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ORIGINAL ARTICLE

Identifying Alcohol Problems and Selected Individual and Contextual Risk Factors Among Adults in South Africa: Findings from the International Alcohol Control Study

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Abstract Many drinkers globally are at risk of developing an alcohol use disorder (AUD). The study aimed to identify the extent of AUDs and associated individual and societal-level risk factors or vulnerabilities among adult drinkers in a country with high levels of heavy episodic drinking. A household survey was conducted in the Tshwane Metro, South Africa, using multistage stratified cluster random sampling. Complete data were available on 949 adult drinkers. Half (49%) reported symptoms of alcohol problems, as a proxy for AUDs, as measured using the RAPS4. Gender and age were not associated with symptoms of alcohol problems. White persons had 74% lower odds of symptoms of alcohol problems compared to Black Africans, and persons who reported stressful life events in the past 6 months were four times more likely to report symptoms of alcohol problems. Persons whose primary drinking location was a pub/bar/tavern and "other club" were more than twice as likely to have

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symptoms of alcohol problems than persons who drank at home, and persons whose primary beverage was wine were 74% less likely to have symptoms of alcohol problems compared to beer drinkers. The findings raise important implications regarding particular vulnerabilities experienced by Black Africans; the sale of alcoholic beverages, and especially beer, in locations such as pubs/bars/taverns; and the need for more comprehensive epidemiological research to assess the nature and extent of AUDs in South Africa together with focused contextual research on particular groups at risk.

Keywords Alcohol use disorders · Problem drinking · Drinking location · Beverage type

Globally, the 1-year prevalence of alcohol use disorders (AUDs) in persons aged 15–64 years was estimated to be 6.3% in 2004, ranging from 0.3% in the WHO Eastern Mediterranean region to 10.9% in the WHO Eastern European region (Rehm et al. 2009). A recent publication (Grant et al. 2017) assessed the extent of changes in AUDs in the USA among 12-month alcohol users, and a 35.7% increase in the prevalence of DSM-IV AUDs between 2001/2002 and 2012/2013 was noted, from 12.9 to 17.5%. Increases were highest among women, older adults, racial/ethnic minorities, and individuals with lower educational level and family income (Grant et al. 2017). The article concluded with a call for population and individual level interventions to reverse this trend, but fell short of suggesting specific interventions.

Over the past decade, the World Health Organization (WHO) has also been calling for stronger action by member states to reduce the harmful use of alcohol and has recommended that countries implement a basket of interventions, with most emphasis being given to increasing the price of alcohol, restricting marketing of alcohol and reducing availability (WHO 2010). WHO's *Global Status Report on Alcohol and Health 2014* (WHO 2014) proposes a conceptual model of alcohol consumption and negative health outcomes based on Rehm et al. (2010) and Schmidt et al. (2010). This model shows how alcohol-related negative outcomes are influenced by peoples' alcohol consumption as well as by individual and societal-level vulnerability factors. Alcohol consumption involves the volume of alcohol consumed and the pattern of drinking. Individual-level vulnerability factors include factors such as age, gender, familial factors, and socioeconomic status, and societal vulnerability factors include the level of development, culture, drinking context and alcohol production, distribution, and regulations. Among the most severe and frequent neuropsychiatric conditions caused by alcohol consumption are AUDs, with alcohol dependence being the most important category in terms of its public health impact (Rehm et al. 2010).

Reliable data on the proportion of the population (and drinkers specifically) at risk for developing an AUD are needed to inform health sector responses and identify risk factors for developing an AUD that might be amenable for intervention. As suggested by the model referred to above, in order to better understand causal factors and guide efforts to reduce the prevalence of AUDs, it is necessary not only to go beyond data on how much people are drinking and their pattern of drinking but also to look at individual vulnerability factors including their exposure to stressful life events and factors associated with drinking context that might affect their risk of acquiring an AUD, such as the types of alcoholic beverage consumed, where they drink, and the size of the container from which they drink. However, where studies have been published focusing on such factors they have typically been limited to developed countries.

Research has shown that a substantial part of alcohol-related harm is accounted for by the drinking context, including where the drinking occurs. One study conducted among young

Swiss men found that drinking volumes at own home, friends' homes, bars/pubs/taverns, discos/nightclubs, outdoor public places, and at special events were consistently significantly associated with the number of DSM-V AUD criteria (Studer et al. 2015). In contrast, drinking volumes at restaurants, when playing sport, during other leisure activities, in cinemas and theaters, and sporting events were not significantly associated with the number of DSM-V AUDs (Studer et al. 2015). Dawson (2000) in a national epidemiological study conducted in the USA found that, in comparison to persons without an AUD, persons with a DSM-IV AUD drank a greater proportion of their absolute alcohol intake in the form of beer and a lower proportion in the form of wine. The findings for spirits were less clear (Dawson 2000). With regard to the effect of container size on consumption and AUDs, research has shown that selling wine in lager container sizes is associated with increased consumption (Pechey et al. 2016) and symptoms of alcohol problems as measured by the CAGE questionnaire (McLoughlin et al. 2013). A study into the association between exposure to stressful life events using an adaptation of the Social Readjustment Rating Scale (Holmes and Rahe 1967) conducted in New Zealand found that persons with the highest exposure to stressful life events were more than twice as likely to have alcohol abuse/dependence (as measured by the Composite International Diagnostic Interview (CIDI)) than persons at the lowest level of exposure (Boden et al. 2014).

The South African arm of the International Alcohol Control (IAC) study (Casswell et al. 2012) allowed for investigating these issues further in a country with high levels of heavy episodic drinking among person who drink (WHO 2014). At 11.0 liters of absolute alcohol (ethanol) consumed per person 15 years and older per annum, South Africa has almost double the average per capita consumption of the WHO African region which includes all of Africa excluding the predominately Muslim countries in the extreme north of Africa (WHO 2014). However, 59.4% of South Africans report having abstained from drinking alcohol in the past 12 months (WHO 2014), implying that a minority of drinkers drink heavily and are at risk of developing an alcohol use disorder (AUD) (APA 2013).

The most recent epidemiological survey to assess the extent of alcohol use disorders in South Africa, using the CIDI (Kessler and Ustun 2004), was conducted between 2002 and 2004. The most prevalent lifetime psychiatric disorder identified was alcohol abuse (11.4%), with the lifetime prevalence of AUDs (alcohol abuse and dependence) being 14.0% (Stein et al. 2008). However, given the burden involved with assessing AUDs at a population level using diagnostic instruments such as the CIDI, screening instruments such as Alcohol Use Disorders Identification Test (AUDIT) (Babor et al. 2001) and the CAGE test (Ewing 1984) are frequently used to provide an estimate of the level of AUDs or hazardous/harmful drinking. The CAGE test was used as part of the 1998 South African Demographic and Health Survey (SADHS), where 27.8% of men and 9.9% of women were found to display symptoms of alcohol problems (Parry et al. 2005). The third South African National HIV, Incidence, Behavior and Communication 2008 survey, using the AUDIT, reported lower levels of hazardous and harmful drinking among 17.0% of men and 2.9% of females (Peltzer et al. 2011). More recently, the 2016 SADHS similarly found that 15.9% of men and 2.7% of women and 15 years and older displayed symptoms of alcohol problems, as indicated by the CAGE test (NDoH et al. 2017).

This study aimed to identify the extent of AUDs among adult drinkers and associated individual and contextual risk factors such as primary drinking location, type of alcoholic beverage consumed, size of drinking container, and exposure to stressful life events in the Tshwane Metropole of South Africa.

Methods

Design and Sampling

The data for this study are from the South African arm of the multicountry IAC study (Casswell et al. 2012). This cross-sectional study was conducted during 2014 in the City of Tshwane Metropolitan Municipality, located around the executive capital, Pretoria. It is located mainly within the province of Gauteng and overlaps into part of North West province. It consists of five regions and 76 wards, that is geopolitical subdivisions of municipalities used for electoral purposes. The rural northern region is the largest area of Tshwane, and it is there where the majority of persons who are young, poor, and unemployed live. Residents of the more prosperous southern regions have a better quality of life, increased access to rudimentary services, and better opportunities for employment (Sustainable Energy Africa 2006). The estimated population of Tshwane is 3.275 million (StatsSA 2017).

The study used a multistage stratified cluster random sampling design. There were four stages to the cluster random sampling involving sampling of wards (stage 1), enumeration areas (EAs) within selected wards (stage 2), households within selected EAs (stage 3), and study participants within selected households (stage 4). At stage 1, wards were the primary sampling unit for the survey. Wards were stratified by region and majority race group, and this resulted in three strata and selected proportional to the population size (18 to 65 years) within each stratum. The population information from the 2011 census was used. Overall, 35 of 105 wards were selected. At stage 2, EAs were the second sampling units. EAs were stratified by size into three strata based on the number of households (< 100, 100–< 150, 150+), and 396 EAs were selected. At stage 3, a fixed number of households (four, six, and eight adults, respectively) were selected by EA size to ensure the self-weighting of this stage. A total of 2468 households were selected for a team visit and a single adult from the eligible participants selected (stage 4).

Data were weighted to take into account the complex sampling design. The sampling weights took the survey design into account: the oversampling of non-black participants at stage 1 and the number of eligible adults in the household at stage 4. Response rates were also calculated at the ward level, and the final weight was the product of the proportional and realization weights. Post hoc stratification weighting was therefore applied to have the approximate census distribution in the sum of the weights across the 16 strata plus the total weight approximately equal to the census population of 2.9 million people of the Tshwane study area. Finite sampling correction information for each stage was setup for the survey design to improve precision.

Eligible participants had to have consumed alcoholic beverages in the past 6 months and be 18 to 65 years old. The target sample size of 2000 was determined by the IAC study (Casswell et al. 2012). The overall response rate was 78% (Parry et al. 2017).

Measures

We adapted the standard (English) IAC questionnaire then translated and back-translated it into seTswana and Afrikaans. The IAC questionnaire included various items, with those that are relevant to this paper being demographic factors (age, gender, total annual personal income, and marital status), alcohol consumption, symptoms of alcohol problems, and stressful life events.

Sociodemographic Variables *Age.* The participant's age was categorized into six categories: "18–19," "20–24," "25–34," "35–44," "45–54," and "55–65." *Gender.* Male and female. *Race* (ethnicity): Black African, White, Colored, and Asian/Indian. The terms "white," "black," and "Colored" refer to demographic markers and refer to people of European, African, and mixed (African, European, and/or Asian) ancestry, respectively. These markers were chosen for their historical significance. Their continued use in South Africa is important for monitoring improvements in health and socioeconomic disparities, identifying vulnerable sections of the population and planning effective prevention and intervention programs. *Marital status.* Married, co-habiting, never married, divorced, separated, and widowed. *Total annual personal income.* The total annual personal income variable was categorized into low, medium, and high. The low category included persons making R30,000 or less; the medium category included persons making greater than R30,000 but less than or equal to R200,000, and the high category included persons making more than R200,000. In July 2017, US$1 = R13.412 [www.oanda.com].

Symptoms of Alcohol Problems Symptoms of alcohol problems were measured using the Rapid Alcohol Problems Screen 4 (RAPS4), a four-item screener designed to identify symptoms of alcohol abuse and dependence in emergency departments but which is also used in general populations (Cherpitel 2002). We adapted the RAPS4 to ask about the past 6 months instead of the usual past year because this was the period for drinking questions in the IAC study: (1) "have you had a feeling of guilt or remorse after drinking," (2) "has a friend or family member told you about things you said or did while you were drinking that you could not remember," (3) "have you failed to do what was normally expected of you because of drinking," and (4) "have you taken a drink when you first got up in the morning"? The four items with "yes" (score of 1)/"no" (score of 0) responses for symptoms of alcohol problems were combined into one dichotomous variable that separated participants who reported any symptoms of alcohol problems and those who did not, i.e., a cutoff of 1 or more (US recommended cutoff). The RAPS4 has sensitivity of 0.86 and specificity of 0.95, and it performs similarly across genders and racial/ethnic groups (Cherpitel 2000). Research has also shown that it outperforms the four-item CAGE questionnaire for alcohol dependence in general population samples (Cherpitel 2002). In research conducted in 13 countries, including South Africa, the RAPS4 was found to demonstrate good sensitivity and specificity for tolerance to absolute alcohol across most countries (Cherpitel et al. 2005).

Primary Drinking Location Primary drinking location was defined as the location in which the participant drank most frequently. The analysis selected the location where the participant consumed a greater volume of absolute alcohol if the participant reported drinking at two locations with the same maximum frequency. Additionally, the study selected the more exotic location if there were two locations with the same maximum frequency and volume. This happened infrequently. The new categorical primary drinking location variable retained 14 of the 17 original drinking locations (i.e., own home, someone else's home, nightclubs, sports clubs, other clubs, restaurants, motor, sports events, outdoors, shebeen (informal/unregistered alcohol outlet often a room in a house or backyard shack), pub/bar/tavern, hotels, special events, and other). The remaining three categories were not retained because no participants primarily drank in theaters, planes, and/or workplaces.

Primary Beverage Primary beverage was defined as the beverage the participant drank with maximum quantity (of absolute alcohol) at their primary location. The new primary beverage variable was categorical and retained 12 of the original 13 beverage types (i.e., beer; low-alcohol beer; homebrew beer; stout; wine; spirits; cocktails; liqueur; shooters; sherry, port, or vermouth; cider; and alcopops). The remaining category was not retained, because no participants drank "other beverages" with maximum quantity at their primary drinking location.

Primary Container Size This study defined primary container size as the usual container size of the primary beverage at the primary drinking location. Container size was categorized by volume of absolute alcohol into "one standard drink," "less than one standard drink," or "more than one standard drink." A standard drink in South Africa is 15 ml or 12 g of absolute alcohol (i.e., 330 ml for beer; 330 ml for low-alcohol beer; 500 ml for home brew beer; 330 ml for stout; 150 ml for wine; 30 ml for spirits; 30 ml for cocktails; 50 ml for liqueur; 25 ml for shooters; 50 ml for sherry, port, or vermouth; 330 ml for cider; 330 ml for other types of alcohol).

Stressful Life Events Participants were asked, "Have any big changes or stressful events happened to you in the last six months?" Persons who answered "yes" were categorized as having had stressful life events, and those who answered "no" were categorized as not having had stressful life events. This was one of many confounding variables included in the questionnaire, and to limit the length of the overall questionnaire, only one question was asked on this issue.

Procedures After obtaining informed consent, participants were interviewed in their homes by trained interviewers. Interviews were administered on a tablet. This approach was adopted due to the complexity of the questionnaire. The mean and the median length of interviews were 34 and 25 minutes, respectively, and interviews ranged in length from 5 to 72 minutes. After the interview, participants received a resource card for alcohol-related problems as well as a shopping or a cellular telephone recharge voucher worth R30. The study was approved by the Research Ethics Committee of the South African Medical Research Council.

Data Analysis

Stata version 14.0 was used for the survey analysis (StataCorp 2015). First bivariate analyses were performed using weighted chi-squared tests to detect associations between symptoms of alcohol problems and the sociodemographic and alcohol consumption characteristics. Second, multivariate logistic regression was undertaken to test the hypotheses that alcohol problem symptoms differ by demographics, alcohol consumption characteristics, and stressful life events. The analysis selected variables with significant relationships with the outcome variables and key demographic variables using best subset variable selection methods without forcing variables into the model. Predictors for the model with the lowest Akaike information criterion (AIC) included age, gender, race/ethnicity, stressful life events, primary drinking location, and primary beverage. The multiple regression models were then repeated for subsamples of persons who consumed the four main types of alcoholic beverages (i.e., beer, wine, spirits, and cider) to determine whether the associations differed by beverage. The model for spirits failed to converge, so it was excluded from this analysis. The analysis assessed

multicollinearity by examining correlations between predictors. No two predictors had a correlation ≥ 0.5. Model fit was checked using Hosmer-Lemeshow's goodness of fit test, and all models indicated appropriate fit. *P* values less than 0.05 were considered statistically significant.

Of the total sample of 1975, alcohol consumption frequency data were missing for 987 participants over some of the 14 primary drinking locations and an additional seven participants did not report enough data to discern a primary drinking location. Three people did not know whether they experienced a stressful event in the past 6 months. Four hundred and thirty-three adults did not know or did not report total annual personal income. These participants were excluded from the analyses. The final sample size included 949 adults. Missing data occurred largely as a result of problems that initially occurred with the complicated programming of the software used in the tablets to handle the numerous skip patterns in the questionnaire.

Persons with missing consumption data tended to be younger ($F = 4.67$, $p = 0.002$) and female ($F = 4.71$, $p = 0.04$), and they were less likely to be separated ($F = 5.17$, $p = 0.001$). Persons with missing consumption data did not differ from persons with consumption data for race/ethnicity ($F = 2.18$, $p = 0.12$), income ($F = 0.02$, $p = 0.97$), or urbanicity ($F = 1.17$, $p = 0.29$). Participants with missing personal income data did not differ from the sample on gender ($F = 0.01$, $p = 0.92$) or heavy drinking status ($F = 0.29$, $p = 0.60$), but were more likely to be 18–19 years old ($F = 7.24$, $p = 0.001$) and married ($F = 49.11$, $p < 0.001$), and they were less likely to be Black African ($F = 10.07$, $p < 0.001$).

Results

The mean age in the sample was 35.7 years, 64.9% were male, and 77.6% were low income (Table 1). Forty-nine percent of the sample reported symptoms of alcohol problems (95% CI 40.4, 58.1%) as indicated by scoring ≥ 1 on the RAPS4. Responses on the RAPS4 were greatest for the question dealing with guilt/remorse (35% of persons on responding yes to any question), followed by the questions dealing with not remembering (31%), failing to do expected things (23%), and morning drinking (20%).

More males (54.8%) reported symptoms of alcohol problems than females (38.9%). Eighteen to 19 year olds, 20–24 year olds, 25–34 year olds, and 35–44 year olds were more likely to report symptoms of alcohol problems than 55–65 year olds. Black African (57.0%) and Colored (48.8%) participants were more likely to report symptoms of alcohol problems than white participants (16.8%), and never married drinkers (61.0%) were more likely to report symptoms of alcohol problems than married drinkers (34.2%). No differences were noted regarding symptoms of alcohol problems based on drinkers' income. While only 27.8% of the sample experienced a stressful event in the previous 6 months, these persons were more likely to report symptoms of alcohol problems (74.5%) than persons who did not experience such an event (39.5%).

Symptoms of alcohol problems were found to differ by primary drink container size, with symptoms increasing with container sizes larger than one standard drink. However, due to the size of the confidence intervals, these differences did not reach significance. Home (60.0%), someone else's home (15.0%), pubs/bars/taverns (14.1%), shebeens (2.7%), and nightclubs (1.9%) were the locations where people drank most frequently. Symptoms of alcohol problems were prominent among those who drank in all common primary drinking locations: pubs/bars/

Table 1 Characteristics of participants included in the sample and comparison by alcohol problem symptoms

	No alcohol problem symptoms[a] ($n = 461$) % (95% CI)	Alcohol problem symptoms ($n = 488$) % (95% CI)	p value[b]	F statistic	Total ($n = 949$) % (95% CI)
Gender			< 0.01	12.97	
Male	57.8 (52.1, 63.3)	72.2 (66.6, 77.2)			64.9 (60.9, 68.6)
Female	42.2 (36.7, 47.9)	27.8 (22.8, 33.4)			35.1 (31.4, 39.1)
Age			0.03	2.87	
18–19	5.0 (2.3, 10.5)	8.1 (4.8, 13.2)			6.5 (4.1, 10.3)
20–24	17.0 (11.4, 24.6)	19.8 (15.6, 24.9)			18.4 (14.9, 22.5)
25–34	24.8 (18.1, 32.9)	33.4 (28.4, 38.8)			29.0 (24.8, 33.7)
35–44	20.0 (15.7, 25.1)	19.6 (15.8, 24.2)			19.8 (16.8, 23.2)
45–54	17.7 (12.6, 24.3)	12.5 (9.2, 16.7)			15.1 (12.2, 18.7)
55–65	15.5 (10.4, 22.5)	6.6 (4.1, 10.4)			11.1 (7.8, 15.7)
Race/ethnicity			< 0.001	12.40	
Black African	62.7 (50.3, 73.7)	86.0 (79.9, 90.5)			74.2 (65.2, 81.5)
Colored	5.2 (3.4, 8.0)	5.1 (3.2, 8.2)			5.2 (3.8, 7.1)
White	30.0 (18.4, 44.8)	6.2 (3.4, 11.1)			18.3 (10.8, 29.3)
Asian/Indian	2.1 (0.6, 7.1)	2.6 (1.0, 7.0)			2.3 (1.0, 5.3)
Marital status			< 0.001	5.52	
Married	50.9 (40.0, 61.7)	27.4 (22.3, 33.1)			39.3 (32.7, 46.3)
Co-habitating	3.9 (1.9, 7.9)	8.3 (5.6, 12.1)			6.1 (4.2, 8.6)
Never married	32.7 (25.1, 41.4)	53.0 (46.4, 59.4)			42.7 (36.8, 48.8)
Divorced	4.1 (1.5, 10.5)	1.8 (0.9, 3.6)			3.0 (1.5, 5.7)
Separated	1.2 (0.6, 2.4)	1.5 (0.7, 3.3)			1.3 (0.7, 2.4)
Widowed	6.0 (3.2, 10.7)	7.3 (4.5, 11.6)			1.1 (0.5, 2.5)
Total annual personal income[c]			0.05	3.36	
Low	78.6 (68.9, 85.9)	76.7 (69.5, 82.7)			77.6 (71.9, 82.4)
Medium	11.1 (7.0, 17.2)	18.6 (14.1, 24.1)			15.0 (11.7, 19.1)
High	10.3 (6.1, 16.9)	4.7 (2.3, 9.4)			7.4 (5.0, 10.8)
Stressful life events[c]			< 0.001	37.24	
No	86.0 (79.5, 90.7)	57.9 (50.1, 65.3)			72.2 (65.4, 78.1)
Yes	14.0 (9.3, 20.5)	42.1 (34.7, 49.9)			27.8 (21.9, 34.6)
Container size[d]			0.02	4.25	
Below average	11.7 (7.0, 18.9)	5.4 (2.6, 10.8)			8.6 (5.4, 13.3)
Average	42.0 (35.4, 49.0)	33.1 (26.4, 40.5)			37.6 (33.2, 42.3)
Above average	46.3 (38.2, 54.7)	61.6 (54.0, 68.7)			53.8 (48.3, 59.3)
Primary location[e]			< 0.001	5.06	
Home	73.6 (63.1, 82.0)	46.0 (40.0, 51.8)			60.0 (52.2, 67.4)
Someone else's home	9.7 (4.9, 18.4)	20.5 (15.0, 27.4)			15.0 (10.5, 21.0)
Nightclub	1.6 (0.6, 3.8)	2.3 (1.0, 5.2)			1.9 (1.0, 3.8)
Sports club	1.5 (0.4, 5.8)	0.8 (0.2, 3.6)			1.2 (0.4, 3.3)
Other club	0.5 (0.2, 1.5)	1.7 (0.8, 3.5)			1.1 (0.6, 2.0)
Restaurant	1.1 (0.3, 3.5)	0.6 (0.2, 1.8)			0.9 (0.4, 1.9)
Motor vehicles	0.0 (0.0, 0.5)	0.5 (0.0, 3.8)			0.3 (0.0, 1.7)
Outdoors	1.5 (0.5, 4.5)	0.5 (0.2, 7.8)			2.7 (1.5, 5.0)
Shebeen	1.3 (0.4, 4.1)	1.8 (0.9, 3.2)			1.5 (0.9, 2.7)
Pub/bar/tavern	7.5 (4.6, 11.8)	20.9 (15.9, 26.8)			14.1 (11.1, 17.7)
Special events	1.7 (0.5, 6.2)	0.8 (0.3, 2.5)			1.3 (0.5, 3.0)
Other	0	0.1 (0.0, 0.9)			0.0 (0.0, 0.4)
Primary beverage[f]			< 0.001	4.62	
Beer	34.4 (27.2, 42.4)	57.6 (51.0, 64.0)			45.8 (40.3, 51.5)
Low-alcohol beer	2.3 (0.9, 5.5)	3.1 (1.2, 7.9)			2.7 (1.3, 5.4)
Home brew beer	0.4 (0.0, 3.5)	1.1 (0.4, 3.1)			0.8 (0.3, 1.8)
Stout	0.7 (0.2, 1.9)	0.7 (0.3, 1.8)			0.7 (0.4, 1.4)
Wine	22.4 (16.2, 30.2)	6.2 (3.4, 11.0)			14.4 (10.9, 18.9)

Table 1 (continued)

	No alcohol problem symptoms[a] ($n = 461$) % (95% CI)	Alcohol problem symptoms ($n = 488$) % (95% CI)	p value[b]	F statistic	Total ($n = 949$) % (95% CI)
Spirits	17.8 (9.1, 32.0)	10.4 (7.2, 14.8)			14.1 (8.7, 22.2)
Cocktails	0.3 (0.0, 2.5)	0			0.2 (0.0, 1.2)
Liqueur	0.7 (0.1, 2.7)	0.0 (0.0, 0.2)			0.4 (0.0, 1.4)
Shooters	0.4 (0.0, 3.1)	0			0.2 (0.0, 1.6)
Sherry, port, or vermouth	0.1 (0.0, 1.1)	0			0.0 (0.0, 0.6)
Cider	20.3 (14.3, 28.0)	19.3 (14.0, 25.9)			19.8 (15.9, 24.4)
Alcopops	0.2 (0.0, 0.9)	1.6 (0.0, 8.2)			0.9 (0.2, 3.9)

CI confidence interval

[a] Symptoms of alcohol problems defined using the RAPS-4. A positive score means the participant reported remorse, amnesia/blackouts, negative consequences on performance, and/or starters/eye openers

[b] p value based on a corrected weight chi-squared statistic transformed into a F statistic

[c] Total annual personal income was categorized as low for R30,000 or less, medium as greater than R30,000 but less than or equal to R200,000, and high as greater than R200,000

[d] Primary container size of the primary beverage consumed at the primary drinking location. Average container size defined as the survey response closest to one standard drink (12 g of absolute alcohol)

[e] The location in which (1) the participant drinks most frequently. If two locations of the same maximum frequency, the location where the participant consumes the greater quantity of absolute alcohol. If two locations of same maximum frequency and quantity, then the more exotic location

[f] The beverage in which the participant consumes the greatest quantity of absolute alcohol at the primary drinking location

taverns (73.0%), someone else's home (67.2%), nightclubs (58.5%), shebeens (56.2%), and home (37.7%). While only 0.9% of the sample primarily drank in motor vehicles, 87.2% of these persons had symptoms of alcohol problems. More persons whose primary drinking location was in someone else's home (67.2%) or in a pub/bar/tavern (73.0%) had symptoms of alcohol problems than persons who drank in their own home (37.7%). Beer (45.8%), cider (19.8%), spirits (14.1%), and wine (14.2%) were the most commonly consumed primary beverages at the primary drinking location, with symptoms of alcohol problems being higher for persons who primarily consume beer (61.8%) at their primary location than for persons who primarily consume wine (21.0%).

Table 2 summarizes the results of the multiple logistic regression, i.e., controlling for other variables. Persons reporting symptoms of alcohol problems did not differ from those not reporting symptoms on gender. White persons had 0.26 the odds of symptoms of alcohol problems as Black Africans, after adjusting for gender, age, stressful life events, primary beverage, and primary drinking location. Stressful life events strongly predicted symptoms of alcohol problems, with persons who reported stressful events in the past 6 months having 4.51 times the odds of symptoms of alcohol problems than persons who did not experience such an event. Primary location and beverage both predicted symptoms of alcohol problems. Persons who primarily drink in pubs/bars/taverns (OR = 2.36) and other clubs (OR = 4.81) had higher odds of symptoms of alcohol problems as compared to persons who primarily drink at home. However, persons who primarily drink wine at their primary drinking location had 0.26 times

Table 2 Multiple logistic regression of alcohol symptom problems

	Symptoms of alcohol problems[a]		
	AOR	95% CI	*p* value
Gender			
Male	Ref.		
Female	0.81	0.49, 1.36	0.41
Age			
18–19	1.56	0.58, 4.20	0.36
20–24	1.51	0.67, 3.42	0.30
25–34	1.85	0.71, 4.82	0.20
35–44	2.07	0.95, 4.52	0.07
45–54	1.61	0.75, 3.42	0.21
55–65	Ref.		
Race/ethnicity			
Black African	Ref.		
Colored	0.82	0.42, 1.62	0.56
White	0.26	0.11, 0.62	< 0.01
Asian/Indian	1.61	0.39, 6.74	0.49
Stressful life events[b]			
No	Ref.		
Yes	4.51	2.68, 7.62	< 0.001
Primary location[c]			
Home	Ref.		
Someone else's home	2.21	0.94, 5.22	0.07
Nightclub	1.60	0.54, 4.70	0.37
Sports club	0.56	0.06, 5.09	0.59
Other club	4.81	1.09, 21.26	0.04
Restaurant	2.14	0.25, 18.37	0.47
Motor	11.35	0.89, 144.71	0.06
Outdoors	2.95	0.81, 10.69	0.10
Shebeen	0.91	0.21, 3.99	0.90
Pub/bar/tavern	2.36	1.08, 5.17	0.03
Special events	0.94	0.16, 5.41	0.94
Primary beverage[d]			
Beer	(ref)		
Low-alcohol beer	0.69	0.14, 3.32	0.63
Home brew beer	3.83	0.34, 42.73	0.26
Stout	0.60	0.12, 2.88	0.50
Wine	0.26	0.10, 0.68	0.01
Spirits	0.72	0.33, 1.56	0.38
Liqueur	0.07	0.00, 1.11	0.06
Cider	0.51	0.24, 1.07	0.07
Alcopops	4.98	0.82, 30.31	0.08

AOR adjusted odds ratio, *CI* confidence interval, *Ref.* reference group

[a] Symptoms of alcohol problems defined using the RAPS-4. A positive score means the participant reported remorse, amnesia/blackouts, negative consequences on performance, and/or starters/eye openers

[b] Stressful life events in the past 6 months

[c] The location in which (1) the participant drinks most frequently. If two locations of the same maximum frequency, the location where the participant consumes the greater quantity of absolute alcohol. If two locations of same maximum frequency and quantity, then the more exotic location. Other locations were excluded because all participants who primarily drank there had symptoms of alcohol problems

[d] The beverage in which the participant consumes the greatest quantity of absolute alcohol at the primary drinking location. Cocktails, shooters, and sherry, port, or vermouth were excluded because no persons with symptoms of alcohol problems primarily drank these beverages

lower odds of symptoms of alcohol problems as compared to persons who primarily drink beer at their primary drinking location.

Table 3 summarizes symptoms of alcohol problems by three of the four main beverage types. When looking within primary beverages, symptoms of alcohol problems did not differ by gender. Among spirits drinkers, persons aged 18–19 years (AOR = 19.48) and 44–54 year olds (AOR = 8.38) had higher odds of symptoms of alcohol problems than did 55–65 year olds, and 44–54 year olds also had higher odds of symptoms of alcohol problems than did 55–65 year olds among cider drinkers (AOR = 38.14). Compared to Black Africans, Colored (AOR = 10.95) and Asian persons (AOR = 9.19) had higher odds of symptoms of alcohol problems among those who primarily drink spirits at their primary drinking location. Experiencing stressful life events in the past 6 months was a strong predictor for symptoms of alcohol problems among persons who primarily drink beer (AOR = 6.36), spirits (AOR = 2.97), and cider (AOR = 4.52). Primarily drinking at someone else's home (AOR = 11.38) or at a pub/bar/tavern (AOR = 4.29) was associated with symptoms of alcohol problems among persons who primarily drink cider. Among persons who primarily drink beer, primarily drinking outdoors (AOR = 38.91) and at other clubs (AOR = 7.03) predicted symptoms of alcohol problems when compared to persons who primarily drink at home.

Discussion

Half of the adult drinkers in Tshwane (49%; 55% of males and 39% of females) were identified as having symptoms of alcohol problems. This is almost three times the figure of 17.5% reported for the prevalence of DSM-IV AUDs among adults who had consumed alcohol in the USA in 2012/2013 (Grant et al. 2017). It is also almost three times higher than the national figure of AUDs reported in the previous SASH Survey in South Africa for drinkers and non-drinkers (Stein et al. 2008). However, if we correct for the fact that only about a third of people in national surveys report drinking (Parry et al. 2005; Peltzer et al. 2011), this comes out at roughly the same percentage of drinkers in the SASH Survey having AUDs. The level of problems drinkers identified by the RAPS4 was also slightly higher than expected based on findings (among drinkers) from the 1998 SADHS previous national studies using the CAGE test (Parry et al. 2005), higher than was found using the AUDIT questionnaire in a 2008 national AIDS survey (Peltzer et al. 2011), and substantially higher than was found among male and female drinkers in Gauteng province scoring ≥ 2 of the CAGE test in the 2016 SADHS (NDoH et al. 2017). If we had used the European Union (EU) cutoff on the RAPS4 of ≥ 2 instead of the US cutoff of ≥ 1 (Cousins et al. 2016), 30% of participants would have been identified as having symptoms of alcohol problems which would have brought the percentage to close to that reported by Peltzer et al. (2011), but still almost double that reported in the 2016 SADHS. A possible reason for the higher proportion of the sample being identified as having higher problem drinking in our survey comes from the fact that our survey went into depth on drinking behavior rather than asking a few questions as part of an omnibus survey (Probst et al. 2017). Our survey, furthermore, included only persons 18 and older, whereas the other surveys included persons 15, 16, and 17 years old. Our use of a 6-month timeframe for the RAPS4 should have had the effect of slightly reducing the proportion of respondents scoring above the cutoff as compared with what would have occurred had the standard reporting period of past 12 months been used.

Table 3 Multiple logistic regression predicting symptoms of alcohol problems by beverage type

	AOR	Beer ($n = 488$)		Spirits ($n = 94$)		Cider ($n = 196$)
		95% CI	AOR	95% CI	AOR	95% CI
Gender						
Male	Ref.		Ref.		Ref.	
Female	0.78	0.46, 1.32	0.45	0.13, 1.63	1.69	0.47, 6.04
Age						
18–19	1.18	0.23, 6.06	19.48*	1.70, 223.22	7.02	0.32, 155.69
20–24	1.04	0.33, 3.29	32.39	0.96, 1094.88	8.00	0.64, 100.46
25–34	1.36	0.46, 4.02	4.45	0.44, 44.89	11.90	0.89, 159.51
35–44	1.21	0.47, 3.11	4.28	0.61, 30.20	16.45	0.94, 288.29
45–54	0.90	0.36, 2.22	8.38*	1.13, 61.71	38.14*	2.79, 520.72
55–65	Ref.		Ref.		Ref.	
Race/ethnicity						
Black African	Ref.		Ref.		Ref.	
Colored	0.68	0.20, 2.36	10.95*	1.45, 82.54	0.51	0.11, 2.45
White	0.58	0.12, 2.81	0.40	0.08, 2.13	0.14	0.01, 1.99
Asian/Indian	0.43	0.03, 5.69	9.18*	1.17, 72.02	1.21	0.10, 14.83
Stressful events[b]						
No	Ref.		Ref.		Ref.	
Yes	6.36***	3.16, 12.82	2.97*	1.07, 8.26	4.52**	1.64, 12.42
Primary location[c]						
Home	Ref.		Ref.		Ref.	
Someone else's home	0.78	0.34, 1.74	5.21	0.56, 48.46	11.38**	2.79, 46.35
Nightclub	2.47	0.41, 14.88	0.53	0.08, 3.52	0.86	0.05, 15.09
Sports club	0.16	0.02, 1.52	–[d]		–[e]	
Other club	7.03*	1.22, 40.70	–[f]		–[e]	
Restaurant	–[d]		0.09	0.00, 1.80	–[d]	
Motor	–[d]		–[e]		–[f]	
Outdoors	38.91**	3.34, 452.92	–[d]		4.31	0.99, 18.77
Shebeen	0.69	0.14, 3.50	–[f]		2.53	0.09, 73.00
Pub/bar/tavern	1.94	0.66, 5.69	0.12	0.02, 0.82	4.29*	1.28, 14.34
Special events	0.95	0.02, 54.24	–[d]		1.77	0.08, 39.47
Other	–[d]		–[f]		–[d]	

AOR adjusted odds ratio, *CI* confidence interval, *Ref.* reference group

*$p<0.05$; **$p<0.01$; ***$p<0.001$

[a] Symptoms of alcohol problems defined using the RAPS-4. A positive score means the participant reported remorse, starter/eye opener, failing to meet responsibilities/performance, and/or amnesia/blacking out because of drinking

[b] Stressful life events in the past 6 months

[c] The location in which (1) the participant drinks most frequently. If two locations of the same maximum frequency, the location where the participant consumes the greater quantity of absolute alcohol. If two locations of same maximum frequency and quantity, then the more exotic location

[d] All participants in this cell reported symptoms of alcohol problems

[e] No participants in this cell reported symptoms of alcohol problems

[f] No observations in this cell

In terms of individual risk factors or vulnerabilities and their influence on AUDs, White persons had 0.26 the odds of symptoms of alcohol problems as Black Africans. This mirrors what was found in the SASH survey (Stein et al. 2008) and is unlikely to reflect any inherent racial difference, but rather other factors such as poverty, post traumatic stress, and stressful life events in general which are likely to be inordinately experienced by Black Africans in a

country like South Africa. In our study, income, which is likely to be highly correlated with race, was borderline in terms of being significantly associated with having symptoms of alcohol problems ($p = 0.05$) in the bivariate analyses. Research on AUDs in the USA similarly found a higher prevalence of AUDs among Black respondents as compared to Whites, no doubt linked to the education and income differences that were also reported in the US research (Grant et al. 2017).

Stressful life events strongly predicted symptoms of alcohol problems, with persons who reported stressful events in the past 6 months having almost five times the odds of symptoms of alcohol problems as compared to who did not experience such events. This finding is in line with Boden et al. (2014) who found that persons in New Zealand with the highest exposure to stressful life events had more than twice the odds of alcohol abuse/dependence compared to persons at the lowest level of exposure. Like Dawson (2000), we found that persons who primarily drank beer were more likely to have symptoms of alcohol problems than persons who primarily drank wine. This could be because beer is one of the least expensive sources of absolute alcohol and thus appealing to those whose primary goal is intoxication (Dawson 2000; Parry et al. 2014), or because of the greater amounts spent on marketing of beer as compared to other alcohol beverage types in South Africa (Econometrix (Pty) Ltd 2013) and elsewhere.

With regard to contextual or societal risk factors and vulnerabilities and their influence on AUDs, Studer et al. (2015) found that drinking in a number of venues including at home, at friends' homes, bars/pubs/taverns, discos night clubs, and outdoor public places was significantly positively associated with the number of DSM-V AUD criteria. Our research also found that persons who primarily drink in pubs/bars/taverns were more than twice as likely to have symptoms of alcohol problems as compared to persons who primarily drank at home. This possibly occurs because people often drink in rounds at bars or because there is social pressure to drink more in such venues, and it is generally more acceptable when drinking a lot to do so away from the family home.

From the bivariate analyses, we also found a non-statistically significant trend towards drinkers of alcoholic beverages in containers larger than one standard drink to be more likely to have symptoms of alcohol problems than persons consuming alcoholic beverages from containers of roughly one standard drink. We found that persons who drank from smaller than average container sizes were the least likely to have symptoms of alcohol problems. A likely explanation for this is that consuming alcoholic beverages in larger container sizes makes the absolute alcohol less expensive per unit consumed (Parry et al. 2014). One recently published paper on this issue (Russell and van Walbeek 2016) found that the shifting of annual excise tax increases by the producer to the consumer on 750-ml bottles of beer in South Africa is substantially lower than that on 330 ml (or 340 ml) cans and the six packs of such cans, resulting in lower levels of tax per unit of absolute alcohol on 750-ml bottles. This could also explain why our study found that symptoms of alcohol problems were generally higher among Black Africans, who are much more likely to drink beer in the large size containers. The recent decision by South African Breweries to stop selling its beer in 440-ml containers and instead move to 500 ml and 1 liter returnable bottles suggests a practice that could, based on our findings, increase the level of AUDs in South Africa and possibly even in the subregion where its reach has expanded considerably over the past decade. The governments should consider limiting the sale of beer in ever larger containers given the increased potential of harm that could occur.

The research is subject to a number of limitations, foremost of which being that the research was cross-sectional which makes it difficult to make inferences of causality. There might even be reverse causation, where, for example, persons with symptoms of alcohol problems could more likely to go to a pub/bar/tavern to drink rather than at home because they are less likely to be criticized by family members in such venues. The data are also specific to the Tshwane Metropole, and it is unknown whether the findings would generalize to other parts of South Africa, particularly rural areas. Furthermore, we relied on a single question to assess stressful life events, and it is possible that our findings might have differed had we used a more comprehensive measure such as the Holmes and Rahe Scale (Holmes and Rahe 1967). Given the finding that a single question on experiencing stressful life events was found to be significant in predicting AUDs, we recommend that future research explore this further using more comprehensive measures and also look at how different expectancies and life circumstances might influence answers to questions about stressful live events.

The definition of standard drinks in our question regarding container sizes is also not without its challenges as countries differ in terms of the volume of absolute alcohol in a standard drink, with a wide variation (8–20 g) noted in a review of data from 37 countries (Kalinowski and Humphreys 2016). Furthermore, within countries, individual drinkers are likely to be often unaware of the number of standard drinks that are in different containers and serving glasses. A review of the literature on alcohol labeling policies in 26 countries and the EU Union identified five elements as being of possible utility to consumers, one of which was serving size and serving per consumer. Only one country, Australia, was identified that requires the number of standard drinks of alcohol (10 g of absolute alcohol in that country) to be listed on containers containing alcohol (Martin-Moreno et al. 2013). Given the risk associated with drinking alcohol in containers with alcohol content greater than roughly one standard drink, this is something that should be considered in South Africa or countries with similar cultures of heavy episodic drinking.

The point has also been made that methods to determine AUDs using screening instruments such as the CAGE (Ewing 1984) or AUDIT (Babor et al. 2001) by design overestimate the prevalence of AUDs (Rumpf et al. 2002). In terms of future research, it is therefore recommended that prospective studies be undertaken using the longer CIDI (Kessler and Ustun 2004) to investigate risk factors for AUDs in more parts of South Africa. Given the finding of greater likelihood of having symptoms of alcohol problems when drinking in pubs/bars/taverns and other clubs, it is also recommended that further research look into how best to reduce harms associated with drinking in such establishments. While not statistically significant, we also found a tendency for drinkers of certain type of alcoholic beverages to be at risk for symptoms of alcohol problems (e.g., drinkers of malt and homebrewed beer and alcopops) and also persons aged 35–44. Further research may therefore also be justified in further investigating the risk profiles of these groups. In the Introduction, reference was made to a theoretical model used by the WHO (2014). Our research has supported the notion of certain individual and societal-level factors or vulnerabilities affecting harms associated with alcohol use, namely ethnicity, primary drinking location, and beverage type. Further research is also needed to investigate the influence of other factors articulated in the model on AUDs, such as familial factors, level of development, culture, marketing practices of alcohol companies, pricing, and taxation. In addition, further research into factors possibly increasing the vulnerability of Black African populations in South Africa to acquiring an AUD is warranted.

Conclusion

This is one of the only studies conducted in a developing country to investigate the link between factors other than demographic characteristics and symptoms of alcohol problems (as a proxy for AUDs). It showed that what a person drinks, where they drink, the size of the container they drink from, and their experience of stressful life events can be associated with their risk for alcohol-related problems. It also raises questions about whether alcohol beverage companies should be restricted from selling to customers in large size containers (e.g., quarts of beer), whether authorities should specifically target producers of certain beverage types (e.g., beer) and sellers of alcoholic beverages in specific outlet types (e.g., bars/pubs/taverns) to reduce risks of harm to individuals and to others, and whether it would be helpful to intervene to mitigate stressful events.

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Compliance with Ethical Standards

Conflict of Interest The authors declare that they have no conflict of interest,

Informed Consent All procedures followed were in accordance with the ethical standards of the responsible committee on human experimentation (institutional and national) and with the 1975 Declaration of Helsinki, as revised in 2000. Informed consent was obtained from all participants for being included in the study.

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