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Examining the relationship between alcohol use and high-risk sex practices in a population of women with high HIV incidence despite high levels of HIV-related knowledge

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Abstract

Objectives—Alcohol use has been linked to risky sexual behaviour and it has been identified as an important modifiable factor to prevent HIV infection. However, the evidence of a link between alcohol use and risky sexual behaviour is mixed. In this paper, we examine the role of alcohol use in sexual risk taking among women in Botswana.

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Contributors NMZ had full access to all the data in the study and takes responsibility for the integrity of the data and the accuracy of the data analysis. Study concept and design: NMZ, CM, BO and RGC. Acquisition of data: NMZ and BO. Analysis and interpretation of data: NMZ, CM, DR-M, RGC and L-WC. Drafting of manuscript: NMZ. Critical revision of the manuscript for important intellectual content: NMZ, CM, BO, DR-M, RGC and L-WC. Statistical analysis: NMZ and L-WC. Administrative, technical, or material support: CM, BO and DR-M. Study supervision: L-WC, RGC.

Methods—Participants were recruited by stratified proportional random sampling and were administered a survey interview that collected information on HIV/AIDS knowledge, risky sexual behaviour and alcohol use. Logistic regression and bivariate probit analyses were used to examine the association between alcohol use and high-risk sexual behaviour.

Results—239 women were interviewed. 168 (70%) had high levels of HIV/AIDS knowledge. We found no significant protective effect of good HIV/AIDS knowledge over high-risk sex behaviour (adjusted OR 0.74, 95% CI 0.38 to 1.42). However, alcohol use before sex was associated with high-risk sex behaviour (adjusted OR 3.04, 95% CI 1.11 to 6.45). However, bivariate probit analysis that simultaneously estimates risky sexual behaviour and alcohol use revealed an insignificant association between alcohol use and risky sex, highlighting the potential presence of other unobserved individual factors that are associated with alcohol use and risky sex.

Conclusions—Knowledge about HIV may not be sufficient to decrease risky sexual behaviour. Alcohol consumption was associated with an increased probability of high-risk sexual intercourse. However, the relationship between alcohol use and risky sex may also be a marker of a third omitted variable (such as overall risk-taking propensity). Further research is needed to identify factors associated with alcohol use and high-risk sex.

BACKGROUND

Out of the 31.3 million adults living with HIV/AIDS worldwide, about half are women, and 98% of these women live in developing countries.¹ Although the adult female to male ratio of HIV prevalence (in 2009) is 1.07 globally, this ratio is 1.48 in sub-Saharan Africa, with women much more likely to be infected than men.² Understanding the factors driving HIV infections among women in sub-Saharan Africa is critical to developing effective HIV prevention programmes.²

Extensive literature supports the role of knowledge of HIV infection in reducing the risk of HIV acquisition and transmission. Over the last few years, the increasing number of interventions designed to provide informational and educational material on the consequences of high-risk sexual activities³⁴ has had a very heterogeneous impact on HIV incidence. Although most effective in settings with poor baseline HIV knowledge,^{3–6} such knowledge-focused interventions are less effective in settings of more mature HIV epidemics, with extensive exposure to educational activities and high levels of HIV-related knowledge. For example, while the majority of people from these populations understand that high-risk sexual encounters can lead to HIV and STI acquisition,⁷ some continue to engage in high-risk sexual intercourse despite motivation to avoid these risks.⁷⁸ This indicates that knowledge of and motivation to avoid infection, although fundamental, is not always sufficient to produce changes in behaviour.

A wide variety of factors have been associated with unprotected sexual activity in spite of appropriate knowledge of the potential consequences. In sub-Saharan Africa, alcohol abuse is widespread, and studies have found a consistent association between alcohol use and risky sexual behaviours.⁹¹⁰ However, whether alcohol use *causes* risky sexual behaviour is more complex. Recent meta-analytic studies suggest that, instead of a causal relationship, it is the existence of some other factor—such as one's personality trait—that may impact alcohol

consumption and risky sex, resulting in a positive association between the two behaviours.^{11–17} Studies using US data have also provided mixed evidence on whether alcohol use causes high-risk sexual activity.^{11–18} In addition to omitted variables that make the relationship between drinking and risky sex look causal, there is also the possibility of reverse causation, in the sense that one wants to have sex, therefore one buys someone else a drink (or accepts someone else's offer of a drink). Kalichman *et al*,¹⁹²⁰ for instance, found evidence of a relationship between desire for transactional sex and alcohol consumption in 'shebeens' (local bars) in South Africa, with social understanding of such expectancies. Therefore, the positive association between drinking and risky sex may not be due to alcohol's disinhibition, but rather could be due to either some omitted factors (such as one's risk-taking preferences) or reverse causation (such as one wanting to pursue risky sex, either using alcohol as a disinhibiting device or as signals for existing social expectancies). Thus, although policies targeting alcohol use may decrease high-risk sexual practices, such policies will have less impact on women who drink alcohol to access opportunities for risky sex or as a result of an overall risk-taking predisposition.¹³¹⁶¹⁷²¹

Data regarding the causal relationship between alcohol use and risky sex among African women in settings with high HIV prevalence are scarce. In this study, we examine the relationship between alcohol use patterns and risky sexual behaviour⁵¹²¹⁷ by studying the following: levels of HIV/AIDS-related knowledge, the factors associated with appropriate knowledge, and the association between levels of knowledge and sexual risk behaviour; levels of alcohol consumption, patterns of alcohol consumption, factors associated with alcohol use, and the association between alcohol use and sexual risk behaviour; and evidence of a relationship between alcohol use and high-risk sexual behaviour.

DESIGN AND METHODS

Setting and study population

Women aged 21–49 years living in Mahalapye for over 12 months qualified for participation in the study. Participation was uncompensated and entirely voluntary (refer to the online supplementary methods for more detailed information).

Study design

Six residential areas within the Mahalapye village were sampled using data from the Census Department. A total of 240 households were selected from the six residential areas using proportional sampling by population density. One woman was randomly selected within each of the households.

Data collection and management

Trained interviewers administered a structured questionnaire with closed-end format from 29 July to 12 August 2010. Measures included socio-demographic variables (age, urban vs rural location, education, monthly income, and source of income), sexual activity, HIV/AIDS knowledge, and alcohol use variables. Information on sex with main and with casual partners in the past month was coded as 'protected' if all sex acts with the respective partner were protected. Other sexual behaviour variables included age of first sex, age difference

with partners, number of partners in the past 12 months, and exchange of sex for money in the past 12 months.

Knowledge of HIV/AIDS was collected using the Joint United Nations Programme on HIV/AIDS (UNAIDS) General Population Survey on knowledge, attitudes and sexual behaviour (which has been validated in Botswana).²² Knowledge was classified as poor or good (as defined in the UNAIDS General Population Survey manual), with those who scored 10 points or less classified as having poor knowledge. We used the Alcohol Use Disorders Identification Test (AUDIT) 10 questionnaire to measure alcohol consumption (refer to the online supplementary methods section for further details).²³

Risky sex was measured using individual markers (number of primary and casual partners in the last year, frequency of condom use, a diagnosis of a sexually transmitted disease within the prior year, and exchanging money for sex in the prior year; tables 1 and 2 and see online supplementary table S2) and a sexual risk composite variable that classified respondents into high or low risk, by using the UNAIDS General Population Survey on knowledge, attitudes and sexual behaviour.²² A participant was classified as having had high-risk sex if she met any one of the following criteria: having three or more sex partners within the last 12 months; having two or more sexual concomitant partners; not having used condoms during the last sexual encounter with a primary partner who is known or believed to have other partners; not having used condoms during the last sexual encounter with a casual partner; and exchanging money for sex in the last 12 months (tables 1 and 2 and see online supplementary table S2). We use these composite high-risk sex practices outcomes because all these behaviours put one at risk for HIV acquisition and by combining them into a single composite outcome our definition of high-risk behaviour would not be too narrowly defined. Further, all participants who were considered 'high risk' in our study shared two or more individual risk factors, suggesting that these behaviours were closely related at the individual level (see online supplementary table S2).

Statistical analysis

Risky sex and alcohol use are the two main study variables. We first tested for bivariate relationships between each main variable and the respondent's socio-demographic status and HIV/AIDS knowledge, using χ^2 , t tests or Wilcoxon rank sum tests if appropriate. We next ran separate logistic regressions to examine the determinants of risky sex and of alcohol use. The explanatory variables for the regressions were selected a priori based on reported importance in the literature and by their statistical significance in the bivariate analyses (p values lower than 0.2). Finally, we used bivariate probit to simultaneously model the determinants of risky sex and of alcohol use, while allowing alcohol use to affect risky sex. This setup allows for the detection and potential correction of statistical problems due to 'omitted variables' and 'reverse causation' (refer to the online supplementary methods for a more detailed explanation of the bivariate probit analysis). Only variables with 10% or less missing data were included in the analysis. Multiple imputations were used to improve the quality of estimates. Stata V.12 (Stata Corp., College Station, Texas, USA) was used for analysis. Level of significance was set at $p < 0.05$.

RESULTS

Of the 250 women invited to participate, 239 (95.6%) agreed to be interviewed. The overall mean age was 30.5 (table 1). A total of 171 (77%) women had ever consumed alcohol, half had consumed alcohol within the prior week (92, 53.8%) and a third (55, 32.2%) were heavy drinkers as per their AUDIT-10 score (table 1). Overall, 77 (34.7%) women reported drinking before sex. However, the use of alcohol before sex varied depending on the type of partner: 41 of 217 (18.9%) women reported using alcohol before sex with their primary partner and 55 of 107 (51.4%) with their casual partners. In terms of sexual behaviour, 226 (95%) reported having had sexual intercourse, of whom 147 (65%) were between the ages of 13 and 17 at first sexual experience (table 1). The majority (173, 77%) had not had more than two sexual partners in the last 12 months. Over 80–90% of respondents gave correct answers to HIV knowledge questions (see online supplementary table S1).

We next examined the determinants of risky sex behaviour, using the individual markers of risky sex (table 2) and the composite high/low risk sex variable (table 3, column 2) as dependent variables in logistic regressions. The results showed that HIV/AIDS knowledge was not a significant predictor of risky sex for this population. Different patterns of alcohol use were associated with different individual markers of risky sex behaviour (table 2). Chronic heavy drinking was associated with having three or more sex partners over the last year (adjusted OR (AOR) 4.01, 95% CI 1.76 to 9.19) and with the diagnosis of a sexually transmitted infection within the prior year (AOR 2.29, 95% CI 1.03 to 5.05). Binge drinking and drinking before sex were also associated with having three or more sex partners over the last year (AOR 1.11, 95% CI 1.04 to 1.16; and AOR 2.42, 95% CI 1.19 to 4.78, respectively) and with inconsistent or no use of condoms with casual partners (AOR 1.98, 95% CI 1.01 to 4.04; and AOR 3.46, 95% CI 1.00 to 12.40, respectively).

Drinking before sex was highly significantly associated with the composite outcome for risky sex behaviour (table 3 column 2). Respondents who drank prior to sex in the last 7 days were three times more likely to have also engaged in risky sex. In predicting drinking before sex, HIV/AIDS knowledge (AOR 0.22, 95% CI 0.09 to 0.53; table 3 column 3), age at sexual debut (AOR 0.38, 95% CI 0.16 to 0.91) and having a history of risky sex (AOR 3.27, 95% CI 1.33 to 8.10) were significant determinants.

These single-equation logistic regressions show that drinking before sex is associated with the engagement in high-risk sexual activities (table 3, column 2) and that a history of engaging in risky sexual activities was also a significant predictor of drinking before sex (table 3, column 3). This suggests that the relationship between risky sex and drinking prior to sex may be confounded by an omitted variable, such as risk-taking personality that is associated with drinking before sex and with high-risk sex. The relationship may also be bidirectional in that not only did drinking prior to sex lead the respondent to pursue risky sex, but also the desire to have risky sex somehow also led the respondent to drink prior to sex.

To tackle the omitted variable and reverse causation problems, we initially used bivariate probit analysis to simultaneously model drinking before sex and risky sex, using only socio-

demographic variables as explanatory variables. The results (not shown) showed a large and significant correlation between the error residuals of the estimating equations ($r=0.42$ and $p<0.01$). This suggests that whatever variable that is omitted from the drinking before sex equation is probably also omitted from the risky sex equation. We next estimated a bivariate probit setup with the inclusion of drinking before sex in the risky sex equation (table 4 column 2)—having used HIV/AIDS knowledge and age at sexual debut to instrument for drinking before sex so as to purge the effect of reverse causation (the instruments are jointly significant at $p<0.001$, as tested by the likelihood ratio statistic; not shown in the table). Drinking before sex was statistically insignificant, in contrast to the single equation logistic regression estimates (table, column 2).

DISCUSSION

Our single-equation regression results confirm the widely accepted belief that alcohol use before sex is associated with risky sexual activities, and thus is a risk factor for high-risk sexual intercourse.⁶ At face value, this association suggests that interventions designed to decrease alcohol consumption could be important in HIV prevention.⁹ Our study highlights the complex issues intrinsic to the relationship between alcohol use and high-risk behaviours. Our results indicate that different alcohol consumption patterns and contexts may have a very different effect on high-risk sex behaviours. Chronic, heavy alcohol use is associated with higher number of casual sex partners and with sexually transmitted disease acquisition, but not associated with condom use or transactional sex. Binge drinking and drinking before sex were associated with higher number of casual partners and inconsistent condom use with casual (but not primary) partners. Our bivariate probit analyses shed further light on this complex association. Having controlled for the effect of reverse causation and omitted variables, the association between alcohol use and risky sex became insignificant. This finding adds to the existing literature that also questions whether alcohol use and risky sex are causally linked.^{11–13,18,21} This also highlights the possibility that unobserved individual factors may drive some of this association.^{14–17} Risk-taking preferences, peer and social norms about risky behaviours, and mental health could drive the association between drinking and risky sex. Our data did not contain any of these potential factors. Identifying such third factors is important in future research, as they may play an important role in maintaining high-risk HIV acquisition behaviour despite appropriate knowledge.

Our findings also show that, in our study population, HIV/AIDS knowledge was high and was not associated with high-risk sexual practices. It is possible that populations may be heterogeneous with regard to modifiable risk factors, and HIV/AIDS education and knowledge acquisition could still be highly effective in preventing high-risk behaviours for a segment of the population. For example, we found that older women (>40 years) had significantly lower HIV knowledge scores compared with younger women (21–29 years). This may be because older people are often in stable relationships with a lower HIV risk perception,^{24,25} with lower motivation to seek out HIV-related information. Educational interventions targeting older women may have higher yield in decreasing high-risk behaviours.^{24–26}

In addition, there may be a different subgroup that, despite having high levels of HIV knowledge, still chooses to engage in high-risk behaviours. This subpopulation deserves further study as the behaviour may contribute to the perpetuation of the HIV epidemic in areas where HIV knowledge is common. This is increasingly important as interventions to decrease HIV prevalence in high-risk areas of the world progress. The high levels of knowledge in most subgroups of our sample suggests that, in settings in which knowledge about HIV/AIDS is widespread, other factors may surface as drivers of high-risk sexual activities. In these settings, interventions limited to educating the population on HIV transmission and acquisition will have limited impact; multidisciplinary prevention interventions, particularly the ones addressing factors that lead to alcohol use and risky sex, are required.¹⁹²⁰

Our results need to be interpreted in the context of several limitations. We only evaluated women between the ages of 21 and 49 in Mahalapye, and the findings may not be generalisable to other female populations, and not generalisable to men. There may be recall bias and reporting bias despite assurances of confidentiality. Our study is limited by the lack of measurement of personality traits, mental health (eg, depression, anxiety, etc), and other variables that potentially confound the relation between alcohol use and risky sex. In terms of the bivariate probit estimation, although HIV knowledge and age at sexual debut were both highly significant predictors of alcohol use and insignificant determinants of risky sex (attributes of good instrumental variables), these are not the traditional instruments truly exogenous to the model. A better set of instruments might include measures of price of alcohol and access and availability of drinking establishments or liquor stores. The bivariate probit results, while in line with previous findings by some other authors, should be interpreted with caution.

Nevertheless, our study does illustrate three main issues confronting HIV/AIDS public health policy. First, the generally high level of HIV knowledge pinpoints the fact that the marginal gain from modifying this factor to reduce HIV transmission may no longer be the most cost effective. Second, the positive relationship between alcohol use and risky sex in single equation estimates that disappears with alternative estimation methods highlights the possibility of some underlying reason for alcohol use that is associated with risky sex. If the underlying reason is not alcohol use per se but some other potentially modifiable factor, then public health interventions should target those other factors instead of reduction of drinking. Finally, our study highlights the significant heterogeneity of individual behaviours and the heterogeneity of the consequences of such behaviours. Clear understanding of these individual-level and event-level characteristics is crucial for the development of effective preventive interventions. Each of these implications deserves further investigation. Our results suggest that future HIV preventive interventions might benefit from screening for personality traits to be used as a risk indicator. This might be important if, as our data suggest, certain personalities (rather than alcohol use per se) influence high-risk behaviours and condom use.

CONCLUSIONS

The women of Mahalapye have good knowledge with respect to HIV/AIDS. However, the relation between knowledge of HIV/AIDS, alcohol consumption and high-risk sexual behaviour is complex. When the vast majority of the population has homogeneous high-level knowledge, other factors may become more important as potential drivers of the HIV epidemic. Although it seems clear that alcohol deserves attention as a potential modifiable target to prevent HIV and STI transmission, its relationship with engagement in high-risk sexual intercourse deserves closer examination. Overall alcohol consumption and, particularly, alcohol consumption before sex could be manifestations of high-risk taking personality in general or they could be driven by one's intention to pursue risky sex in the first place. Studies looking specifically into the role of risk taking propensity and sexual risk taking in conjunction with alcohol use on different populations are urgently needed.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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Key messages

- HIV knowledge levels are very high on average, and efforts to increase knowledge as a way to decrease risky sexual behaviour may need to be targeted to specific subpopulations.
- In populations with a high level of knowledge about HIV prevention, alcohol consumption and, particularly, alcohol consumption before sex are important risk factors associated with high-risk sexual intercourse.
- In populations with a high level of knowledge about HIV prevention, alcohol use and misuse deserve attention as potentially modifiable targets to prevent transmission of HIV and sexually transmitted infections. However, the relationship between alcohol use and risky sex may also be a marker of other, less understood risk factors, such as overall risk-taking propensity.

Table 1

Demographics, characteristics and sexual behaviour of women of reproductive age in Mahalapye, Botswana (n=239)

	n	Percentage
<i>Demographics</i>		
Age range		
21–29	123	51
30–39	90	38
40–49	26	11
Source of income		
Parents/relatives	70	29
Boyfriend/partner	50	21
Part-time/full-time job	119	50
Income per month		
Less than P1000 (\$140)	100	42
Between P1000 and P2000 (\$140–280)	54	23
Between P2000 and P3000 (\$140–520)	40	17
Over P3000 (>\$520)	44	18
Highest level of education attained		
Primary education or less	43	18
Secondary	122	51
Tertiary	74	31
Location of respondents		
Urban	114	48
Rural	128	52
<i>Alcohol use</i>		
Have you ever drunk alcohol?		
Yes	171	77
No	51	23
If you have drunk alcohol in the past, how many drinks have you had in the prior 7 days?		
I have not drunk alcohol in the last 7 days	49	49
1–4 drinks	32	32
5–9 drinks	7	7
10 or more drinks	12	12
If you have drunk alcohol in the past, have you drunk alcohol immediately before having sexual intercourse in the last 7 days?		
Yes	38	38
No	62	62
<i>Sexual behavior</i>		
Have you ever had sexual intercourse?		
Yes	226	95
No	11	4
Condom use during last sexual intercourse in exchange for money		

	n	Percentage
Yes	29	12
No	108	45
Age at first sexual exposure		
Less than 12 years	3	1
13–17 years	147	62
18–26 years	77	32
27–33 years	5	2
Sexual partners in past 12 months		
0–2 partners	173	72
3–5 partners	28	12
6–8 partners	5	2
9–11 partners	2	1
Do you currently have a primary partner?		
Yes	167	70
No	72	30
Condom use during the last sexual intercourse with primary partner		
Yes	62	37
No	105	63
Condom use during the last sexual intercourse with casual partner		
Yes	118	75
No	39	25
Exchange of sex for money in last 12 months without condom		
Yes	9	4
No	221	92
Exchange of sex for money in last 12 months with condom		
Yes	29	12
No	108	45

Table 2

Multivariate logistic regression of factors associated with individual markers of high-risk sexual intercourse among women in Mahalapye, Botswana

	Factors associated with having 3 or more casual sex partners in the prior year				Factors associated with no condom use with stable partners suspected/known to have other sex partners				Factors associated with no condom use with casual partners				Factors associated with the diagnosis of a sexually transmitted disease within the prior year				Factors associated with having been paid for sex within the prior year			
	AOR	95% CI	p Value		AOR	95% CI	p Value		AOR	95% CI	p Value		AOR	95% CI	p Value		AOR	95% CI	p Value	
Good knowledge of HIV/AIDS	1.48	0.70 to 3.77	0.36		0.97	0.43 to 2.21	0.96		2.92	0.53 to 16.01	0.22		1.40	0.60 to 3.23	0.42		0.56	0.21 to 1.45	0.23	
Chronic mild drinking	Ref				Ref				Ref				Ref				Ref			
Chronic moderate drinking	1.13	0.46 to 2.79	0.77		0.69	0.28 to 1.72	0.43		0.58	0.08 to 4.19	0.59		1.21	0.50 to 2.88	0.68		1.97	0.69 to 5.56	0.20	
Chronic heavy drinking	4.01	1.76 to 9.19	0.001		1.12	0.49 to 2.54	0.78		0.55	0.11 to 2.89	0.48		2.29	1.03 to 5.05	0.03		0.84	0.28 to 2.49	0.76	
Binge drinking	1.11	1.04 to 1.16	0.001		1.03	0.97 to 1.07	0.34		1.98	1.01 to 4.04	0.04		1.12	0.98 to 1.10	0.31		0.98	0.92 to 1.05	0.69	
Drinking before sexual intercourse	2.42	1.19 to 4.78	0.02		1.78	0.79 to 3.96	0.16		3.46	1.00 to 12.40	0.04		1.47	0.72 to 3.29	0.32		1.66	0.69 to 3.96	0.25	
Age 21–29 years	Ref				Ref				Ref				Ref				Ref			
Age 30–39 years	1.37	0.63 to 2.93	0.42		1.23	0.56 to 2.66	0.61		5.16	0.84 to 31.59	0.07		1.15	0.55 to 2.39	0.71		1.03	0.38 to 2.77	0.95	
Age >40 years	1.25	0.17 to 2.36	0.44		0.84	0.24 to 2.9	0.78		2.04	0.22 to 19.25	0.53		0.72	0.23 to 2.26	0.58		0.61	0.13 to 2.93	0.53	
Age 18 years or older by the time of first sex	4.35	1.80 to 9.37	0.001		1.01	0.47 to 2.19	0.98		1.02	0.21 to 5.10	0.98		1.17	0.56 to 2.44	0.67		1.30	0.47 to 3.59	0.61	
Source of income: parents	Ref				Ref				Ref				Ref				Ref			
Source of income: partner	2.40	0.95 to 6.94	0.08		1.95	0.76 to 5.01	0.17		0.46	0.06 to 3.66	0.47		3.17	1.10 to 9.07	0.03		2.77	0.79 to 9.78	0.11	
Source of income: self-employed	1.41	0.48 to 3.93	0.53		0.57	0.20 to 1.60	0.29		0.43	0.04 to 4.50	0.48		1.79	0.61 to 5.16	0.28		0.51	0.12 to 2.28	0.38	
Monthly income <P1000	Ref				Ref				Ref				Ref				Ref			
Monthly income P1000–2000	0.60	0.26 to 1.84	0.09		0.49	0.18 to 1.31	0.16		4.30	0.41 to 45.21	0.23		1.51	0.58 to 3.92	0.40		1.18	0.36 to 3.93	0.78	
Monthly income P2000–3000	0.51	0.17 to 1.87	0.53		0.54	0.17 to 1.78	0.32		7.47	0.59 to 95.14	0.12		2.06	0.65 to 6.42	0.22		1.13	0.26 to 4.98	0.87	
Monthly income >P3000	0.43	0.12 to 1.87	0.18		0.41	0.10 to 1.70	0.22		13.7	0.90 to 233.3	0.06		2.49	0.66 to 9.37	0.18		2.06	0.39 to 10.9	0.39	
Primary education	Ref				Ref				Ref				Ref				Ref			
High-school education	1.72	0.53 to 5.69	0.28		2.24	0.61 to 8.17	0.23		1.51	0.43 to 6.52	0.38		4.84	1.2 to 19.18	0.02		0.53	0.13 to 2.24	0.40	
Graduate/superior education	2.90	0.61 to 12.96	0.16		3.38	0.71 to 16.0	0.13		2.90	0.41 to 14.01	0.29		2.04	0.40 to 10.17	0.38		0.33	0.06 to 1.83	0.20	
Over 10-year difference with stable sex partner	1.10	0.40 to 3.03	0.78		1.30	0.47 to 3.57	0.61		1.85	0.18 to 18.65	0.60		0.80	0.27 to 2.31	0.68		0.51	0.13 to 1.95	0.32	
Over 10-year difference with casual sex partner	2.06	0.88 to 4.83	0.07		1.78	0.31 to 2.97	0.60		5.48	1.01 to 29.91	0.04		0.56	0.22 to 1.40	0.21		6.02	2.21 to 16.4	<0.001	

	Factors associated with having 3 or more casual sex partners in the prior year			Factors associated with no condom use with stable partners suspected/known to have other sex partners			Factors associated with no condom use with casual partners			Factors associated with the diagnosis of a sexually transmitted disease within the prior year			Factors associated with having been paid for sex within the prior year		
	AOR	95% CI	p Value	AOR	95% CI	p Value	AOR	95% CI	p Value	AOR	95% CI	p Value	AOR	95% CI	p Value
Living in a primarily rural area	1.27	0.61 to 2.63	0.58	1.05	0.51 to 2.16	0.89	2.66	0.45 to 15.81	0.28	1.98	0.97 to 3.98	0.06	0.59	0.24 to 1.47	0.25

AOR, adjusted OR.

Table 3

Multivariate logistic regression of factors associated with good knowledge of HIV/AIDS, factors associated with engaging in high-risk sexual intercourse and factors associated with the use of alcohol before sexual intercourse among women in Mahalapye, Botswana

	Factors associated with good knowledge of HIV/AIDS			Factors associated with engagement in high-risk sexual intercourse			Factors associated with drinking alcohol before sexual intercourse		
	AOR	95% CI	p Value	AOR	95% CI	p Value	AOR	95% CI	p Value
Good knowledge of HIV/AIDS	NA			0.74	0.38 to 1.41	0.36	0.22	0.09 to 0.53	0.01
Engaging in high-risk sex behaviour	0.74	0.38 to 1.42	0.37	NA			3.27	1.33 to 8.10	0.001
Drinking before sexual intercourse	0.22	0.09 to 0.53	0.001	3.04	1.28 to 7.20	0.01	NA		
Age 21–29 years									
Age 30–39 years	0.97	0.48 to 1.98	0.94	0.85	0.45 to 1.61	0.61	1.70	0.69 to 4.18	0.25
Age >40 years	0.29	1.11 to 0.77	0.01	1.20	0.46 to 3.10	0.70	0.53	0.13 to 2.19	0.38
Age 18 years or older by the time of first sex	0.91	0.44 to 1.92	0.82	0.99	0.49 to 1.96	0.97	0.38	0.16 to 0.91	0.03
Source of income: parents									
Source of income: partner	1.34	0.51 to 3.59	0.55	1.55	0.64 to 3.77	0.33	1.33	0.40 to 4.41	0.64
Source of income: self-employed	0.84	0.36 to 1.96	0.69	0.98	0.45 to 2.13	0.97	1.09	0.36 to 3.29	0.88
Monthly income <P1000									
Monthly income P1000–2000	0.57	0.24 to 1.34	0.20	2.18	1.00 to 4.95	0.05	0.14	0.03 to 0.59	>0.01
Monthly income P2000–3000	1.70	0.54 to 5.34	0.36	2.01	0.74 to 5.43	0.17	0.90	0.22 to 3.69	0.89
Monthly income >P3000	1.80	0.52 to 6.31	0.36	1.91	0.62 to 5.94	0.26	0.91	0.20 to 4.28	0.91
Primary education									
High-school education	1.76	0.60 to 5.21	0.30	3.51	1.22 to 10.10	0.02	1.09	0.30 to 3.94	0.90
Graduate/superior education	1.07	0.29 to 3.91	0.92	2.43	0.71 to 8.40	0.16	0.67	0.14 to 3.20	0.62
Over 10-year difference with primary sex partner	1.95	0.57 to 6.64	0.26	0.69	0.23 to 2.08	0.51	2.82	0.79 to 10.06	0.11
Living in a primarily rural area	1.00	0.52 to 1.93	0.99	0.82	0.45 to 1.49	0.52	1.82	0.76 to 4.38	0.18

Statistically significant results are highlighted in bold. AOR, adjusted OR.

Table 4

Bivariable probit analysis to determine whether the factors associated with both, high-risk sexual behavior and the presence of high level of knowledge could be explained by a different (yet unknown) variable not included in our model

	Drinking before sexual intercourse			Engaging in high risky sex behavior		
	Coefficient	Lower 95% CI limit	Higher 95% CI limit	Coefficient	Lower 95% CI limit	Higher 95% CI limit
Good knowledge of HIV/AIDS	-0.91	1.39	0.43	–	–	–
Drinking before sexual intercourse	–	–	–	0.75	-0.82	2.33
Age 30–39 years	0.21	-0.27	0.71	-0.09	-0.49	0.30
Age >40 years	-0.39	-1.16	0.37	0.14	-0.42	0.71
Age 18 years or older by the time of first sex	-0.52	-1.01	-0.03	–	–	–
Source of income: partner	0.19	-0.46	0.85	0.26	-0.27	0.80
Source of income: self-employed	-0.01	-0.60	0.60	-0.01	-0.47	0.46
Monthly income P1000–2000	-0.96	-1.74	-0.18	0.50	-0.04	1.06
Monthly income P2000–3000	0.10	-0.65	0.86	0.40	-0.20	1.01
Monthly income >P3000	0.09	-0.75	0.94	0.36	-0.30	1.04
High-school education	0.16	-0.55	0.88	0.74	0.12	1.35
Graduate/superior education	-0.14	-1.01	0.72	0.54	-0.18	1.27
Over 10-year difference with primary sex partner	0.53	-0.17	1.25	-0.23	-0.92	0.44
Living in a primarily rural area	0.29	-0.18	0.77	-0.12	-0.50	0.25

Statistically significant results are highlighted in bold.