
Rich/richest	37.0 (2876)	44.6 (3674)	
HIV test result			
HIV Positive	7.0 (462)	8.0 (662)	< 0.019
HIV Negative	93.0 (6453)	91.9 (7944)	
Knows condoms prevent HIV			
Yes	86.4 (5958)	80.6 (6796)	< 0.001
No	13.6 (957)	19.4 (1810)	
Sex with non-spousal, non-cohabitating partner(s) (prior year)			
Yes	32.2 (2189)	16.3 (1393)	< 0.001
No	67.8 (4726)	83.7 (7213)	
Relationship to last sexual partner			
Steady	96.7 (6694)	98.7 (8502)	< 0.001
Casual	3.3 (221)	1.3 (104)	
Transactional Sex			
Yes	-	4.1 (332)	
No	-	95.9 (8274)	

Percentages and statistical tests based on weighted figures, Ns based on unweighted figures; * Standard errors in parentheses for continuous variable age

Table 2. Bivariate and multivariable logistic regression analyses of unprotected sex at last sexual intercourse among men and women in Uganda

Characteristic	Men OR (95% CI)	Women OR (95% CI)	Men AOR (95% CI)	Women AOR (95% CI)
Intoxication at last sexual intercourse				
Yes	1.81 (1.50-2.18)	2.05 (1.63–2.49)	*	1.36 (1.07–1.73)
No (Ref.)				
Age (average, in years)	1.21 (1.14-1.38)	1.28 (1.19-1.43)	1.02 (1.01–1.04)	1.03 (1.02–1.04)
Marital status				
Unmarried	0.10 (0.08-0.11)	0.15 (0.12-0.18)	*	0.30 (0.23–0.39)
Married/cohabitating (Ref.)				
Education				
Primary/no education	2.57 (2.24-2.95)	3.37 (2.90-3.92)	1.64 (1.38–1.94)	1.63 (1.35–1.97)
Secondary or higher (Ref.)				
Residence				
Rural	2.80 (2.41-3.24)	2.70 (2.31-3.16)	1.41 (1.15–1.72)	1.17 (0.95–1.43)
Urban (Ref.)				
Wealth index				
Middle vs. rich/richest (Ref.)	2.27 (1.87-2.78)	2.50 (2.00-3.13)	1.60 (1.25-2.04)	1.42 (1.09–1.85)
Poor/poorest vs. rich/richest (Ref.)	3.01 (2.60-3.62)	3.00 (2.49-3.54)	1.64 (1.31–2.03)	1.55 (1.23–1.95)
HIV test result				
HIV Positive	0.47 (0.38-0.59)	0.37 (0.29-0.45)	0.26 (0.20–0.34)	0.37 (0.29–0.46)
HIV Negative (Ref.)				
Knows condoms prevent HIV				
No	2.35 (1.82-3.05)	2.29 (1.80-2.91)	1.70 (1.27–2.28)	1.31 (1.01–1.71)
Yes (Ref.)				
Sex with non-spousal, non-cohabitating partner(s) (prior year)				
Yes	0.10 (0.08-0.12)	0.10 (0.08-0.11)	0.31 (0.25–0.39)	0.35 (0.26–0.45)
No (Ref.)				
Relationship to last sexual partner				
Casual	0.18 (0.14-0.24)	0.33 (0.21-0.51)	0.61 (0.45–0.82)	1.22 (0.74–2.00)
Steady (Ref.)				
Transactional sex				
Yes	-	0.61 (0.45-0.84)	-	1.37 (0.97–1.96)
No (Ref.)				
Intoxication * married/cohabitating	-	-	0.98 (0.75–1.29)	-
Intoxication * unmarried	-	-	2.09 (1.45–2.84)	-

Bolded bivariate unadjusted odds ratios (ORs) and multivariable adjusted odds ratios (AORs) are significant at $p < 0.001$ level; CI = confidence interval; Ref= reference group; * Main effects for intoxication and marital status are not interpretable in the presence of their interaction

Among women, intoxication was positively and significantly associated with unprotected sex (AOR = 1.36; 95% CI = 1.07-1.73) and no covariate was observed to moderate the intoxication-unprotected sex association. That is, the odds of unprotected sex were 1.36 times greater among women whose partners (or both partners) were intoxicated at last sexual intercourse. The remaining results of the multivariable model for women were similar to that of men with the following exceptions. The odds of unprotected sex were lower among unmarried women and greater among women who had engaged in transactional sex although this association was of marginal significance ($p < 0.077$). However, the low prevalence of reported transactional sex among women (4.1%) may be responsible for failure to find that it moderated the intoxication-unprotected sex association. In contrast to the results observed for men, residence (urban vs. rural) and relationship to last sexual partner (casual vs. steady) were not associated with unprotected sex among women.

Discussion

This event-level analysis showed that intoxication at last sexual intercourse was associated with an increased risk of unprotected sexual intercourse, even after adjusting for sociodemographic and behavioral factors empirically shown to be associated with unprotected sex. Although this effect was observed for men and women, gender differences were noted. Among women, the positive association between intoxication and unprotected sex was driven mostly by an intoxicated partner. This association was not moderated by any sociodemographic or behavioral characteristic examined in this study. Among men, the intoxication-unprotected sex association was moderated by marital status. Specifically, the association between intoxication at last sexual intercourse and unprotected sex was concentrated among unmarried men. No association was observed among men who were married or cohabitating. Unlike women, the intoxication-unprotected sex association among men was driven by their own intoxication. The finding that intoxication prior to last sexual intercourse increased the likelihood of unprotected sex among unmarried men was not unexpected since unmarried marital status has been consistently associated with both unprotected sex and HIV infection in numerous studies conducted in Uganda [24,25] although moderation of the intoxication-unprotected sex association by marital status has not previously been observed.

Event-level associations between intoxication and unprotected sex observed in this study are consistent with results found by Tumwesigye, Wanyenze, & Greenfield [17] among men and women in Uganda in 2006 as well as among men in Southern African countries in the Kiene and Subramanian study [16]. However, in contrast to the results of this study, Kiene and Subramanian did not find an association between intoxication at last sexual intercourse and unprotected sex among women in Eastern or Southern African countries [16]. In the present study, the intoxication-unprotected sex association was moderated by marital status among men. Kiene and Subramanian found that partner type moderated the association among men in the East African countries: intoxication at last sexual intercourse with a casual partner increased the likelihood of condom use, an association not found among men whose last sexual intercourse was with a steady partner. These discrepancies in results may, in large part, be due to combining countries into regions in the Kiene and Subramanian study, thereby obscuring important country-level specific associations between intoxication and unprotected sex [16].

The observation that the intoxication-unprotected sex association among women was largely driven by male partner's intoxication is consistent with a model of male control of sexuality, especially in Southern and Western Africa. This model supports a conclusion that structural factors, such as social, economic, cultural, political and gender-power dynamics all constrain women's ability to introduce condoms into their sexual relationships [26,27,28]. Gender disparities in negotiating power with relationships may leave women less able to refuse sex or insist on condom use.

Over the last 20 years, Uganda has implemented various HIV prevention and intervention approaches through its National HIV Prevention Strategy (NPS) [20]. In 2011, the NPS consisted of several structural, behavioral and biological interventions that promote abstinence, being faithful among uninfected partners, and consistent condom use, with the ultimate goal of reducing the incidence of HIV. The strong intoxication-unprotected sex associations found in this study underscore the need to develop new protocols to standardize prevention messages emphasizing the link between intoxication and unprotected sex and its relationship to HIV/AIDS. Provisions should also be made to help strengthen community systems and civil society organizations in delivering these prevention messages and outreach.

That intoxication was strongly associated with unprotected sex in this study among both men and women also highlights the need to integrate alcohol harm reduction programs within multicomponent HIV prevention strategies in Uganda. More effort will also be needed to protect women from having unprotected sex with intoxicated partners. Programs that combine alcohol reduction and address structural factors that constrain women's ability to negotiate condom use are needed to reduce unprotected sexual intercourse and risk of HIV infection, particularly in countries like Uganda, characterized by heavy consumption, high HIV prevalence and gender inequalities [29].

Multilevel strategies are required to control intoxication and other hazardous drinking and consequent unprotected sexual relations in Uganda. These include several interventions that have shown promise in SSA countries: (1) brief screening and intervention for hazardous drinking in HIV health services; (2) evidence-based interventions in schools, churches and other sociocultural institutions, and (3) development of clear public health messages that highlight the role of hazardous drinking and risky sexual behaviors in the transmission of HIV infection [30;31]. Interventions are also needed in high-risk drinking venues (e.g. bars) to reduce alcohol-related sexual risk behaviors among unmarried men, and especially among women whose risk of HIV is elevated in such venues as the result of their partner's drinking. Importantly, interventions should be monitored and evaluated to assess the impact of alcohol reduction on specific sexual encounters and within specific venues as well as for their impact on HIV incidence.

This study has several strengths including its use of national general population data, event-level association methodology, high response rates supporting generalizability of the findings, and the assessment of variables that moderate the intoxication-unprotected sex association. Limitations are noted. This was a cross-sectional study and causal relationships cannot be entirely inferred. However, the event-level design of this study does satisfy the temporality criteria for causality not present in global association and situational studies focusing on alcohol use and unprotected sex. This study was based on self-report measures of high risk drinking and sexual behaviors that are subject to recall and social desirability bias. Approximately 11.5% of men and 17.3% of women had missing values on one or more study variables (excluding those who had never had sexual relations) and were excluded from the analyses.

As a result, this study was subjected to nonresponse bias. Future research should improve upon the validity of those factors that can be measured more objectively. For example, future work in this area would benefit from explicitly defining intoxication in survey instruments. Further, more detailed measure of hazardous drinking patterns other than intoxication would also have been useful (e.g. quantity and frequency of alcohol use at last sexual intercourse) to establish more definitively a dose-response relationship between hazardous drinking and unprotected sex.

In summary, the results of this study strongly suggest that the alcohol-unprotected sex link be clearly articulated within Ugandan National Strategies for HIV Prevention [32]. Alcohol reduction interventions will likely have major benefits to HIV prevention strategies beyond those focused on hazardous drinking and unprotected sex since hazardous drinking patterns have also been shown to be risk factors for reduced HIV testing, entry into care and retention in care prior to initiating ART, decreased ART adherence, and, increased susceptibility to HIV and accelerated progression of the disease [33]. Culturally adapted multilevel alcohol-HIV risk reduction interventions tailored specifically for Uganda should remain a public health priority.

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