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The Information–Motivation–Behavioral Skills Model and Unprotected Sex: Assessing the Model's Utility and Predictability Among Bar Patrons in Tshwane, South Africa

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Abstract

The Information–Motivation–Behavioral skills (IMB) model has been a useful tool for understanding sexual risk behavior. However, its utility in predicting sexual risk behaviors among bar patrons, for whom the bar setting poses a higher risk of alcohol-related sexual risk behavior, has been underexplored. We assessed (1) the extent to which the IMB predicted number of episodes of unprotected sex in the past six months and (2) whether incorporating sex under the influence of alcohol and alcohol use improved the predictability of the model among bar patrons. Hierarchical regression models were conducted on data from 406 men and women from bars in rural areas of North-West province, South Africa. Behavioral skills were the sole IMB variable to predict unprotected sex with main partners ($\beta = -0.40$; $p < .001$), explaining 18% of the variance. Variance explained increased to 21% with addition of sex under the influence of alcohol ($\beta = 0.13$; $p = .019$) and further increased to 26% with the addition of alcohol use ($\beta = 0.24$; $p < .001$). Motivation ($\beta = -0.21$; $p = .006$) and behavioral skills ($\beta = -0.21$; $p = .006$) were the significant IMB predictors of unprotected sex with casual partners (explaining 15% of the variance). Variance explained increased to 22% with the addition of sex under the influence of alcohol ($\beta = 0.26$; $p = .001$), but alcohol consumption was not an independent predictor of episodes of unprotected sex with casual partners. Interventions for improving HIV prevention behaviors among bar patrons should focus on enhancing individuals' behavioral skills and motivation and reducing their alcohol consumption.

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Author Contributions All authors contributed to the study conception and design, data collection, and analysis. The authors further jointly drafted the manuscript and read and approved the final manuscript.

Declarations

Informed Consent Informed consent was obtained from all individual participants included in the study.

Conflict of interest Sebenzile Nkosi declares that she has no conflict of interest. Eileen Rich declares that she has no conflict of interest. Neo Morojele declares that she has no conflict of interest.

Keywords

Information–Motivation–Behavioral Skills Model; Alcohol use; Unprotected sex; Bar patrons; South Africa

Introduction

The Southern and East Africa region has the highest prevalence of HIV infection in the world and accounts for over half of the global burden of HIV infection (UNAIDS, 2020). While a decrease of 38% in new infections has been observed since 2010 in the region, further significant decreases are needed for a substantial reduction in the global HIV burden and AIDS-related mortality (UNAIDS, 2020). South Africa has the largest number of people living with HIV with a prevalence rate of 20.6% (Human Sciences Research Council, 2018). The Sub-Saharan Africa (SSA) region also has among the highest levels of heavy drinking (WHO, 2018). For South Africa in particular, just over two fifths of those who drink report engagement in binge drinking (Vellios & van Walbeek, 2018). Heavy drinking fuels the HIV epidemic as alcohol is associated with risky sexual behaviors, such as unprotected sex (Hahn et al., 2011; Scott-Sheldon et al., 2013; Shuper et al., 2010), and has been examined in terms of global, situational and event-level associations (Leigh & Stall, 1993).

Most studies finding a significant relationship between alcohol consumption and sexual risk behavior have shown that alcohol consumption is related with sexual risk behavior at the global level (e.g., Kalichman et al., 2007; Scott-Sheldon et al., 2012; Woolf-King & Maisto, 2011), i.e., that people who are more likely to drink alcohol are also more likely to report engagement in unprotected sex. Less consistent associations have been observed between alcohol consumption and sexual risk behavior at the situational level, i.e., frequency of engagement in sex while drinking is associated with sexual risk behavior (e.g., Choudhry et al., 2014) or the event-level (e.g., Kiene et al., 2008; Woolf-King et al., 2018), i.e., where alcohol use during specific sexual events increases the chances of sexual risk behavior during those events. At the event-level, when individuals have consumed alcohol, they have poorer negotiating skills and lower condom use efficacy, and hence, an increased likelihood of engagement in unprotected sex (John et al., 2017; Maisto et al., 2004; Zhang et al., 2011). The environment or setting in which people drink may also increase the risk of engagement in sexual risk behavior (Browne & Wechsberg, 2010). Past month attendance of informal alcohol serving establishments, known as shebeens, was found to be an independent predictor, over and beyond demographic factors and alcohol consumption, of number of sexual partners and condomless vaginal sex in a study among community members in a township in Cape Town (Cain et al., 2012). Scott-Sheldon et al. (2014) found, for men who had a high prevalence of alcohol use disorder, that engagement in sex in drinking venues—shebeens, taverns or bottle stores (setting)—and consumption of alcohol before sex were significantly associated with number of sexual partners and number of unprotected sex events. In terms of the association between alcohol and risky sexual behavior at the global level, they found that alcohol use disorder (AUD) was independently associated with the proportion of unprotected sex events in the past 30 days.

A number of behavior change models such as the health belief model (Becker, 1974; Rosenstock, 1974), social cognitive theory (Bandura, 1986), theory of reasoned action and theory of planned behavior (Ajzen & Fishbein, 1980; Fishbein & Ajzen, 1975), and the Information–Motivation–Behavioral (IMB) skills model (Fisher & Fisher, 1992) have been proposed to explain people's engagement in health-related behaviors. The IMB model was developed specifically to explain HIV-related behaviors. The model posits that the essential determinants of HIV preventative behaviors (such as condom use) are HIV prevention information, motivation, and behavioral skills (Fisher & Fisher, 1992). Specifically, it proposes that engagement in HIV preventative behavior requires one to (1) be knowledgeable about how HIV is transmitted and how to prevent it (Fisher & Fisher, 1992); (2) be motivated to engage in HIV preventative acts. Such motivation entails personal motivation (e.g., wanting to be disease free), and social support from significant others to engage in HIV preventative behaviors (e.g., approval from one's peers not to engage in unprotected sex while intoxicated); and (3) have the ability and/or perceived self-efficacy to engage in HIV preventative acts, such as being able to persuade a partner to use a condom (Fisher & Fisher, 1992). According to the model, information and motivation impact on preventative behavior both indirectly, via their impact on behavioral skills, and directly (Fisher & Fisher, 1992).

In Sub-Saharan Africa, numerous studies have applied the IMB model to examine HIV preventative behaviors among participants in clinics (Kalichman et al., 2006; Kiene et al., 2013; Pitpitan et al., 2015; Shuper et al., 2014; Simbayi et al., 2004; Smith et al., 2013), educational settings (Ndebele et al., 2012; Ybarra et al., 2013), and community settings (Simbayi, 2010). The large majority of these studies have supported the main tenets of the model (Kalichman et al., 2006; Kiene et al., 2013; Simbayi et al., 2004). In some cases, only motivation and behavioral skills (Kalichman et al., 2002), or motivation alone (Ybarra et al., 2013), were found to be significant and independent predictors of engagement in preventative behaviors. Moreover, in some cases, results differed by sex (Shuper et al., 2014), or partner type (Mustanski et al., 2013).

Although alcohol consumption is a well-recognized risk factor for sexual risk behavior (Kalichman et al., 2007), its role, relative to the key IMB constructs, in predicting unprotected sex has been under explored. In one study involving patients living with HIV enrolled in an HIV prevention with positives trial in rural areas of Kwa-Zulu Natal, South Africa, Shuper et al. (2014) found that IMB constructs (but not alcohol use prior to sex) were significant predictors of unprotected sex with partners whose HIV status was negative or unknown. The IMB model has also been used to inform interventions (which included an alcohol component) aimed at reducing sexual risk behavior in South Africa. Simbayi (2010) applied the IMB model in an intervention among male and female shebeen patrons and found it to be effective in reducing the rate of past month unprotected sex. Pitpitan et al. (2015) found that a brief sexual risk reduction intervention based on the IMB model resulted in less risky sexual behavior, but that the change was attributable to reductions in alcohol use rather than the IMB constructs. Kalichman et al. (2007) found that an IMB-model-based HIV and alcohol risk reduction counseling intervention delivered in sexually transmitted infection (STI) clinics in Cape Town was successful in increasing condom use at last sex and reducing rates of unprotected sex over a six-month assessment period. Similarly,

Kalichman et al.'s (2008) randomized control trial of a community-based alcohol-related HIV risk-reduction intervention in Cape Town found that the intervention was successful in (1) reducing rates of unprotected sex, alcohol use before sex and number of sexual partners, and (2) increasing consistent condom use. In addition, they found that alcohol use was a moderator of these effects, with lighter problem drinkers being more likely to experience the benefits of the intervention than heavier problem drinkers. Outside of SSA, there have been studies in which the IMB model was applied in interventions to reduce men's engagement in condomless sex while under the influence of drugs or alcohol (e.g., Benotsch et al., 2007; Calsyn et al., 2010). Another study explored IMB constructs as moderators of the relationship between alcohol use prior to sex and unprotected sex (Mustanski et al. (2013). While these studies examined different populations from the population under consideration in this study (namely, bar patrons), their findings are relevant and instructive.

In sum, the IMB model has been found to be useful in explaining people's engagement in health behaviors (Cooperman et al., 2015; Kalichman et al., 2006; Kiene et al., 2013; Osborn & Egede, 2010; Simbayi et al., 2004). However, the model's key tenets have not been assessed specifically among people who consume alcohol in bars in rural areas as opposed to urban areas in South Africa (Simbayi, 2010). This study extends previous research by involving both male and female bar patrons (unlike Scott-Sheldon et al., 2014) and including non-health-seeking populations, unlike other studies that have been conducted in clinics (Pitpitan et al., 2015). Furthermore, this study is one of the first to assess whether alcohol consumption at both the event-level and the global level (unhealthy alcohol use) may further explain unprotected sex independently of IMB model constructs in South Africa. This study focuses on the applicability of the IMB model with respect to bar patrons' engagement in condomless sex with casual partners and engagement in condomless sex with main partners since the dynamics of condom use among these different partner types also tend to differ (Macaluso et al., 2000; Mustanski et al., 2013). Knowledge about the relative role of IMB constructs, sex under the influence of alcohol, and alcohol use disorder in predicting number of episodes of unprotected sex can inform much-needed interventions for addressing condomless sex among men and women who frequent alcohol serving venues in South Africa. The aims of this study were to explore (a) the extent to which the IMB model predicts the number of episodes of condomless sex with main and casual sexual partners among bar patrons in rural areas in South Africa and (b) whether incorporating sex under the influence of alcohol and problem alcohol use as predictors improves the predictability of the IMB model in accounting for condomless sex with main and casual partners among bar patrons in rural areas in South Africa.

Method

Participants

The study was conducted in two villages that are situated in North West province; approximately 70 km from Pretoria and 70 km from each other. These villages were selected via convenience sampling as they were among the closest villages in North West province to the researchers' offices. North West province is one of the smallest and poorest provinces in South Africa and has 3,856,200 people (Statistics South Africa, 2014). The majority

of its residents speak seTswana. The main economic activities involve mining (30%), manufacturing (5%), agriculture (2%), and construction (2%) (Trade & Industry Policy Strategies, 2016). The province has high levels of unemployment; for example, 31.5% in 2011 as compared to the national average of 29.8% (Statistics South Africa, 2014). In 2017, South Africa's HIV prevalence rate among 15–49 year olds was 20.6%, whereas North West's HIV prevalence rate for the same age group was 22.7% (HSRC, 2018). Participants were 406 patrons (314 men and 92 women) recruited from drinking establishments in two villages of the North West province in South Africa.

We employed a cross-sectional survey design and sought to recruit two drinking establishments per village and 315 patrons (approximately 158 per drinking establishment) into our study. In order to sample two drinking establishments per area, trained fieldworkers engaged in observations of fifteen drinking establishments in the two areas where the research was conducted. Those locales were assessed in terms of the following study inclusion criteria: at least 30 patrons on a given day, about 25% of the clientele are female, and the establishment is generally frequented by the same patrons every week ("regulars"). At the end of the observation period, two bars from each area with the higher number of patrons on an average day and the highest number of female patrons were chosen for inclusion in the survey. We selected high volume bars to minimize the duration of participant recruitment.

In order to sample participants in the selected drinking establishments, patrons who crossed a predetermined intercept zone were approached to participate in the study. To be included in the study, the patrons had to be at least 18 years old, visit the bar at least once per month, and not be intoxicated at the time of being approached for inclusion. No attempt was made to stratify the sample by sex. A total of 970 patrons were approached. Of these, 417 were eligible and agreed to be included in the study, yielding a response rate of 43%.

Sample size and power calculations were based on estimates of rates of condom use at last sexual episode. The study was designed to detect a 64% rate of condom use at last sex with a margin of 5%. The figures were based on the rate of condom use at last sex reported for high-risk drinkers in the 2008 national HIV survey conducted by the Human Sciences Research Council (Shisana et al., 2009). Attaching a 90% confidence level to our assumptions, the implied sample size was 315.

Procedure

Trained fieldworkers visited the drinking establishments that met the criteria for inclusion at peak times of drinking (i.e., Friday evenings, Saturdays, and Sundays). They approached every third patron who crossed a predetermined intercept zone and screened those interested for eligibility. Those eligible and interested in participating in the study signed informed consent forms and were thereafter interviewed in quiet areas in and around the drinking establishments, out of hearing range of other patrons. At the end of the interviews, participants received a resource list with telephone numbers of various local service providers who offer help and/or support for problem alcohol use, psycho-social problems, and sexual risk behavior.

Measures

The trained interviewers administered a structured questionnaire to assess participants' demographic characteristics (i.e., sex, age, education level, marital status and employment status), unhealthy alcohol use, information, motivation, behavioral skills, sex under the influence of alcohol (with casual partners and main sexual partners) in the past six months, and unprotected sex (with casual partners and main sexual partners) in the past six months. Unhealthy alcohol use was assessed with the Alcohol Use Disorders Identification Test (AUDIT; Cronbach' alpha = 0.81). The scale consists of 10 items that assess frequency and quantity of alcohol consumption, consequences of, and harm from, drinking alcohol. The scores range from 0 to 40 with higher scores denoting greater unhealthy alcohol use.

In terms of the IMB model variables, information was assessed with a one-item scale, "using condoms when you have sex can reduce the chance of getting HIV" with response options being "true," "false," or "don't know." The "don't know" responses were recoded as "false." High scores on the scale indicated greater knowledge about HIV transmission/prevention. Behavioural skills was assessed with a 7-item scale with a "yes" and "no" response format (Cronbach's alpha = 0.74). An example of an item from that scale is "You have refused sex without a condom." We used this scale with items concerning past behavior as a proxy for a scale that assesses participants' perceived ability to engage in preventative behavior, and hence, we operationalized behavioral skills in the same way as has been done in other studies (e.g., Walsh et al., 2011). Higher scores indicated greater ability to engage in risk reduction behavior. Motivation was assessed with a 12-item scale scored on a 5-point Likert scale from "very negative" to "very positive" (Cronbach's alpha = 0.77). Sample items in this scale were "How positive or negative do you feel about refusing to have unsafe sex" and "how would people who are important to you feel if you refused to have unsafe sex." High scores indicated greater motivation to engage in HIV preventative behavior.

Sex under the influence of alcohol (number of episodes) was assessed for all partners by considering the number of sexual partners, the number of times the participant had had sex with each partner, and the number of times he/she had been intoxicated before engaging in sex with each partner in the past 6 months. Then, separately for main and casual partners, Sex under the influence of alcohol was calculated as the difference between the number of times the participant had had sex with each partner and the number of times that the participant had been intoxicated before engaging in sex with the partner in the past 6 months. Main sexual partners were defined as sexual partners with whom participants were in a formal "romantic" relationship, such as a marital or committed sexual relationship, while casual sexual partners were defined as sexual partners with whom participants did not have, or did not consider having, a formal "romantic" relationship.

The outcome variables were (1) the number of episodes of unprotected sex with main sexual partners in the past 6 months, and (2) the number of episodes of unprotected sex with casual sexual partners in the past 6 months. The number of episodes of unprotected sex with main sexual partners in the past 6 months was calculated as the difference between the number of times the participant had had sex with all main partners and the number of times that they had used condoms with all main sexual partners in the past 6 months. Similarly, the number of episodes of unprotected sex with casual sexual partners in the past 6 months was

calculated as the difference between the number of times they had had sex with all casual partners and the number of times that they had used condoms with all casual partners in the past 6 months.

Analysis

Data analysis was carried out on SPSS Version 25. Descriptive analyses were conducted on the data concerning the sample's demographic characteristics, information, motivation, behavioral skills, sex under the influence of alcohol with main and casual sexual partners in the past six months, and unprotected sex with main and casual sexual partners in the past six months. We then conducted correlation analyses to examine associations between all the variables. Finally, we conducted hierarchical multiple regression models in which we entered groups of variables in four steps for two outcome variables (1) unprotected sex with main sexual partners in the past six months, and (2) unprotected sex with casual sexual partners in the past six months. For each of the models, we entered demographic variables (age, education, gender, employment status, and relationship status) at the first step, then the IMB model variables (information, motivation, and behavioral skills) at the second step, sex under the influence of alcohol with main partners (for the main partners outcome) and casual partners (for the casual partners outcome) at the third step, and finally, the AUDIT score (assessing unhealthy alcohol use) at the fourth and final step. The IMB variables were entered second to determine whether they predicted unprotected sex over and above the demographic factors. The sex under the influence of alcohol and AUDIT variables were entered in the final two steps, respectively, in order to determine whether they improved the predictability of the IMB model in accounting for unprotected sex. Sex under the influence alcohol and the outcome variables were log transformed prior to being entered in the correlation and regression models as they were positively skewed.

Results

The sample comprised 406 (314 men and 92 women) participants. Their ages ranged from 18–71 years with a mean of 30.7 years (SD = 8.93). Table 1 presents the participants' demographic characteristics. As shown in the table, the majority (72%) had a Grade 12 education or above, were employed (57%), and were not in relationships at the time of data collection (73%). Significant differences were observed between men and women on most variables. There were significant sex differences in age categories ($p < .001$). A higher proportion of women (83%) than men (70%) were single ($p < .05$). A higher proportion of men (66%) than women (24%) were employed ($p < .001$).

Table 2 shows the differences between the men and women on the predictor variables. Women were more likely to indicate that they agreed that using condoms can reduce the chances of being infected with HIV. Apart from Behavioral Skills, significant differences were observed between men and women on all other continuous variables. Specifically, women had higher scores than men on the Motivation scale. On the other hand, compared to women, men had higher mean AUDIT scores, had engaged in more episodes of unprotected sex with main and casual partners in the past 6 months, and had engaged in more episodes of sex while under the influence of alcohol with main and casual partners in the past 6 months.

Table 3 shows the correlations among the predictor variables and each of the outcome variables. Significant associations were observed among most of the predictor variables. Unprotected sex with main partners in the past 6 months was significantly associated with most of the predictor variables, except age and Information. Unprotected sex with casual partners in the past 6 months was significantly associated with many of the predictor variables except age, education level, employment status, and Information.

Table 4 shows the results of hierarchical regression analyses predicting unprotected sex with main partners. In the first step, where demographic variables were entered, only relationship status ($\beta = 0.17$, $p = .006$) was a significant predictor of number of episodes of unprotected sex with main sexual partners. Participants who were (or had been) in formal relationships (e.g., married or cohabiting) had engaged in more episodes of unprotected sex with their main sexual partners than those who were not in relationships. At this step, the total model explained 6% of the variance (adjusted $R^2 = 0.06$; $F = 4.69$; $p < .001$). At Step 2, where IMB variables were entered, Behavioral Skills were associated with an increased likelihood of engagement in unprotected sex with main sexual partners ($\beta = -0.40$, $p < .001$). Motivation and Information were not significant predictors of the outcome variable. At this step, the variance explained significantly increased to 18% (adjusted $R^2 = 0.18$; $F = 8.56$; $p < .001$). At Step 3, engaging in sex under the influence of alcohol increased the likelihood of engaging in unprotected sex with main partners ($\beta = 0.13$, $p = .019$). The total variance explained at this step significantly increased to 21% (adjusted $R^2 = 0.21$; $F = 9.19$; $p < .001$). Finally, at the fourth step, higher scores on the AUDIT were associated with engagement in more episodes of unprotected sex with main partners ($\beta = 0.24$; $p < .001$). At this step, the variance explained increased to 26% (adjusted $R^2 = 0.26$, $F = 10.64$; $p < .001$).

Table 5 shows the results of hierarchical regression analyses predicting unprotected sex with main partners. In the model for the outcome variable unprotected sex with casual sexual partners, in the first step, where demographic variables were entered in the model, relationship status ($\beta = 0.12$, $p = .089$) was a marginally significant predictor of number of episodes of unprotected sex with casual sexual partners. The total model at this step explained 5% of the variance (adjusted $R^2 = 0.03$; $F = 1.95$; $p = 0.088$) and was marginally statistically significant. At Step 2, where IMB variables were entered in the model, behavioral skills ($\beta = -0.21$, $p = 0.006$) and motivation ($\beta = -0.21$, $p < .006$) were associated with a reduced likelihood of engagement in unprotected sex with casual sexual partners. Information was not a significant predictor of the outcome variable. At this step, the variance explained significantly increased to 15% (adjusted $R^2 = 0.15$; $F = 5.24$; $p < .001$). At the third step, engaging in sex under the influence of alcohol increased the likelihood of engagement in unprotected sex with casual sexual partners ($\beta = 0.26$, $p = .001$). The total variance explained at this step significantly increased to 22% (adjusted $R^2 = 0.22$; $F = 6.94$; $p < .001$). At the final step, the addition of the AUDIT score did not significantly increase the variance explained in unprotected sex with casual sexual partners.

Discussion

This study examined the utility of the IMB model in predicting unprotected sex with main and casual partners among male and female bar patrons in two rural areas of North West

province in South Africa, and whether addition of alcohol use-related variables to the model enhances predictability of the model. This is one of the first studies of which we are aware, to examine the role of alcohol consumption both at the event and global levels, over and above information, motivation and behavioral skills in predicting condomless sex.

It emerged that only behavioral skills, but not information or motivation, were significantly and independently predictive of number of episodes of unprotected sex with main partners. On the other hand, both behavioral skills and motivation were significant predictors of number of episodes of unprotected sex with casual partners. The finding that behavioral skills were a significant predictor of number of episodes of unprotected sex with both main and casual partners is in keeping with numerous other previous studies (Kalichman et al., 2002, 2006; Pitpitan et al., 2015; Simbayi et al., 2004).

The finding that motivation was a significant predictor of unprotected sex with casual partners was not unexpected. Individuals in committed relationships (or with a primary partner) who are motivated to use condoms may find that motivation may not be easily translated into actual behavior, as raising the issue of condom use may be construed as a lack of trust (Macaluso et al., 2000).

Information was not a significant predictor of number of episodes of unprotected sex with both partner types, which is in keeping with numerous other previous studies that demonstrate that education/information may not always predict HIV preventative behaviors (Fisher et al., 2009; Kalichman et al., 2002). In this study, the large majority of participants were knowledgeable of the protective effect of condoms against HIV infection, which could explain this finding.

In response to our second aim, we found that adding sex under the Influence of alcohol to the IMB model significantly increased the predictive power of the model for unprotected sex with both main partners and casual partners. This finding is not consistent with a study that was also conducted in a rural area of South Africa (in the Kwa-Zulu Natal province) (Shuper et al., 2014) which found that alcohol use prior to sex was not a significant predictor of condomless sex. However, Shuper et al.'s sample consisted of patients at a clinic, whereas those in this study were bar patrons, all of whom drank alcohol.

We also found that addition of AUDIT score to the model of key IMB model constructs and sex under the influence of alcohol further increased the predictability of the model in terms of number of episodes of unprotected sex with main partners but not with casual sexual partners. Global-level associations between alcohol use and sexual risk behavior have been explained in terms of personality variables that are associated with risk-taking, such as sensation seeking (e.g., Shuper et al., 2010). Furthermore, global-level associations can be attributed to the association of unhealthy alcohol use with coercive sexual behavior and intimate partner violence among men. Women's choice to use condoms is often compromised when their partners are violent and sexually coercive (Scott-Sheldon et al., 2012). The reasons for the global level associations between alcohol consumption and unprotected sex with main partners but not with casual partners need to be further explored.

The findings of this study, although correlational, suggest that the factors that are associated with unprotected sex vary depending on the type of sexual partner. They also suggest that interventions to reduce condomless sex among main and casual partners should focus in particular on individuals' behavioral skills (self-efficacy and ability to engage in risk reduction behaviors), while addressing motivational factors would be important for addressing unprotected sex with casual partners. Furthermore, the findings point to the importance of sexual behavior in the context of drinking (for both main and casual partners) and unhealthy alcohol use (for sex with main partners).

Appropriate interventions for addressing alcohol use by bar patrons may be bar-based (Morojele et al., 2014; Pitpitan & Kalichman, 2016) and/or community based (Kalichman et al., 2008; Simbayi, 2010). However, a systematic review of HIV-alcohol risk reduction interventions in sub-Saharan Africa (Carrasco et al., 2016) has found mixed results regarding such interventions in reducing alcohol use, alcohol use in sexual contexts and unprotected sex. Most of the interventions that were effective were conducted in community settings, but many of their positive outcomes were often short-lived. Multilevel interventions that include structural components and policy changes have been identified as particularly essential for reducing sexual risk behavior (Pitpitan & Kalichman, 2016; Zajac et al., 2015).

In general, we did not find that demographic characteristics predicted numbers of episodes of unprotected sex, with the exception of relationship/marital status. Specifically, those who were in formal relationships reported more episodes of unprotected sex with both their main partners and their casual partners than single individuals. This is consistent with previous research that shows that married people are less likely to use condoms than single people (Shisana et al., 2014).

Despite its strengths, this study's findings should be interpreted with caution due to a few limitations. First, the information scale comprised only one item which may explain the finding that information was not significantly associated with the outcomes (number of episodes of unprotected sex). On the other hand, this result is consistent with that of numerous previous studies on this topic (Kalichman et al., 2002; Ybarra et al., 2013). Second, in line with other investigators (e.g., Walsh et al., 2011) we assessed actual past behavior as a proxy for behavioral skills, and hence, the measure did not take account the intended self-efficacy element of the behavioral skills construct. Third, the cross-sectional design precludes conclusions about the direction of the relationships. Indeed, in some instances, the number of episodes of unprotected sex (the dependent variable in this case) may give rise to specific perceptions regarding HIV prevention. For example, having failed to use condoms in the past, an individual may evaluate prospects of success negatively (behavioral skills), or may become demotivated to try to use condoms in the future (motivation). A fourth limitation relates to the relatively small number of women in the sample that precludes disaggregating the findings by sex. Future studies should be adequately powered for sex subgroup analyses to unpack gender differences, given the nature of gender dynamics in the South African context and their relationship to HIV (Jewkes & Morrell, 2010). A fifth limitation is that information regarding the number of episodes of sexual behavior and condom use was based on participants' memory which may have been affected by recall bias, particularly given the large time frame (i.e., 6 months) over

which participants were asked to recall their sexual behavior. Finally, participants' reports about their alcohol consumption and engagement in condomless sex may have been affected by their desire to seem to conform to conventional and contextual social norms in relation to these behaviors.

The results of this study suggest the need for further investigations of the role of alcohol within the IMB model in predicting bar patrons' unprotected sex, using questionnaires with more reliable measures, and larger samples of women to permit the disaggregation of the analyses by sex. Furthermore, both longitudinal and intervention studies that take into account IMB model constructs in conjunction with alcohol consumption, at both event and global levels, in predicting sexual risk behavior are much needed. We are aware of only a few previous such studies (Kalichman et al., 2002, 2006; Pitpitan et al., 2015; Simbayi et al., 2004), but none of them have included samples in rural areas in South Africa where people's attitudes, perceptions and behaviors regarding condom use, HIV and alcohol consumption tend to differ from those of people in urban locations (Simbayi et al., 2019). Furthermore, rural areas have fewer resources for interventions into alcohol and sexual risk behavior. Interventions to address alcohol consumption and sexual risk behavior are much needed in rural communities in South Africa and other parts of sub-Saharan African which have high rates of alcohol use, sexual risk behavior, and HIV infection (Shisana et al., 2014; UNAIDS, 2020; WHO, 2018).

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Ethical Approval

This study has been approved by the Research Ethics Committee of the South African Medical Research Council (protocol number EC 10–13). All procedures performed in this study involving human participants were in accordance with the ethical standards of the 1964 Helsinki Declaration and its later amendments of comparable ethical standards.

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Table 1

Sociodemographic characteristics

Variables	Categories	Total sample (*N*=406) *N* (%)	Male (*N* = 314) *N* (%)	Female (*N* = 92) *N* (%)	*p* value
Age (in years)	18–24	112 (27.6)	78 (24.8)[a]	34 (37.0)[b]	< 0.001
	25–29	105 (25.9)	88 (28.0)[b]	17 (18.5)[b]	
	30–34	90 (22.2)	60 (19.1)[a]	30 (32.6)[b]	
	> 34	99 (24.4)	88 (28.0)[a]	11 (12.0)[b]	
Education	≤grade 12	289 (71.5)	227 (72.5)	62 (68.1)	0.414
	>grade 12	115 (28.5)	86 (27.5)	29 (31.9)	
Relationship status	Single	297 (73.2)	221 (70.4)	76 (82.6)	0.020
	Non-single[†]	109 (26.8)	93 (29.6)	16 (17.4)	
Employment status	Employed	229 (56.5)	207 (66.1)	22 (23.9)	< 0.001
	Unemployed	176 (43.5)	106 (33.9)	70 (76.1)	

[†]Non-single category includes: married (n = 60), cohabiting (n = 39), separated (n = 2), divorced (n = 5), and widowed (n = 3)

[a,b]Proportions are significantly different at $p \leq .05$ level if superscript letters in male and female columns are different from each other

Table 2

Proportions for categorical variables and ranges, means, SD of scores for continuous variables

Categorical variable		**Total (*n* = 406)**		**Men (*n* = 314)**		**Women (*n* = 92)**		
		***N* (%)**		***N* (%)**		***N* (%)**	χ^2	***p*-value**
Information: condom use can reduce chance of HIV infection		361 (90.2)		273 (88.6)		88 (95.7)	3.96	0.047
Continuous variables	Range	Mean (SD)	Range	Mean (SD)	Range	Mean (SD)	*t*	
Behavioral skills	0–7	4.94 (1.94)	0–7	4.93 (1.97)	0–7	4.95 (1.86)	−0.08	0.934
Motivation	−24–24	10.81 (10.16)	−24–24	10.26 (10.29)	−24–24	12.70 (9.50)	−2.12	0.035
AUDIT score	0–37	12.74 (7.17)	0–37	13.79 (7.22)	0–27	9.17 (5.74)	6.38	< 0.001
Episodes of unprotected sex with main sexual partners in the past 6 months	0–504	36.50 (71.89)	0–504	41.08 (78.30)	0–224	22.77 (45.47)	2.44	0.015
Episodes of unprotected sex with casual sexual partners in the past 6 months	0–122	10.23 (47.39)	0–122	8.13 (18.00)	0–60	2.42 (10.11)	2.60	0.011
Episodes of sex under the influence of alcohol with main partners in the past 6 months	0–150	5.69 (15.15)	0–150	6.53 (16.92)	0–22	2.77 (4.75)	3.25	0.001
Episodes of sex under the influence of alcohol with casual partners in the past 6 months	0–296	5.82 (20.20)	0–296	7.13 (22.61)	0–40	1.27 (4.76)	3.997	< 0.001

Table 3

Correlations between predictor variables and each of the outcome variables

	1	2	3	4	5	6	7	8	9	10	11
1. Age											
2. Gender	0.16**										
3. Education level	0.05	0.04									
4. Relationship status	0.48**	−0.12*	0.06								
5. Employment status	0.22**	−0.36**	0.13**	.12*							
6. Behavioral Skills	−0.16**	0.00	0.22**	−13*	0.06						
7. Motivation	−0.18**	0.10*	0.14**	−17**	0.05	0.54**					
8. Information	−0.11*	0.10*	0.21**	−0.08	0.04	0.25**	0.28**				
9. AUDIT score	0.00	−0.27**	−0.14**	−0.01	0.08	0.04	-0.04	−0.09			
10. Sex under the influence of alcohol with main partners	0.13*	−0.78	0.05	0.15**	0.13*	−0.02	0.01	0.12*	0.18*		
11. Sex under the influence of alcohol with casual partners	0.19***	−0.23***	−0.08	−0.11*	0.09	0.08	0.01	−0.01	0.45*		
12. Unprotected sex with main partners	0.09	−0.15*	−0.15*	0.21**	0.11***	−0.39***	−0.22***	0.01	0.28***	0.22**	0.14*
13. Unprotected sex with casual partners	0.04	−0.19**	−0.03	0.16*	0.06	−0.29**	−0.32**	−0.09	0.18**	−0.27	0.31***

*$\rho \leq .05$

**$\rho \leq .01$

***$\rho \leq .001$

Table 4

Hierarchical regression results: Unprotected sex with main partners

Predictors	Variables	*β*	*t*	*p*-value	R^2	Adj. R^2	R^2 change	*F*	*p*-value
Step 1					0.08	0.06	0.08	4.69	< 0.001
Demographic factors	Age	−0.12	−1.83	0.068					
	Education	−0.03	−0.52	0.605					
	Gender	−0.05	−0.78	0.437					
	Employment status	0.06	0.93	0.352					
	Relationship status	0.17	2.78	0.006					
Step 2					0.21	0.18	0.12	8.56	< 0.001
IMB model variables	Behavioral Skills	−0.40	−6.21	< 0.001					
	Motivation	0.04	0.62	0.537					
	Information	0.04	0.80	0.425					
Step 3					0.24	0.21	0.03	9.19	< 0.001
Alcohol-related risk behavior	Sex under the influence of alcohol	0.13	2.36	0.019					
Step 4					0.29	0.26	0.05	10.64	< 0.001
Alcohol use	AUDIT score	0.24	4.27	< 0.001					

Table 5

Hierarchical regression results: Unprotected sex with all casual partner

Predictors	Variables	β	*t*	*p*-value	R^2	Adj. R^2	R^2 change	*F*	*p*-value
Step 1					0.05	0.03	0.05	1.95	0.088
Demographic factors	Age	0.01	0.12	0.903					
	Education	−0.02	−0.37	0.715					
	Gender	−0.11	−1.57	0.119					
	Employment status	−0.03	−0.42	0.673					
	Relationship status	0.12	1.71	0.089					
Step 2					0.19	0.15	0.14	5.24	< 0.001
IMB model variables	Behavioral skills	−0.21	−2.80	0.006					
	Motivation	−0.21	−2.79	0.006					
	Information	−0.02	−0.32	0.750					
Step 3					0.26	0.22	0.07	6.94	< 0.001
Alcohol-related risk behavior	Sex under the influence of alcohol	0.26	3.45	0.001					
Step 4					0.26	0.22	0.00	6.29	< 0.001
Alcohol use	AUDIT score	0.05	0.72	0.470					

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