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Intoxication at Last Sexual Intercourse and Unprotected Sex among HIV Positive and Negative Individuals in Uganda: An Event-Level Analysis

Bradley T. Kerridge¹, Phu Tran², and Deborah S. Hasin^{1,3,4}

Bradley T. Kerridge: bradleykerridge@gmail.com

¹Department of Epidemiology, Mailman School of Public Health, Columbia University, New York, New York, 10032

²St. George's University, SGU Caribbean Medical School, True Blue, Grenada, West Indies

³Department of Psychiatry, College of Physicians and Surgeons, Columbia University, New York, New York, 10032

⁴Mailman School of Public Health, Department of Epidemiology and College of Physician and Surgeons, Columbia University and. New York State Psychiatric Institute, 1051 Riverside Drive, Box 123, New York, New York 10032

Abstract

This study examined, for the first time, the association between intoxication at last sexual intercourse and unprotected sex separately among HIV-positive and HIV-negative individuals. Data were derived from a nationally-representative survey of Uganda in 2011. Multivariable logistic regression analyses of the intoxication-unprotected sex association included adjustment for sociodemographic and behavioral covariates that were also examined as moderators of the association. Among HIV-positive individuals, intoxication was associated with unprotected sex, whereas among HIV-negative individuals, the intoxication-unprotected sex association was moderated by knowledge that condoms prevent HIV transmission. The odds of unprotected sex was 2.67 times greater among HIV-negative individuals who were unaware that condoms prevent HIV, an association not observed among those who possessed such knowledge. The results suggest that the intoxication-unprotected sex link be incorporated within Ugandan National HIV Prevention Strategies among HIV-positive and HIV-negative individuals. HIV-negative individuals who are unaware that condoms prevent HIV should be targeted for interventions focusing on increasing HIV transmission knowledge especially on the role of condoms in preventing the disease. The latter interventions should also identify those sociocultural and political beliefs about condom use that may serve as barriers to consistent condom use.

Correspondence to: Bradley T. Kerridge, bradleykerridge@gmail.com.

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None.

Keywords

Intoxication; alcohol; unprotected sex; Africa; HIV, condom knowledge

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Introduction

Research conducted over the past four decades has generally shown that alcohol use is related to high-risk sexual behaviors for human immunodeficiency virus (HIV) and other sexually transmitted diseases [1, 2]. 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 [3]. Many countries in SSA also have high rates of risky drinking patterns, including drinking until intoxication and heavy episodic drinking [4]. The most current prevalence of heavy episodic drinking, defined as consuming 5 or more drinks on one occasion, among drinkers in Africa was estimated to be 25.1% in 2005, more than twice the global average (11.5%) [4].

The majority of evidence supporting the association between alcohol use and high risk sexual behavior is based on two types of study design, global association studies that correlate various measures of alcohol use and high risk sexual behaviors (e.g. frequency of alcohol use and frequency of unprotected sex during a specific time frame) and situational overlap studies that examine alcohol use in sexual situations without reference to any specific sexual incident [2, 5]. 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 reviews of event-level studies on alcohol and high-risk sexual behaviors have been inconclusive. Earlier reviews of event-level research [6–9] found support for the alcohol-unprotected sex association in studies that examined first-time sexual intercourse among adolescents. Among adults, however, alcohol was generally not associated with unprotected sex when new or most recent sexual intercourse was examined. Similar reviews of event-level studies conducted among men who have sex with men (MSM) [10, 11] have found inconclusive results, with significant findings observed for studies using specific measures of binge drinking (e.g. defined as drinking 4-to-6 drinks or more prior to sexual intercourse) but not other measures of alcohol use. These earlier meta-analyses and reviews included studies largely conducted in the US, Europe and Canada [6–11].

Among event-level studies conducted to date, only four have been conducted in SSA [13–16]. In the first study [13], 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). Similarly, Kiene et al. [14] conducted daily phone interviews with 82 HIV positive men and women for 42-days to assess daily sexual behavior and alcohol use. In both of these samples 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.

In contrast to the majority of event-level research conducted worldwide to date, the remaining two event-level studies conducted in SSA used data derived from general population surveys. Using data derived from a national survey conducted in Uganda in 2006, Tumwesigye et al. [15] also found positive associations between intoxication prior to last sexual intercourse and unprotected sex among men who reported being intoxicated and among women who reported that their partners were intoxicated. Kiene and Subramanian [16] 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. Intoxication prior to last sexual intercourse was associated with unprotected sex only among men residing in Southern African countries. Among men residing in East African countries, partner type (casual vs. steady) moderated this association: when the sex event was with a casual partner, intoxication at last sexual intercourse was associated with a lower odds of unprotected sex, whereas there was no association between intoxication and unprotected sex when the sex event was with a steady partner.

Although the Tumwesigye et al. [15] and Kiene and Subramanian [16] studies both controlled for covariates that might confound the intoxication-unprotected sex association (e.g. partner type, age), the latter study was one of only a very few event-level studies [17–23] to test these covariates as moderators of the relationship. Identification of moderators of the intoxication-unprotected sex association is critical to tailoring interventions to specific subpopulations in HIV prevention research [24].

In addition to the dearth of event-level research on alcohol use and unprotected sex conducted in general populations in SSA, especially those that seek to identify moderators of the association, event-level research has rarely been conducted among people living with HIV/AIDS (PLWHAs). Of the four studies conducted among PLWHAs recently reviewed in meta-analyses of this literature [12, 25], two were conducted in the US [26, 27] and two were conducted in South Africa [14, 28]. Each of these studies found support for the alcohol-unprotected sex association. These studies both had small sample sizes ($n < 200$) and recruited participants from HIV/AIDS service organizations. To our knowledge, only one event-level study [29] compared HIV-negative and HIV-positive individuals. In this study of 1,719 men recruited from five Veteran Affairs Medical Centers in the US, intoxication at most recent sexual intercourse was associated with unprotected sexual intercourse among HIV-positive, but not HIV-negative men.

The present study was designed to fill gaps in the event-level literature on alcohol use and unprotected sex. The intoxication at last sexual intercourse and unprotected sex association was examined in the Sub-Saharan country of Uganda using a large national representative survey, the 2011 Uganda AIDS Indicator Survey (AIS) [30]. Multivariable analyses of the intoxication-unprotected sex were conducted separately among HIV-negative and HIV-positive individuals, adjusting for covariates empirically shown to confound [31–36] and/or moderate [17–23] the relationship. Understanding the intoxication-unprotected sex

association among HIV-negative individuals is important for preventing the acquisition of new HIV infections [29, 37]. Knowledge of the association is equally critical among PLWHAs because unprotected sex can transmit the virus to previously uninfected individuals, increase infections with other strains of the virus that may seriously compromise the effectiveness of antiretroviral therapy and shorten life expectancy [29, 37].

Understanding the intoxication-unprotected sex association and those factors that may moderate the relationship is also of great relevance in Uganda, a Sub-Saharan African country characterized by high rates of drinking and 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) [38]. During this 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 [4]. In 2011, Uganda had the second highest per capital alcohol consumption (11.91 liters) in Africa, ranking 28th in the world [4, 15, 39]. Given the high prevalences of HIV, drinking and risk drinking in Uganda, we hypothesized that intoxication at last sexual intercourse would be associated with unprotected sex among HIV-positive and HIV-negative individuals in that country.

Methods

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 [30]. The survey was funded by the government of Uganda and the U.S. Agency for International Development and its co-sponsors, including the World Health Organization, U.S. President's Emergency Fund for AIDS Relief (PEPFAR), the United Kingdom Department for International Development, the Danish International Development Agency and U.S. Centers for Disease Control..

The 2011 Uganda AIS was 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.

The sampling frame for the 2011 Uganda AIS was the 2002 Population Census, consisting of 49,000 census enumeration areas (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 sample 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, for a total of 11,750 households. All men and women aged 15-to-59 years who were either permanent residents 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%.

A total of 250 experienced interviewers recruited from the local community conducted the AIS fieldwork, 120 supervisors/interviewers, 80 laboratory technicians and 50 HIV counselors. Trainees participated in a 5-day intensive training session covering information on survey design and objectives, questionnaire administration, use of personal digital assistants (PDAs) and administrative issues. Interviewers and counselors were trained in groups based on their local languages. The AIS data collection procedures were approved by the IFC International Review Board in addition to the Ethics Committee in Uganda responsible for approving human subjects research. Respondents were informed of the voluntary nature of the survey and its purpose and objectives. Informed consent was obtained from participants by interviewers and documented on 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 as the respondent and/or their partner being intoxicated.

Sociodemographic covariates included sex, 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 defined by a wealth index originally scored on a 5-point scale from poorest to richest [30]. This index reflected inequalities in household characteristics, use of health and other services and health outcomes empirically shown to be consistent with standard expenditure and income measures [30]. In this study, the wealth index was operationalized as a 3-level categorical variable (poor/poorest vs. middle vs. rich/richest income status). Behavioral covariates empirically shown to be confounders [31–36] and/or moderators [17–23] of the intoxication-unprotected sex association included relationship to most recent sexual partner, steady (spouse/boyfriend not living together/live-in partner) vs. casual (acquaintance/commercial sex worker), age at first sexual intercourse (< 15 and ≥ 15), and number of current sex partners excluding spouse (none vs. one or more). HIV status was 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) antigen with Vironstika HIV Uniform II Plus-O antigen used to confirm sero-status. The results of these laboratory tests were used to classify individuals as HIV-positive.

Statistical Analyses

Bivariate analyses were conducted to assess differences in the distribution of each study variable between HIV-positive and HIV-negative individuals. 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 conducted to estimate odds ratios of the association between each covariate and unprotected sex, unadjusted by other covariates, separately for HIV-positive and HIV-negative individuals.

Multivariate logistic regression models were conducted to determine the association between intoxication at last sexual intercourse and unprotected sex, adjusted for the confounding effects of sociodemographic and behavioral covariates. In this model, intoxication was classified as the major or exposure variable of interest and all two-way interactions between intoxication and each covariate (e.g. intoxication * sex) tested for effect modification.

The modeling process consisted of two steps. In the first step, a backwards-stepwise regression procedure was used to eliminate all nonsignificant interaction terms ($p > 0.05$). Stage 2 entailed the identification of confounders, or, alternatively, the detection of nonconfounders from the reduced model resulting from Stage 1 (i.e. a model containing all main effects and significant two-way interactions). In the case of no interaction, the elimination of nonconfounders consisted of removing each main effect sequentially (e.g. sex) to produce an even more reduced model. If the main effect coefficient of the exposure variable intoxication did not materially change when a main covariate effect term was eliminated, the use of the reduced model without that main effect term would lead to a gain in precision. On the other hand, if the exposure-involved coefficient did show substantial change ($\pm 5\%$) upon refitting, the main effect term was retained in the model as a confounder. In the presence of interaction, main effect terms involved in the model as modifiers were not candidates for deletion regardless of whether they were statistically significant or not. In the situation of interaction, the main effects exposure coefficient and all exposure-related cross-product coefficients were monitored for change upon refitting to determine if actual confounders would be retained in the model. Fit of the logistic models was assessed with the Hosmer-Lemeshow's goodness of fit statistics [40]. 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 14,350 HIV-negative and 1,118 HIV-positive individuals with available data on exposure, outcome and covariates. The majority of missing values resulted from to excluding respondents who had never had sex from the analyses ($n=3008$; 91.2% HIV-negative, 5.8% HIV-positive) and HIV-negative in this study.

Results

HIV-negative individuals were less likely to report intoxication before last sexual intercourse than HIV-positive individuals (22.3% vs. 29.9%, $\chi^2 = 35.8$ $p < 0.001$). HIV-negative respondents, 7.8% reported their own intoxication only, 9.9% reported intoxication only among their partner's and 4.6% reported intoxication among both partners (Table 1). Among HIV-positive individuals, 9.7% reported their own intoxication only, 12.9% reported intoxication among their partners only, while 7.3% reported intoxication among both partners. Relative to HIV-positive respondents, HIV-negative respondents were significantly more likely to engage in unprotected sex at last intercourse, to be married, have a secondary or higher education, reside in a rural area, be classified with middle or rich/richest income status, to be unaware that condoms prevent HIV transmission, and to have sex with non-spousal, non-cohabitating partner(s) in the past year. In contrast, HIV-positive respondents

were younger and more likely to be male and to have their first sexual intercourse prior to age 15.

Results from the bivariate logistic regression analyses are shown in Table 2. Among HIV-negative respondents, the unadjusted odds of unprotected sex was 2.18 times greater when at least one partner was intoxicated. Relative to respondents in the respective reference groups, the odds of unprotected sex was also greater among HIV-negative respondents with no schooling/primary education, those who resided in rural areas, and those classified with middle or poor/poorest income status and among those who were unaware that condoms prevent HIV transmission. In contrast, the odds of unprotected sex were lower among males, the unmarried, those who had sex with non-spousal, non-cohabitating partner(s) in the past year, and those whose last sexual encounter was with a casual partner. The result of the bivariate logistic regression analysis for HIV-positive respondents mirrored those among HIV-negative respondents with the exception that gender and age were not associated with unprotected sex.

The final reduced multivariable logistic regression models, retaining all significant two-way interaction terms and main effects that qualified as confounders of the intoxication-unprotected sex association, are shown in Table 3 for HIV-negative and HIV-positive respondents. Hosmer-Lemeshow chi-square statistics indicated good fit of each of these logistic models (HIV-negative: $\chi^2 = 14.50$, $df = 8$, $p < 0.07$; HIV-positive: $\chi^2 = 17.3$, $p < 0.14$).

All covariates of the logistic model conducted among HIV-negative respondents were retained in the model as confounders of the intoxication-unprotected sex association. Among HIV-negative respondents, the intoxication-unprotected sex association was moderated by knowledge that condoms prevent HIV. The odds of unprotected sex was 2.67 (95% CI = 1.30 – 5.48) times greater among HIV-negative respondents who were intoxicated relative to those who were not intoxicated at last sexual intercourse only among respondents who were unaware that condoms prevent HIV, an association not found among HIV-negative respondents who were aware that condoms prevent HIV (AOR = 1.21; 95% CI = 1.00 – 1.46).

The odds of unprotected sex increased with age and was greater among respondents with primary/no education, those residing in rural areas, those classified with middle or poor/poorest income status, and those whose first sexual intercourse occurred prior to age 15 (compared with their respective reference groups). In contrast, male sex, sexual intercourse with a non-spousal, and non-cohabitating partner, and having last intercourse with a casual partner decreased the odds of unprotected sex.

Among HIV-positive respondents, the covariates gender, residence, age at first sexual intercourse and knowledge that condoms prevent HIV were identified as nonconfounders of the intoxication-unprotected sex association and removed from the final model. Among HIV-positive respondents, intoxication was positively associated with unprotected sex (OR = 1.45; 95% CI = 1.04 – 2.04), and no covariate was shown to moderate the intoxication-unprotected sex association. The odds of unprotected sex was greater among HIV-positive

respondents with no/primary education, and those classified with middle or poor/poorest income status relative to their respective reference groups. In contrast, the odds of unprotected sex decreased with age and was lower among the unmarried and those who had sexual intercourse with non-spousal, non-cohabitating partner(s) in the past year.

Discussion

This event-level study found that intoxication at last sexual intercourse was associated with unprotected sex among HIV-negative individuals and PLWHAs. Among HIV-negative individuals, the intoxication-unprotected sex association was moderated by knowledge that condoms prevent HIV. That is, the association was concentrated among HIV-negative individuals who were unaware that condoms could prevent HIV, an association not observed among those who possessed such knowledge.

Associations between intoxication and unprotected sex observed in this study are consistent with results found in other event-level studies conducted in SSA [13, 15, 16] and the majority of event-level research conducted among PLWHAs [26–29]. However, the results are at variance with those of Cook et al. [29] who found intoxication before last sexual intercourse was significantly associated with unprotected sex among HIV-positive but not HIV-negative individuals. This discrepancy may, in large part, be due to age, gender, methodological or cultural differences between this nationally representative general population survey conducted among men and women in Uganda, ages 15–59 years, and the Cook et al. study [29] conducted among 1,719 older males (mean age 51 years) recruited from Veteran Administration Medical Centers in the US.

Although prior research has examined the association between HIV knowledge and a variety of sexual risk behaviors [31], to our knowledge, only one event-level study has examined whether the HIV knowledge construct interacts with situational variables such as intoxication prior to sexual intercourse. In contrast to the present study, Mustanski et al. [20] did not observe a moderating effect of HIV knowledge on the intoxication-unprotected sex association in a US community sample of adolescents. This study also did not find that casual or new partner relationship or age moderated the intoxication-unprotected sex association observed in other event-level studies [16–19, 21, 23] conducted largely among MSM who were not differentiated in terms of HIV status.

Although condom use in SSA remains low, cross-country analyses of Demographic Health Survey data [41–43] shows increases over the last several years in condom use at last sexual intercourse, especially among women and young adults. Numerous sociocultural and behavioral factors influence condom use in SSA including insufficient and absent knowledge about the HIV prophylactic effects of condoms. Several well-documented beliefs and misinterpretations about HIV transmission and condom use among largely HIV-negative individuals in SSA countries [44–47] may be, in part, responsible for the intoxication-unprotected sex association observed in this study. These beliefs can be classified as fatalistic (e.g. only God can determine whether HIV infection results from a sexual encounter), instrumental efficacy (e.g. condoms do not protect against HIV because they slip, tear or allow the infectious agent to pass through) or historically political (e.g.

condoms are associated with Western country's twentieth century campaigns to depopulate Africa) [48]. Taken together, these beliefs may present a major impediment to condom use among HIV-negative individuals whose lack of knowledge or beliefs that condoms can prevent HIV places them at especially high-risk of HIV infection. In contrast, HIV-positive individuals are generally aware of the means by which they acquired HIV, explaining, in part, why we observed no moderating effect of AIDS knowledge on the intoxication-unprotected sex association among these individuals.

Reasons underlying the association between intoxication and unprotected sex include alcohol's role in lowering inhibitions. Strong sociocultural norms dictating PLWHAs motivation to use condoms to prevent HIV transmission to their partners may be considerably weakened under conditions of intoxication [32, 35]. Intoxication prior to sexual intercourse may also reduce, albeit temporarily, the anger, anxiety and depression that is common among PLWHAs [29, 49]. It is also possible that intoxication may reduce PLWHA's motivation to disclose their HIV status to their partners, which could result in decreased condom use to avoid refusals to have sexual intercourse, loss of privacy and stigmatization [25, 29]. PLWHAs may also have misconceptions concerning the role of treatment for the disease in eliminating their risk of HIV transmission. Intoxication can therefore provide an escape from negative affect and the powerful constraints, motivations and inhibitions that typically govern PLWHAs decisions to use condoms.

This study sought to examine the intoxication-unprotected sex association among HIV-negative and HIV-positive individuals, accounting for the effects of various empirically documented covariates and previously established moderators of the association. The nature of the observed associations among individuals defined in terms of HIV status has important implications for targeted HIV prevention in Uganda. Among PLWHAs, intoxication had a direct effect on unprotected sex, suggesting prevention interventions that reduce intoxication and other hazardous drinking patterns and unprotected sexual intercourse among this subgroup of the population. Integrating alcohol harm reduction programs within multicomponent HIV prevention strategies among PLWHAs will be important in this era of highly active antiretroviral therapy (HAART) in which PLWHAs feel better, live longer and may feel protected from sexually transmitting the infection [50]. Increasing numbers of PLWHAs are entering clinical care in Uganda, affording the opportunity to deliver HIV prevention interventions highlighting the role of intoxication and risky sexual behaviors in HIV transmission. In addition, screening and prevention efforts targeted toward individuals at most risk of HIV infection within situations of intoxication could have the greatest impact on potentially reducing new HIV infections and the exacerbation of existing infections.

This study found that the intoxication-unprotected sex association was concentrated among HIV-negative individuals who were unaware that condom use could prevent HIV infection. This finding suggests a dual-programmed intervention approach among HIV-negative individuals in Uganda may be appropriate. Alcohol harm reduction programs should target HIV-negative individuals who are unaware that condoms could prevent HIV or, alternatively, those who hold sociocultural, religious or political views that create barriers to condom use. Interventions should be developed among these specific HIV-negative individuals to increase knowledge of HIV and condom use in such a way that reduces

unprotected sex during intoxication. Alcohol harm reduction programs should also be introduced to reduce risky sexual behaviors, including unprotected sex.

This study has several strengths, including the use of data derived from a national general population survey, event-level study methodology, and high response rate supporting generalizability of the findings. The intoxication-unprotected sex association was importantly examined among HIV-negative individuals and PLWHAs and assessed covariates that potentially moderated the association for the purpose of designing prevention interventions to target at most-risk of HIV infection within situations of intoxication. 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 intoxication and unprotected sex. Although the study was based on a representative sample of Uganda, results cannot be generalized to other SSA countries with characteristically different HIV epidemics. This study was also of most relevance to individuals engaging in heterosexual relations with steady partners and cannot be generalized to MSM and/or those having sex with casual partners. This study was also based on self-report measures of intoxication and unprotected sex, measures sensitive to recall and social desirability bias. Future research should improve on the reliability of those factors that can be measured more objectively. For example, work in this area would benefit from explicitly defining intoxication in survey instruments, as is routinely done in the general alcohol research literature. A more detailed measure of hazardous drinking patterns other than intoxication would have been useful (e.g. those derived from quantity and frequency of alcohol use) to establish more definitively a dose-response relationship between hazardous drinking and unprotected sex. Examining a single sexual encounter in this study may be misleading since that encounter may not be representative of all of the individual encounters and future research in this area would benefit from multi-event assessment. Further, it is possible that covariates not measured in the Uganda AIS (e.g. partner HIV-status) could potentially have confounded or moderated the intoxication-unprotected sex association. Future research would benefit from the addition of measures of relevant constructs including HIV-related motivation and behavioral skills, sex-related alcohol expectancies, personality traits and medical and psychiatric comorbidities.

In summary, the results of this study suggest that the intoxication-unprotected sex link be clearly articulated within Ugandan national strategies for HIV reduction among HIV-negative individuals and PLWHA's. Prevention interventions focusing on alcohol harm reduction and increasing knowledge that condoms prevent HIV together with dispelling belief about condoms that may be potential barriers to their use among HIV-negative individuals promises to have great impact on HIV prevention. Alcohol reduction interventions will likely have major benefits to HIV prevention strategies among HIV-negative individuals and PLWHAs beyond those focused on intoxication 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 [34].

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Table 1

Distribution of sociodemographic and behavioral characteristics among HIV-Negative and HIV-Positive Individuals in Uganda, 2011

Characteristic	HIV-Negative (N=14,350) % (N)	HIV-Positive (N=1,118) % (N)	P-Value
Intoxication at last sexual intercourse			
Respondent only	7.8 (1137)	9.7 (105)	<0.001
Partner only	9.9 (1406)	12.9 (144)	
Both respondent and partner	4.6 (682)	7.3 (82)	
Neither	77.7 (11125)	70.1 (787)	
Condom use at last sexual intercourse			
Yes	10.4 (1499)	21.6 (239)	<0.001
No	89.6 (12856)	78.4 (879)	
Sex			
Male	45.6 (6451)	42.1 (462)	<0.024
Female	54.4 (7899)	57.9 (656)	
Age (average, in years)	32.1 (0.08) *	33.8 (0.16)	<0.001
Marital status			
Married/cohabitating	80.7 (11568)	76.9 (859)	<0.001
Unmarried	19.3 (2782)	23.1 (259)	
Education			
Primary/no education	70.7 (4148)	75.8 (849)	<0.002
Secondary or higher	29.3 (10,202)	24.2 (269)	
Residence			
Urban	18.7 (2661)	23.7 (278)	<0.001
Rural	81.3 (11,689)	76.3 (840)	
Wealth index			
Poor/poorest	43.4 (5665)	52.1 (364)	<0.001
Middle	19.5 (2714)	17.2 (194)	
Rich/richest	37.1 (5971)	30.7 (560)	
Age at first sexual intercourse			
< 15 years	14.0 (12294)	17.2 (923)	<0.019
15 years	86.0 (2056)	82.8 (193)	
Knows condoms prevent HIV			
Yes	83.0 (11754)	86.9 (964)	<0.001
No	17.0 (2596)	13.1 (154)	
Sex with non-spousal, non-cohabitating partner(s) (past year)			
Yes	23.1 (3264)	27.9 (307)	<0.001
No	76.9 (11086)	72.1 (811)	
Relationship to last sexual partner			
Steady	98.0 (14071)	96.0 (1073)	<0.003
Casual	2.0 (279)	4.0 (45)	

Note: Percentages and statistical tests based on weighted figures; Ns based on unweighted figures.

• Standard errors in parentheses for continuous variable age.

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Table 2

Bivariate Logistic Regression Analyses of Unprotected Sex at Last Sexual Intercourse Among HIV-Positive and HIV-Negative Individuals in Uganda, 2011

Characteristic	HIV-Negative (N=14,350)		HIV- Positive (N=1,118)	
	β (SE)	OR (95% CI)	β (SE)	AOR (95% CI)
Intoxication at last sexual intercourse				
Yes	0.78 (0.08)	2.18 (1.86–2.55)	0.30 (0.16)	1.35 (1.01–1.76)
No (Ref.)				
Sex				
Male	−0.53 (0.05)	0.60 (0.53–0.66)	−0.26 (0.14)	0.77 (0.58–1.02)
Female (Ref.)				
Age (mean, in years)	0.09 (0.03)	1.10 (1.09–1.11)	−0.01 (0.01)	0.99 (0.97–1.01)
Marital status				
Unmarried	−2.56 (0.06)	0.08 (0.07–0.09)	−1.16 (0.15)	0.31 (0.23–0.42)
Married/cohabitating (Ref.)				
Education				
Primary/no education	1.24 (0.05)	3.44 (3.10–3.84)	0.40 (0.15)	1.50 (1.10 2.04)
Secondary or higher (Ref.)				
Residence				
Rural	1.06 (0.06)	2.90 (2.58–3.25)	0.41 (0.15)	1.51 (1.11 2.05)
Urban (Ref.)				
Wealth index				
Middle vs. rich/richest (Ref.)	0.91 (0.08)	2.48 (2.11–2.91)	0.51 (0.20)	1.67 (1.11–2.49)
Poor/poorest vs. rich/richest(Ref.)	1.12 (0.07)	3.08 (2.69–3.51)	0.73 (0.17)	2.08 (1.48 2.93)
Age at First Sexual Intercourse				
< 15 years	0.02 (0.01)	1.02 (0.87–1.19)	0.12 (0.09)	1.13 (0.78–1.65)
15 years				
Knows condoms prevent HIV				
No	0.90 (0.09)	2.47 (2.04–2.98)	0.55 (0.24)	1.74 (1.08 2.79)
Yes (Ref.)				
Sex with non-spousal, non-cohabitating partner(s) (prior year)				
Yes	−2.53 (0.06)	0.08 (0.07–0.09)	−1.17 (0.14)	0.31 (0.23 0.41)
No (Ref.)				
Relationship to last sexual partner				
Casual	−1.64 (0.12)	0.20 (0.15–0.25)	−1.43 (0.30)	0.24 (0.13 0.44)
Steady (Ref.)				

Note:

Bolded odds ratios (ORs) significant at $p < 0.001$;

β = beta coefficient; SE= standard errors; 95% CI = confidence interval; Ref. = reference group.

Table 3

Multivariate Logistic Regression Analyses of Unprotected Sex at Last Intercourse Among HIV-Negative and HIV-Positive Individuals in Uganda, 2011

Characteristic	HIV-Negative (N=14,350)		HIV-Positive (N=1,118)	
	β (SE)	p-value	β (SE)	p-value
Intoxication at last sexual intercourse				
Yes	0.19 (0.09)	p < 0.047	0.38 (0.17)	p < 0.001
No (Ref.)				
Sex				
Male	-0.30 (0.06)	p < 0.001		<i>a</i>
Female (Ref.)				
Age (average, in years)	0.04 (0.004)	p < 0.001	-0.03 (0.01)	p < 0.001
Marital status				
Unmarried	-1.19 (0.09)	p < 0.001	-0.73 (0.20)	p < 0.001
Married/cohabitating (Ref.)				
Education				
Primary/no education	0.48 (0.07)	p < 0.001	0.35 (0.17)	p < 0.040
Secondary or higher (Ref.)				
Residence				
Rural	0.26 (0.07)	p < 0.002		<i>a</i>
Urban (Ref.)				
Wealth index				
Middle vs. rich/richest (Ref.)	0.42 (0.09)	p < 0.001	0.46 (0.21)	p < 0.033
Poor/poorest vs. rich/richest(Ref.)	0.49 (0.08)	p < 0.001	0.51 (0.18)	p < 0.007
Age at first sexual intercourse				
< 15 years	0.20 (0.09)	p < 0.037		<i>a</i>
15 years				
Knows condoms prevent HIV				
No	0.27 (0.10)	p < 0.018		<i>a</i>
Yes (Ref.)				
Sex with non-spousal, non-cohabitating partner(s) (prior year)				
Yes	-1.17 (0.09)	p < 0.001	-0.71 (0.19)	p < 0.001
No (Ref.)				
Relationship to last sexual partner				
Casual	-0.28 (0.13)	p < 0.042	-0.62 (0.24)	p < 0.061
Steady (Ref.)				
Intoxication*Knows Condoms Prevent HIV	0.79 (0.37)	p < 0.036	-	-

Note: β = beta coefficient; SE = standard error.

^a Sex, residence, age at first sexual intercourse and knowledge that condoms prevent HIV were removed from the final model as nonconfounders.