

DETERMINANTS OF ALCOHOL RISK OF HARM PROFILES AMONG SOUTH AFRICAN CONSTRUCTION WORKERS

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Excessive alcohol consumption is a global public health concern. Aside of its adverse health effects, it is also associated with risky sexual behaviours and lower levels of HIV testing. Using data obtained from 450 workers drawn from 18 construction sites in the Western Cape, the Alcohol Use Disorders Identification Test (AUDIT) was used to predict alcohol risk of harm profiles as a function of demographic characteristics and sex-related behaviours among site-based workers. Logistic regression was used to determine factors associated with increased risk of alcohol harm. Determinants of alcohol risk of harm were (ordered from most to least proximal) frequency of alcohol or drug use before and/or during sex, attitude toward condom use, education, and HIV testing behaviour. The complexities associated with workplace interventions are highlighted.

Keywords: alcohol consumption; determinants; alcohol; risk of harm; site-based

INTRODUCTION

Excessive alcohol consumption has been identified as a global public health concern by the World Health Organisation (WHO 2018). In 2016, an estimated 5.3% of all global deaths and 5.1% of the global burden of disease and injury was determined to be associated with alcohol, as measured in disability-adjusted life years (DALYs). In South Africa, the burden of disease attributable to alcohol use has been estimated at 7.1% of all national deaths and 7.0% of total DALYs. Peltzer *et al.*, (2011) found that approximately 27.7% of all South Africans are frequent consumers of alcohol. Their study also showed that alcohol consumption differed by age, gender, population group, locality type, province, education, employment, and income status. Other behaviours linked to alcohol use are behaviours associated with an increased likelihood of HIV infection, such as the use of alcohol before or during sex, multiple and concurrent sex partnerships, and non-condom use (Parry *et al.*, 2010).

Health and safety is a major concern in construction. Potential hazards of working in the industry include working at elevated heights; exposure to the elements; the use of

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hand-held powered tools; as well as the operation of moving plant and equipment. The use of alcohol before or during work has been shown to cause serious accidents in the workplace and has also been linked to reduced productivity (Burnhams *et al.*, 2014). Furthermore, people who work in jobs involving physically taxing labour have been found to be more likely to have alcohol dependency problems than are persons who work in jobs that pose less physical risk (Lehman and Bennett 2002). Despite the physical nature of construction work, little is empirically known about alcohol consumption among employees in the SA construction industry. Thus, in this study, we sought to examine the predictive relationship between harmful alcohol consumption, demographic factors, and HIV-related health behaviours among workers in the South African construction industry.

LITERATURE REVIEW

Relationship Between Harmful Alcohol Consumption and HIV-related Health Behaviours

Baliunas *et al.*, (2009) investigated the association between HIV incidence and alcohol consumption, finding that, in general, alcohol consumption increased the risk of HIV infection. Specifically, alcohol consumers were found to have a 77% higher risk of acquiring HIV than did non-drinkers. Furthermore, those consuming alcohol prior to, or at the time of, sexual relations, were at an 87% increased risk. Parallel results were found in studies investigating the relationship between alcohol use and unprotected sexual behaviour among people living with HIV (PLHIV) (Shuper *et al.*, 2009). Similarly, in the construction industry, Bowen *et al.*, (2017) have found that workers reporting higher levels of alcohol and drug use also reported significantly higher levels of risky sexual behaviour.

Townsend *et al.*, (2010) demonstrated the link between harmful alcohol consumption and choice of sexual partner and found that problem drinkers were more likely to report having had at least one once-off sexual encounter in the past three months. Kader *et al.*, (2014) found that harmful alcohol consumption was significantly related to the health status of patients attending HIV clinics, with participants at medium to high risk of alcohol harm less likely to adhere to their anti-retroviral (ARV) treatment regimen. Based on this and other research evidence, the following hypotheses were postulated:

H1: Respondents that have previously had an HIV test are less likely to present with a moderate to high alcohol risk of harm profile.

H2: Respondents with a high negative attitude toward condom use are more likely to present with a moderate to high alcohol risk of harm profile.

H3: Respondents who frequently use alcohol or drugs before and/or during sex are more likely to present with a moderate to high alcohol risk of harm profile.

Relationship Between Harmful Alcohol Consumption and Demographic Factors in South Africa

Harmful alcohol consumption has been found to be associated with socio-demographic factors, including gender, relationship status, settlement type, age, occupation category, education, and income level. Nationally, the Western Cape has been identified as having the highest rates of harmful alcohol consumption (Adams *et al.*, 2014). Peltzer *et al.*, (2011) found that harmful alcohol consumption was higher among men than women across all nine South African provinces. They also noted that while harmful alcohol consumption did not differ across age groups for women, it

was significantly greater among males older than 20 years compared with males between 15 and 19 years.

Peltzer *et al.*, (2011) found that harmful alcohol consumption was significantly higher among Coloured men than among Black African men. Regarding education, men who had completed primary school, but who had not completed secondary school were more likely to be more harmful consumers of alcohol than men who had only primary education and men who had completed secondary school (Peltzer *et al.*, 2011). On the other hand, in the construction industry, Bowen *et al.*, (2014) found that higher levels of education were associated with higher levels of alcohol consumption among both male and female workers. The association between marriage status and alcohol risk of harm is not clear in South Africa, but it is possible that there is a significant association especially when considered within the national context of high levels of intimate partner violence and relationship power inequity (Jewkes *et al.*, 2010).

The association between employment status and harmful alcohol consumption is mixed. Despite this ambiguity, being employed was found to be more strongly associated with alcohol drinking than being unemployed (Walia *et al.*, 2021, Ragnarsson *et al.*, 2010). Based on existing research evidence, the following hypotheses were postulated:

H4: Age is positively associated with moderate to high alcohol risk of harm.

H5: Black Africans are less likely to have moderate to high alcohol risk of harm profiles compared to “Others”.

H6: Education is positively associated with moderate to high alcohol risk of harm.

H7: Respondents who are single are more likely to present with moderate to high alcohol risk of harm profiles compared to respondents in married/long-term relationships.

H8: Workers on permanent contracts are more likely to present with moderate to high alcohol risk of harm profiles compared to workers on casual or temporary contracts.

METHOD

Instrument and Measures

Field-administered survey questionnaires were used to collect data. Table 1 lists the variables, sample items, and point of scales. The questionnaire was based on an instrument originally developed by Bowen *et al.*, (2015) and in a modified and expanded form by Yakubu *et al.*, (2021). In all instances, higher scores indicate higher levels of the construct of interest. Alcohol risk of harm was assessed using the 10-item Alcohol Use Disorders Identification Test (AUDIT) (Saunders *et al.*, 1993). Negative attitudes towards condom use were measured using a 5-item scale (Roy *et al.*, 2013), and alcohol and drug use before and/or during sex was assessed using a 6-item scale (Turchik *et al.*, 2010).

In this study alcohol risk of harm was represented by a quantitative variable and so refers to a respondent's total AUDIT score. The AUDIT scores range from 0 - 40, with the following thresholds for level of alcohol risk of harm: 0-7 (low risk of harm); 8-15 (moderate risk of harm); 16-19 (high-risk or harmful level); and 20 or more (dependence likely). For the logistic regression, we compared low risk of harm against moderate to high risk of harm, and so the 4 categories were transformed into

two categories as follows: 0-7 (low risk of harm) versus moderate to high risk of harm (8 or more).

Table 1: Demographic, behavioural, and cognitive characteristics and scale items for composite variables (n=450)

Items and Constructs	Sample items	No. of items	Response options and point of scales
1. Demographic characteristics			
Age	-	-	Years
Ethnicity	-	-	'Black' African=1; 'Other'=2
Education	-	-	No formal school education=0; Completed primary school=1; Attended high school but did not complete matric=2; Completed matric=3; Attended university or college, but did not graduate=4; Graduated from university or college=5
Relationship status	-	-	Divorced, separated, widowed, or never married=0; Married or living with a partner=1
Work status	-	-	Casual=1; Contract=2; Permanent=3
2. Behavioural and Cognitive characteristics			
AUDIT alcohol risk of harm assessment (Scale score range: 0-40); $\alpha = .89$.	<i>'How often during the last year have you had a feeling of guilt or remorse after drinking?' [Q18]</i>	10	'Never'=0 to 'Daily or almost daily'=4
HIVAIDS testing status	<i>'Have you been tested for HIV?' [Q64]</i>	-	'Never tested'=0; 'Tested'=1
Attitude towards condom use (negative) (CN) (Scale score range: 5-25); $\alpha = .85$	<i>'Using condoms makes sex unenjoyable' [Q36c]</i>	5	'Strongly disagree'=1 to 'Strongly agree'=5
Alcohol and / or drug use before and / or during sex (AD) (Scale score range: 6-30); $\alpha = .84$	<i>'How often have you [your partner] used both alcohol and drugs before or during sex?' [Q44l and Q44o]</i>	6	'Never'=1 to 'Always'=5

Note: Question number references are given in parentheses.

Data Collection

Participants were drawn from 18 construction sites in the Western Cape, involving 7 construction firms. The purposive sample consisted of all male employees of each construction company present on site on the day scheduled for the visit by the field researchers. The survey questionnaire was available in three of the eleven official languages of South Africa, namely, Afrikaans, English and isiXhosa. These are the most-commonly spoken languages in the Western Cape region. A total of 576 questionnaires were administered and after accounting for missing data we had a usable dataset of 450 participants.

Data Analysis Methods

Confirmatory factor analysis (CFA) (weighted least square mean and variance adjusted (WLSMV) estimator) using Mplus 8 (Muthén and Muthén 2017) was first conducted to verify the factorial structure of measured items underlying the three latent variables. The WLSMV estimator makes no distributional assumptions about the observed variables. Five critical model fit indices were applied to determine the degree of model fit as follows: χ^2/df ratio (less than 4); the Tucker Lewis TLI (non-normed fit index (0.95 and greater)); Bentler CFI (comparative fit index (0.95 and

greater)); RMSEA (root mean square error of approximation (0.08 and less)); and the SRMR (Standardized Root Mean Square Residual) index (0.08 or less). A factor loading of 0.5 is minimally accepted, with a loading of 0.7 being considered satisfactory.

Once the factorial structure had been validated, the determinants of alcohol risk of harm as a function of demographic, behavioural, and cognitive characteristics were explored using logistic regression. Unweighted scale scores were developed for each of the AUDIT (10-items: range 0-40), negative attitude to condom use (5 items: range 5-25) and alcohol and drug use before or during sex (6 items: range 6-30). Higher scale scores indicate greater levels of the construct of interest. For the scale scores of each of the negative attitude to condom use and the alcohol and drug use before and/or during sex scales, a median-split method was used to position the responses for the scale into one of two (categorical) groups, namely, values falling below the median and values equal to or exceeding the median - specifically, low negative attitude to condom use versus moderate to high negative attitude; and low use of alcohol and drugs before and/or during sex versus moderate to high use. Logistic regression does not make assumptions concerning the distribution of scores for the predictor variables but is sensitive to high correlations among predictor variables.

FINDINGS

Sample Characteristics

All participants were male, aged 18-67 years ($M=35.4$; $Md=34$). More than half ($n=268$; 59.6%) had at most primary school level education, were single ($n=230$; 51.1%), and were "Black" African ($n=262$; 58.2%). A majority were permanent staff ($n=213$; 47.3%), 182 (40.4%) were employed on a contract basis, and 55 (12.2%) were casually employed. A minority ($n=128$; 28.4%) had never had an HIV test, approximately half ($n=223$; 49.6%) held high negative attitudes to condom use, and nearly half ($n=222$; 49.3%) indicated moderate to high use of alcohol and drugs before or during sex.

Regarding alcohol consumption, nearly half ($n=221$; 49.1%) of the survey participants reported that they never consume alcohol. Including these abstainers, a total of 334 (74.2%) participants were classified according to the AUDIT thresholds as low risk (score <8). The at-risk workers were categorized as follows: 18.7% ($n=84$) at medium risk (score 8-15); 3.3% ($n=15$) at high risk (score 16-19); and 3.8% ($n=17$) at very high risk (score 20+). Of the 229 (50.9%) workers who reported using alcohol, 32 (14.0%) (score 16+) may be categorized as being at high-to-very high risk. In summary, 25.8% ($n=116$) (score 8+) of construction participants may be classed as engaging in harmful alcohol consumption

Confirmatory Factor Analysis

Output indices for the 21-item, 3-factor model indicated a good fit to the data (χ^2/df ratio = 2.995; TLI = .956; CFI = .961; RMSEA = .067 CI 90% (.060 - .073); and SRMR = .086. All items loaded strongly onto their respective factors ($> .7$), and all factor loadings were statistically significant ($p < .001$). No modifications were necessary, and the dimensionality of the model was deemed tenable.

Logistic Regression Analysis

None of the correlations among the predictor variables were high, with the vast majority being small. Based on the hypotheses, a binary logistic regression analysis

was specified and tested. A test of the full model against a constant-only model was statistically significant, indicating that the predictors, as a set, reliably distinguished between workers who had low alcohol risk of harm profiles from those with moderate to high alcohol risk of harm profiles ($\chi^2 = 53.716, p < .001$ with $df = 12$). The -2 Log Likelihood was 295.621. The Hosmer and Lemeshow Goodness-of-Fit test ($\chi^2 = 6.165, p = .629$ with $df = 8$) indicated a good fitting model. A summary of the testing outcomes of the hypothesized relationships is presented in Table 2.

Statistically significant unique contributions were made by education ($\chi^2 = 6.282, p < .05$ with $df = 1$), HIV tested or not ($\chi^2 = 5.049, p < .05$ with $df = 1$), a negative attitude to condom use ($\chi^2 = 8.199, p < .01$ with $df = 1$), and alcohol and drug use before and/or during sex ($\chi^2 = 25.015, p < .001$ with $df = 1$). Age, ethnicity, relationship status, and work status failed to make a uniquely statistically significant contribution to the prediction of alcohol risk of harm.

Table 2: Summary of hypothesis testing

Hypotheses	Results
H1: Respondents that have previously had an HIV test are less likely to present with a moderate to high alcohol risk of harm profile.	Partially Supported*
H2: Respondents with a high negative attitude toward condom use are more likely to present with a moderate to high alcohol risk of harm profile.	Supported
H3: Respondents who frequently use alcohol or drugs before and/or during sex are more likely to present with a moderate to high alcohol risk of harm profile.	Supported
H4: Age is positively associated with moderate to high alcohol risk of harm.	Not Supported
H5: Black Africans are less likely to have moderate to high alcohol risk of harm profiles as compared to "others".	Not Supported
H6: Education is positively associated with moderate to high alcohol risk of harm.	Supported
H7: Respondents that are single are more likely to present with moderate to high alcohol risk of harm profiles as compared to respondents in married/long-term relationships.	Not Supported
H8: Workers on permanent contracts are more likely to present with moderate to high alcohol risk of harm profiles as compared to workers on casual or temporary contracts.	Not Supported

* The association between alcohol use and HIV testing behaviour was confirmed, but respondents that have previously had an HIV test were found to be more likely to present with moderate to high alcohol risk of harm profile than were their counterparts.

The odds of being classified at low risk of alcohol harm is 2.4 times higher among male construction workers who have completed or been exposed to primary school education compared to those who have completed or been exposed to secondary or tertiary level education. A worker who has never had an HIV test is 1.9 times more likely than a worker who has had an HIV test to be classified at low risk of alcohol harm compared to moderate or high risk. The odds of being classified at low risk of alcohol harm is almost two times higher among male construction workers who hold a low negative attitude towards condom use compared to those who hold a high negative attitude towards condom use.

Finally, workers who report low levels of alcohol and drug use before and/or during sex were found to be 3.3 times more likely than workers indicating moderate to high use of alcohol and drug use before and/or during sex to be classified at low risk of alcohol harm. No significant differences were noted between the categories of age, ethnicity, relationship status, and work status in contrast to their respective reference groups in relation to alcohol risk of harm classification.

DISCUSSION

Our research goal was to develop an approach to profile male workers in terms of their alcohol consumption that is data-driven, informative for programming interventions, and potentially applicable in other contexts.

Moderate to high alcohol risk of harm was predicted by (in order of most to least proximal): a worker's frequency of alcohol or drug use before and/or during sex, their (negative) attitude toward condom use, level of education, and their HIV testing behaviour. A worker's age, ethnicity, relationship status, or work status makes no difference in differentiating between low and moderate to high risk of alcohol harm prediction profiles.

Of the five demographic factors included in the predictive model, only level of education was found to be associated with alcohol risk of harm. This aligns with Bowen *et al.*, (2014), who observed a significant predictive pathway between alcohol consumption and education among construction workers in the Western Cape.

The link between education and alcohol use warrants further investigation, however, as it is possible that higher levels of education are associated with greater levels of disposable income and so an increased ability to purchase alcohol, especially in extreme and harmful volumes. Moreover, given that this finding aligns with previous research in the Western Cape construction industry (Bowen *et al.*, 2014), a further implication of this finding is that alcohol risk of harm reduction interventions in the workplace (at least at a provincial level) need to specifically target workers with higher levels of education.

All three behavioural and cognitive factors included in the model were found to be significantly associated with alcohol risk of harm. Harmful alcohol use has been previously linked to HIV transmission in sub-Saharan Africa. A significant positive association has been found between alcohol use, risky sexual behaviour, and HIV infection across multiple settings (see Morojele *et al.*, 2013). The literature also suggests that people who consume higher levels of alcohol will be less likely to undertake voluntary HIV testing (Peltzer *et al.*, 2010). Our study confirms the association between alcohol use and HIV testing behaviour; however, it also offers an interesting insight over previous research. Specifically, we observe that workers who reported that they had previously had an HIV test were more likely than workers who had never had an HIV test to present with a moderate to high risk of alcohol harm profiles. While this association may appear to be counter-intuitive, it may be partly explained by sex-related alcohol expectancies (see Celio *et al.*, 2016).

An association was detected between possessing a negative attitude towards condom use and risk of alcohol harm. Respondents with higher negative attitudes towards condom use were determined to have higher odds of having a moderate to high risk of alcohol harm profile than did those who had more positive attitudes towards condom use. This corresponds with the findings of Townsend *et al.*, (2010).

The behaviour with the strongest effect size of association on alcohol risk of harm was determined to be the use of alcohol or drugs before and/or during sex. This corresponds with the findings of Bryan *et al.*, (2007).

CONCLUSIONS

This study has several implications for policy and practice. First, given that there are not many South African workplace interventions that address substance abuse (alcohol and drugs) and HIV in a single programme (see Burnhams *et al.*, 2013), this study provides an evidence base for an intervention formulated on the growing understanding of the nexus between substance abuse and HIV. Such interventions should include risk of alcohol harm messages embedded in a wider health promotion

framework which focuses on topics such as HIV, sexual and reproductive health, and other aspects of wellness.

Second, despite the need to target ‘at-risk’ groups, the lack of association of demographic factors including age, ethnicity, relationship status, and work status with the measure of risk of alcohol harm, is an indication that interventions need to expand their scope beyond simply identifying and targeting at risk demographic groups. Further research is needed to examine the clustering of multiple behaviours, and in particular the association of cognitive and behavioural factors with harmful alcohol use.

Finally, the psychometric approach to evaluating alcohol risk of harm using AUDIT allows for greater confidence in the use of the scale across additional regions in Southern Africa to assess and diminish the pervasive effects of alcohol abuse.

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