Prevalence of alcohol use, associated risk factors, and the impact on the HIV care cascade among adolescent girls and young women in South Africa: Findings from the HERStory Study

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Background. High rates of hazardous and binge drinking patterns have been identified among adolescent girls and young women (AGYW) in South Africa. AGYW also bear the highest burden of HIV/AIDS in the country, placing them at increased risk of negative outcomes for both HIV and alcohol.
Objectives. To estimate the prevalence of alcohol use and describe the patterns of use for AGYW enrolled in the HERStory Study. Secondary aims included identifying covariates of alcohol consumption and examining the impact of alcohol use patterns on the HIV care continuum.
Methods. We included all 4 377 AGYW (aged 15 - 24 years) enrolled in the HERStory baseline survey from six high HIV-risk districts. Alcohol consumption was assessed using the abbreviated Alcohol Use Disorders Identification Test, the AUDIT-C screening tool, with a score of ≥2 indicating hazardous drinking, while binge drinking was defined as consuming ≥6 drinks on one occasion at least monthly.
Results. Among participants, the median (interquartile range) age was 19 (17 - 21) years; 57.2% attended school, 82% were of low socioeconomic status and 66.3% self-reported as HIV negative. The prevalence of alcohol use was 32.2% and was highest among women aged 20 - 24 years (36.1%) and among those living in the Cape Town and Tshwane districts (52.8% and 51.6%, respectively). Of the 1 394 participants who reported ever drinking, 50.6% reported hazardous drinking and 22.7% binge drinking. Hazardous drinking was associated with residence in Cape Town district (odds ratio (OR) 2.25) and absence from school (OR 1.42) in univariate analyses. The odds of binge drinking were 2 - 7 times greater in all districts compared with King Cetshwayo in univariate analyses, and remained significant in the multivariate analysis. No association was found between hazardous or binge drinking and HIV care outcomes.
Conclusion. The prevalence of alcohol use was elevated in the population of young women aged 20 - 24 years. Hazardous and binge drinking patterns were common in most districts and among those not attending school. Efforts to address the risk of drinking in this age group could focus on increased screening of AGYW for alcohol use, and supporting school attendance and after-school activities.

Keywords: alcohol, adolescents, young women, HIV, South Africa

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Sub-Saharan Africa (SSA) has the second highest age-standardised attributable burden of disease for alcohol.[1] South Africa (SA) has the sixth-highest level of per capita daily alcohol consumption among drinkers globally.[2] A recent national survey found that 33.1% of the population have ever used alcohol, with one-third of all drinkers reporting binge and hazardous drinking patterns.[3] Among young adults aged 15 - 24 years, 25.2% consume alcohol. Binge drinking (defined in the study as consuming ≥5 drinks per session) was reported by almost half (47.9%) of the respondents.[3] Alcohol is an important contributor to the overall disease burden in SA, and is ranked fifth for overall causes of death and disability-adjusted life years.[4]

SA also has the largest HIV epidemic in the world, with a prevalence of 13.5% among the general population.[5] Although the distribution of HIV across the country is heterogeneous by geographical area, age, gender and population group, young women aged 15 - 24 years are disproportionately affected,[6] accounting for one-third of all new HIV infections in this subpopulation.[7] The prevalence of substance use (including alcohol) is also increasing in this age group.[8,9]

Coupled with the burden of HIV disease, alcohol use poses a threat to the success of HIV treatment and prevention programmes in SA.[10] This is despite the widespread access to antiretroviral therapy (ART) in the country, where 3.7 million people living with HIV are on ART, and mortality from AIDS continues to decline.[11]

Alcohol consumption increases the incidence of HIV infection, accelerates the progression of HIV disease and increases HIV-related mortality.[12,13] Adolescent girls and young women (AGYW) aged 15 - 24 years are at particular risk for poor HIV outcomes;[14]

therefore, identifying factors that create barriers for AGYW living with HIV to achieve viral suppression, maintain care engagement and prevent onward HIV transmission is crucial.

Research findings have demonstrated the harmful effects of alcohol use on the developing brain of adolescents, causing neurocognitive deficits and reducing sensitivity to motor impairment and aversion effects from alcohol, which may contribute to increased risk of future alcohol dependence, and is associated with drug dependence, antisocial behaviour and depression in adulthood.[15] With regard to HIV infection, alcohol use in adolescents is associated with an increased likelihood of condomless sex, suboptimal adherence to ART and pre-exposure prophylaxis and viral non-suppression, all of which contribute to HIV acquisition and ongoing transmission.[10,12,16] Alcohol has also been found to increase viral replication of HIV, impair the immune system and increase the risk of drug interactions and liver damage.[16] In addition, the cognitive function necessary to manage one's ART medication or negotiate safe sex is diminished under the influence of alcohol.[16]

Combination prevention strategies that target AGYW from high-risk communities are essential to reduce HIV incidence in SA and accelerate progress towards ending the HIV epidemic by 2030, in line with the country's Sustainable Development Goals.[17] The Joint United Nations Programme on HIV/AIDS (UNAIDS) 90-90-90 targets are key indicators for tracking the progress and impact of treatment and prevention programmes.[18] These targets represent percentages in a set of goals aimed at ending the HIV/AIDS epidemic. The aim of the first is for 90% of people living with HIV to know their status, the second for 90% of those diagnosed with HIV to be on ART, and the last for 90% of those on ART to achieve viral suppression.[19] Significant gaps exist for adolescents with regard to testing and access to ART. There are several biological, societal and structural factors that limit young women's ability to protect themselves from HIV, including gender inequalities, gender-based violence, transactional sex, poverty, stigma and discrimination.[19] Sex with older men who do not know their HIV status or use condoms, the absence of positive role models and the lack of social and structural support to remain in school, obtain employment and resist the use of alcohol and drugs are well-documented drivers of HIV in this young population.[19,20]

The HERStory Study was designed to evaluate a combination intervention, including behavioural, biomedical and structural HIV prevention programmes that address the unique challenges faced by AGYW, with the primary aim of reducing HIV incidence in this population. This study also enabled us to examine the prevalence and correlates of alcohol use among young women living in high HIV-risk communities.

The primary aim of this analysis was to estimate the prevalence and describe the patterns of alcohol use among AGYW enrolled in the HERStory Study. Secondary aims included identifying important sociodemographic covariates of alcohol consumption and examining the impact of alcohol use, particularly hazardous and binge drinking patterns, on the HIV care continuum.

Methods

Study design

Data for this analysis were collected as part of the HERStory Study, an evaluation of a combination of intervention programmes. The analysis used baseline data from the cross-sectional, representative household survey of AGYW aged 15 - 24 years living in 6 of the 10 districts in which the combination HIV prevention intervention was implemented: City of Cape Town (Western Cape Province); Ehlanzeni (Mpumalanga Province); OR Tambo (Eastern Cape Province); Tshwane (Gauteng Province); and King Cetshwayo and Zululand (KwaZulu-Natal Province). The survey was conducted between September 2017 and November 2018. The detailed study design has been described previously.[21]

A stratified cluster, with three stages of sampling design, was used to select individual households. Small-area layers (SALs) based on the 2011 census were targeted for the survey. These areas included 300 000 households, in which 120 000 AGYW resided. A simple random sample of SALs in the intervention areas of each district was selected, followed by a systematic random sample of 35% of the available households within each sample SAL to achieve the required sample size. All AGYW aged 15 - 24 years in sampled households were invited to participate.

Participants and procedures

All AGYW aged 15 - 24 years living in the selected subdistricts and enrolled in the HERStory Study were included in this analysis.[21] The inclusion criteria for the parent study were: AGYW aged 15 - 24 years residing in selected households; girls aged <18 years who gave assent to participate and were granted permission to participate by their primary caregiver; and willingness to participate in the study, undergo study procedures and provide written informed consent. The exclusion criteria used were: inability to provide written informed consent; inability to hear or speak; inability to speak English, isiZulu, isiXhosa, Northern Sotho, Sesotho, Tswana, Tsonga, siSwati, Sepedi or Afrikaans; and unavailability to participate between 08h00 and 21h00. The initial sample size was calculated to detect a 33% reduction in HIV incidence from a baseline of 3% or 4% over 2 years, and was estimated at 14 000. This sample would allow 80% power to detect the difference at an alpha of 5%. A final weighted sample size of 7 300 participants was used to account for the inclusion of only 6 of the 10 districts in the final analysis.

To assess alcohol consumption, the AUDIT-C screening tool – an abbreviated version of the 10-item Alcohol Use Disorders Identification Test (AUDIT) – was administered to AGYW.[22,23] The AUDIT-C tool comprises the first three items of the 10-item AUDIT instrument and measures self-reported alcohol consumption (Appendix Table S1). The AUDIT-C tool is comparable with the 10-item AUDIT in accuracy, with a reliability coefficient reported to range from 0.69 to 0.91, high sensitivity for alcohol dependence and similar performance for males and females at lower cut-off scores.[23] Its use has been evaluated in HIV care settings and across SSA contexts, where its quickness to administer increases the likelihood of use in busy primary healthcare clinics. It is brief, easy to score and has minimal risk of cultural bias.[23-25] The AUDIT-C has Likert-type response options (0 - 4) with a possible overall score of 12. The World Health Organization (WHO) recommends a cut-off score of ≥3 for women and ≥4 for men to indicate hazardous alcohol use, and defines binge drinking as consuming ≥6 drinks on one occasion, monthly or more frequently. For this analysis, we used cut-off scores of ≥2 for women. This was based on recommendations from a study conducted in SA that found that this lower cut-off score was optimal in the SA context.[25] Binge drinking was defined using the WHO-recommended definition. Cronbach's alpha was calculated to determine the reliability of each of the AUDIT-C items, yielding a value of 0.79 in this sample.

Data analysis

Descriptive statistics were used to summarise the prevalence of alcohol use (defined as self-reported ever drinking), the prevalence of hazardous and binge drinking (based on the AUDIT-C questionnaire responses (Appendix Table S1)), sociodemographic factors and

HIV outcomes, including HIV status, ART initiation and viral suppression. Prevalence was summarised overall and stratified by two age categories (15 - 19 years and 20 - 24 years) to account for evidence of differences in alcohol use between the two age groups, with frequency of use and alcohol-related harm increasing as adolescents move into early adulthood.[26] Prevalence was compared across these strata using the χ^2 test. Categorical data were summarised using frequencies, and continuous data using medians and interquartile ranges (IQRs).

Logistic regression models were used to examine the impact of the sociodemographic variables collected at baseline on alcohol use prevalence. All variables that were statistically significant in univariate analyses ($p<0.05$) were included in the multivariable models. Unadjusted odds ratios (uORs) and adjusted odds ratios (aORs) with 95% confidence intervals (CIs) were calculated for age, district and socioeconomic status (SES). SES was assessed using structured electronic questionnaires administered by trained fieldworkers. The questionnaire incorporated categorical variables related to SES. A participant's SES group was determined using cluster analysis with the K-modes algorithm.[21] School attendance was defined as a self-reported binary variable indicating whether the participant was currently attending school or not. HIV status was either self-reported or confirmed through laboratory testing using dried blood spots (DBSs) for consenting participants.

To examine the impact of alcohol use on the HIV treatment cascade (diagnosis, ART initiation and viral suppression), we compared outcomes between drinkers and non-drinkers, hazardous and non-hazardous drinking and binge and non-binge drinking. The χ^2 test for correlation was used to assess correlations between hazardous drinking or binge drinking and the HIV treatment cascade variables (HIV status, adherence to ART and viral load suppression). Participants who self-reported HIV-positive status and had a positive laboratory-based HIV test were defined as knowing their status, corresponding to the first 90% in the UNAIDS targets. Those who knew their HIV-positive status and had laboratory evidence of being on ART were considered to have been initiated on ART, corresponding to the second 90% in the UNAIDS targets. Antiretroviral testing was performed on DBS samples using high-performance liquid chromatography coupled with tandem mass spectrometry for ARTs used in either first- or second-line regimens in the public sector. Participants with laboratory evidence of ART and a suppressed viral load were considered virally suppressed, corresponding to the last 90% in the UNAIDS targets. Viral suppression was defined as a viral load <1 000 copies/mL.

Statistical analysis was conducted using Stata 15 (StataCorp, USA).

Ethical considerations

The study was approved by the South African Medical Research Council (SAMRC) Research Ethics Committee (ref. no. EC036-11/2016). It was also reviewed in accordance with the US Centers for Disease Control and Prevention (CDC) human research protection office, and determined to be research. However, CDC investigators did not have access to personally identifiable data or specimens collected for research purposes. The research protocol for this sub-analysis was submitted to the Human Research Ethics Committee of the Faculty of Health Sciences at the University of Cape Town. Approval was obtained on 31 January 2024 (ref. no. 899/2023).

Results

Participant characteristics and prevalence of alcohol use

Of the 4 399 AGYW aged 15 - 24 years who participated in the baseline survey of the HERStory Study, 4 377 (99.5%) were included in this analysis after deduplication (Fig. 1).

The median (IQR) age of participants was 19 (17 - 21) years. Young girls (15 - 19 years) accounted for 57% of all study participants. A higher proportion of women aged 20 - 24 years reported ever drinking than those aged 15 - 19 years (37.2% v. 29.7%). School attendance was reported by 57.2% of participants. Most participants (82%) were of relatively low SES, as defined in the main study.[21] HIV-positive status was confirmed in 13% of participants (Table 1).

The overall prevalence of alcohol use in this study was 32.2%. The highest proportion of those who reported ever drinking was in the urban districts of Cape Town (52.8%) and Tshwane (51.6%). Participants who attended school (71.2%) and those of relatively low SES (69.7%) were more likely to be non-drinkers. No differences were observed in drinking status across the HIV treatment cascade variables (Table 1).

Prevalence of hazardous drinking overall

The overall prevalence of hazardous drinking (AUDIT-C score ≥2) was 17.0%. Hazardous drinking, compared with non-hazardous drinking, was more common among older women (median (IQR) 20 (18 - 22) years) and those living in Cape Town (33.5%) and Tshwane districts (28.2%). Participants who attended school (13.6%) were less likely to be hazardous drinkers than those who did not (21.6%). Participants of high SES were more likely to be hazardous drinkers (24.3%) than those of low SES (15.4%). No differences in hazardous drinking status were observed by HIV status, ART exposure or HIV viral load suppression (Table 2).

Prevalence of binge drinking overall

Binge drinking had an overall prevalence of 7.2% (317/4 377) among all participants, and 23.9% (317/1 322) among all drinkers. Binge drinking, compared with non-binge drinking, was more common for participants living in Cape Town (39.9%) and Tshwane (28.8%) districts ($p<0.001$). A greater proportion of binge drinkers (26.7%) did not attend school than non-binge drinkers (21.3%) ($p=0.021$) (Table 2).

Logistic regression results

In the univariate analysis, hazardous drinking was strongly associated with residence in the Cape Town district compared with King Cetshwayo (OR 2.25, 95% CI 1.36 - 3.72, $p=0.002$) and with non-attendance of school (OR 1.42, 95% CI 1.11 - 1.82, $p=0.006$). When adjusting for age and school attendance in multivariate analysis, residence in Cape Town remained associated with hazardous drinking (OR 1.84, 95% CI 1.03 - 3.27, $p=0.002$). School attendance was not significantly associated with hazardous drinking in the multivariate regression analysis (Table 3).

In univariate analysis, binge drinking was positively associated with all districts compared with King Cetshwayo, non-attendance of school (OR 1.42, 95% CI 1.06 - 1.91, $p<0.05$) and high SES (OR 1.46, 95% CI 1.06 - 2.02, $p<0.05$). No association was found for HIV status, ART or viral load suppression.

In multivariate analysis, the odds of binge drinking remained 2 - 6 times higher in all districts compared with King Cetshwayo, keeping all other variables constant. However, there was no difference in the odds of binge drinking by SES or school attendance after adjustment for district (Table 3).

Relationship between HIV treatment cascade and drinking status

Of the 462 participants who both had a positive HIV laboratory test and had self-reported their HIV status, 283 had diagnosed HIV. More than half (61.3%) of the participants in this study correctly

self-reported their HIV status. Of those who knew their HIV status, 80.8% had evidence of being on ART. Viral load suppression among those on ART was 91.8%. No significant differences in hazardous or binge drinking were identified for self-reported HIV, ART exposure or viral load suppression (Table 4).

Discussion

In this study, we found a high prevalence of alcohol consumption – characterised by hazardous and binge drinking patterns – among AGYW living in six high HIV-incidence districts in SA. The proportion consuming alcohol was largest among those aged 20 - 24 years. Hazardous and binge drinking patterns were strongly associated with district and school attendance, but not with SES. Notably, HIV status and HIV care (being on ART or virally suppressed) were not associated with hazardous or binge drinking patterns in either age group.

Our estimates of alcohol consumption are consistent with global and regional data. The WHO estimates that global alcohol use prevalence among adolescents aged 15 - 19 years is 26.5%, with much higher rates in the European region (43.8%), the Americas (38.2%) and the Western Pacific region (37.9%).[2] A 2018 meta-analysis by Olawole-Isaac *et al.*[27] estimated alcohol use in SSA at 32.8%, but with significant regional variation. Southern Africa had the highest proportion of alcohol use among adolescents (40.8%), and West Africa the lowest (28.2%).[27] This finding for southern Africa is higher than reported by SA studies. A recent national survey in SA reported a prevalence of 33.1% in all adults, and 25.2% in females aged 15 - 24 years.[3] Other studies in SA conducted between 2011 and 2018 reported findings ranging between 21.3% and 29.7% for adolescent females.[28-30] Comparing results across different studies is challenging owing to the use of different age groupings and varying measures of alcohol consumption levels. However, what is evident is that the proportion of people who use alcohol is substantial, and appears to be increasing, particularly among young women.[9]

Consistent with findings from global and local studies,[2,3,28-30] hazardous and episodic drinking patterns were common among adolescent females. In the 2018 global status report on alcohol and health,[2] the WHO reported high levels of heavy episodic drinking (HED), defined as ≥60 g of pure alcohol on at least one occasion at least once per month, in adolescents. In this report, HED in SSA was lower among those aged 15 - 19 years (12.7%), and peaked among those aged 20 - 24 years (20.8%), compared with the total population (17.4%).[2] Although HED levels are declining, Eastern Europe and SSA continue to report very high levels, with HED

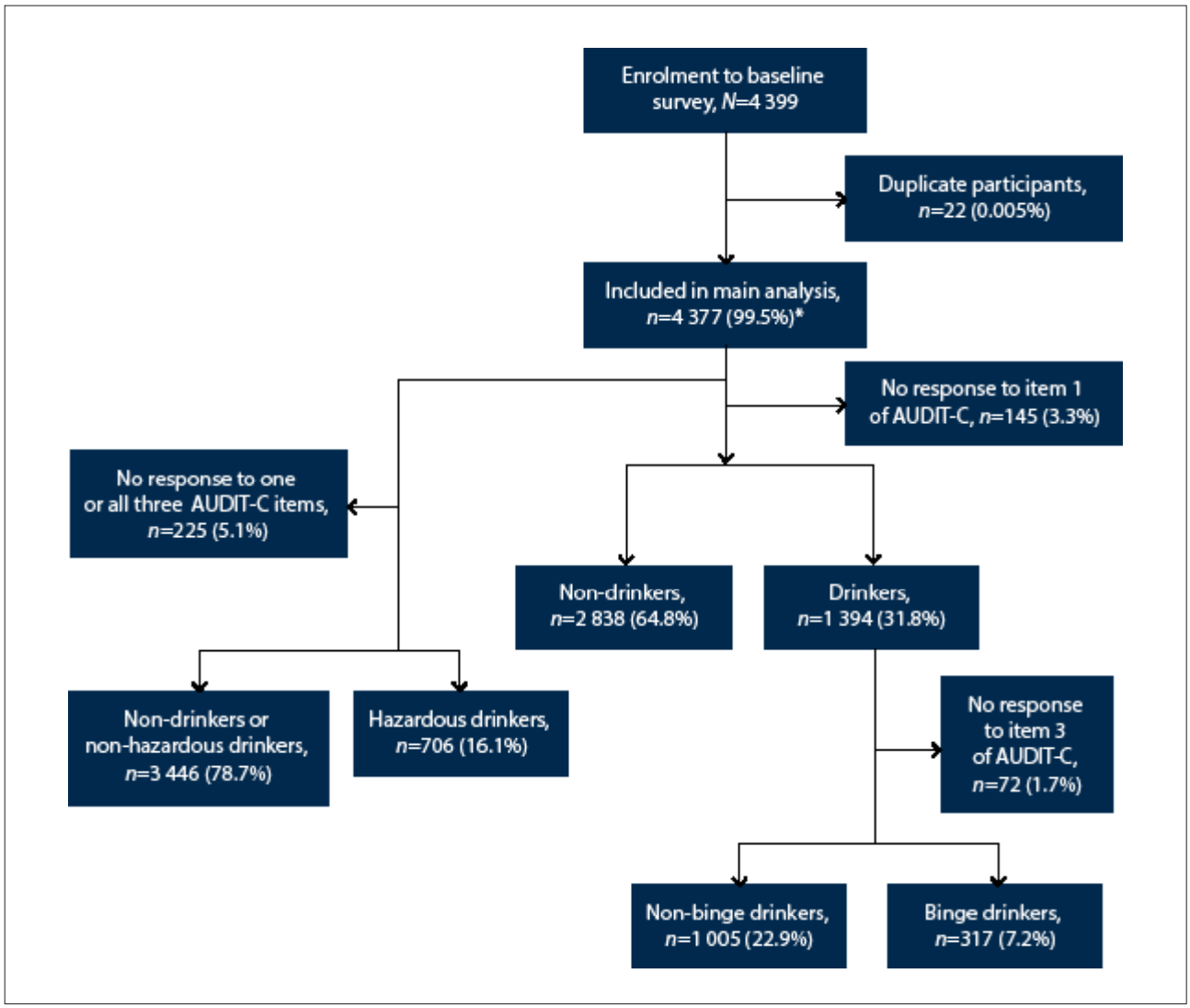

*Fig. 1. HERStory alcohol sub-study participant profile (N=4 399). *Denominator for all other percentages in figure. (AUDIT-C = abbreviated version of Alcohol Use Disorders Identification Test.[21])*

Table 1. Baseline characteristics of HERStory participants overall and by drinking status (*N*=4 377)

Characteristic	Non-drinkers (*n*=2 838, 67%),* *n* (%)†	Drinkers, *n*=1 394, 32.2%),* *n* (%)†	Total, *n* (%)†	*p*-value
Age, years, median (IQR)	18 (17 - 21)	19 (17 - 22)	19 (17 - 21)	
Age category, years				<0.001
15 - 19	1 691 (70.3)	715 (29.7)	2 495 (57.0)	
20 - 24	1 147 (62.8)	679 (37.2)	1 882 (43.3)	
District				<0.001
Cape Town	169 (47.2)	189 (52.8)	374 (8.5)	
Ehlanzeni	487 (64.1)	273 (35.9)	798 (18.2)	
OR Tambo	517 (76.5)	159 (23.5)	687 (15.7)	
Tshwane	357 (48.4)	381 (51.6)	764 (17.4)	
Zululand	748 (76.6)	229 (23.4)	1 007 (23.0)	
King Cetshwayo	560 (77.5)	163 (22.5)	747 (17.1)	
Race				<0.001
Black African	2 716 (68.1)	1 272 (31.9)	4 119 (94.1)	
White	4 (100)	0 (0)	4 (0.1)	
Coloured	108 (47.4)	120 (52.6)	242 (5.5)	
Indian/Asian	1 (50.0)	1 (50.0)	2 (0.1)	
Other	9 (90.0)	1 (10.0)	10 (0.2)	
In school				<0.001
No	1 117 (61.5)	698 (38.5)	1 878 (42.9)	
Yes	1 721 (71.2)	696 (28.8)	2 499 (57.2)	
Relationship status				<0.001
Single	158 (74.3)	400 (25.7)	1 609 (36.8)	
Dating, not living together	1 551 (62.7)	923 (37.3)	2 560 (58.5)	
Dating, living together	76 (61.8)	47 (38.2)	126 (2.9)	
Married, not living together	11 (91.7)	1 (8.3)	12 (0.3)	
Married, living together	18 (66.7)	9 (33.3)	27 (0.6)	
Divorced/separated	2 (100)	0	3 (0.7)	
Prefer not to say	16 (55.2)	13 (44.8)	32 (0.7)	
Other	6 (85.7)	1 (14.3)	8 (0.2)	
SES				<0.001
Low	2 423 (69.7)	1 052 (30.3)	3 588 (82.0)	
High	415 (54.8)	342 (45.2)	789 (18.0)	
HIV status (self-report)				0.058
HIV positive	216 (66.9)	107 (33.1)	330 (7.5)	
HIV negative	1 869 (66.2)	954 (33.8)	2 901 (66.3)	
Did not get result	663 (68.3)	307 (31.7)	1 008 (23.0)	
Prefer not to say	90 (77.6)	26 (22.4)	138 (3.2)	
HIV status (laboratory test)				0.187
HIV positive	354 (64.6)	194 (35.4)	568 (13.0)	
HIV negative	2 483 (67.4)	1 199 (32.6)	3 807 (87.0)	
Still taking ART				0.114
No	24 (52.2)	22 (47.8)	50 (16.5)	
Yes	163 (66.0)	84 (34.0)	251 (82.8)	
Prefer not to say	2 (100)	0	2 (0.7)	
ART exposure				0.076
No	155 (67.8)	101 (32.2)	269 (47.4)	
Yes	198 (60.6)	94 (39.4)	299 (52.6)	
Viral load category				0.508
<1 000 (suppressed)	231 (65.4)	122 (34.6)	364 (63.8)	
≥1 000 (not suppressed)	124 (62.6)	74 (37.4)	207 (36.2)	
Total	4 232*		4 377	

IQR = interquartile range; SES = socioeconomic status; ART = antiretroviral therapy.
*145 participants coded as 97, 'prefer not to say', were excluded from the analysis on drinking status.
†Unless otherwise indicated.

more prevalent among males than females.[2] Several studies among female adolescents in SA have, however, reported higher levels of binge drinking than observed in our analysis: 20.1% (2011 National Youth Survey, aged 10 - 19 years);[28] 11.9% (2014 - 2015 National Survey, aged 15 - 24 years);[3] 15.9% (Tshwane, aged 15 - 25 years)[29] and 27.8% (Tshwane, aged 16 - 25 years).[30] This wide range of estimates reflects differences in measurement tools and cut-off thresholds, the years the studies were conducted and the increasing prevalence of HED among women. In our study, a lower AUDIT-C cut-off score (≥2) than the standard cut-off for females (≥3) was used to define hazardous drinking, based on recommendations from a recent SA study.[25] Despite these differences, patterns of HED have been identified globally among youth aged 15 - 24 years. This pattern of drinking among SA youth is of particular concern given the country's challenging socioeconomic conditions and high HIV prevalence. An increase in alcohol use with binge drinking patterns places women and young girls at increased risk of HIV acquisition and poor HIV outcomes.[10,31] Alcohol use has also been reported to increase vulnerability among adolescents by limiting their ability to protect themselves from gender-based violence and unsafe sexual practices.[17,29,30,32]

The association of hazardous and binge drinking with urban districts, school attendance and SES has previously been reported in SA.[28,29,33] Harker *et al.*[30] found a prevalence of 50.1% for alcohol use in Tshwane, characterised by HED patterns among the youth and adults living in this district. In 2018, Trangenstein *et al.*[34] also reported a prevalence of 53% for heavy drinking in an adult population in the Tshwane district. In our findings, the Cape Town and Tshwane districts showed the strongest association with hazardous and binge drinking patterns. Urban areas in SA are at particularly high risk for alcohol use because of ubiquitous access to alcohol, the normalisation of alcohol use through marketing and advertisements targeted at young people and the reduced cost of many alcoholic drinks.[35] Cape Town and Tshwane districts are major urban centres that have been shown to have higher rates of hazardous drinking and greater availability of alcohol outlets near schools.[34-37] In addition, social norms around alcohol consumption in Tshwane, which takes place predominantly in nightclubs and at sports events, contribute to the prevalence of drinking.[30,34] In Cape Town, both social and cultural factors, such as the 'dop' system and weekend binge drinking

Table 2. Characteristics of HERStory participants by hazardous and binge drinking status

	Hazardous drinking status, *n*=4 152*			Binge drinking status, *n*=1 322†		
Characteristic	**Do not drink and non-hazardous, *n*=3 446 (83%), *n* (%)‡**	**Hazardous, *n*=706 (17%), *n* (%)‡**	***p*-value**	**Non-binge, *n*=1 005 (76%), *n* (%)‡**	**Binge, *n*=317 (24%), *n* (%)‡**	***p*-value**
Age, years, median (IQR)	19 (17 - 21)	20 (18 - 22)		19 (17 - 22)	20 (18 - 22)	0.252
Age category, years			<0.001			0.195
15 - 19	2 026 (58.8)	339 (48.0)		527 (52.4)	153 (48.3)	
20 - 24	1 420 (41.2)	367 (51.0)		478 (47.6)	164 (51.7)	
District			<0.001			<0.001
Cape Town	224 (66.5)	113 (33.5)		101 (60.1)	67 (39.9)	
Ehlanzeni	615 (83.1)	125 (16.9)		197 (77.9)	56 (22.1)	
OR Tambo	584 (87.0)	87 (13.0)		119 (77.3)	35 (22.7)	
Tshwane	515 (71.8)	202 (28.2)		262 (71.2)	106 (28.8)	
Zululand	806 (89.2)	105 (10.8)		200 (89.7)	23 (10.3)	
King Cetshwayo	642 (89.7)	74 (10.3)		126 (80.8)	30 (19.2)	
Race			<0.001			<0.001
Black African	3 293 (84.0)	626 (16.0)		943 (77.9)	268 (22.1)	
White	4 (100)	0		0	0	
Coloured	138 (63.6)	79 (36.4)		61 (56.0)	48 (44.0)	
Indian/Asian	2 (100)	0		1 (100)	0	
Other	9 (90.0)	1 (10.0)		0	1 (100)	
In school			<0.001			0.021
No	1 390 (78.4)	383 (21.6)		483 (73.3)	176 (26.7)	
Yes	2 056 (86.4)	232 (13.6)		522 (78.7)	141 (21.3)	
Relationship status			<0.001			0.041
Single	1 353 (88.1)	183 (11.9)		289 (76.0)	91 (24.0)	
Dating, not living together	1 937 (80.0)	484 (20.0)		673 (76.8)	203 (23.2)	
Dating, living together	95 (78.5)	26 (21.5)		33 (73.3)	12 (26.7)	
Married, not living together	12 (100)	0		1 (100)	0	
Married, living together	21 (77.8)	6 (22.2)		4 (44.4)	5 (55.6)	
Divorced/separated	2 (100)	0		0	0	
Prefer not to say	19 (73.1)	7 (26.9)		4 (40.0)	6 (60.0)	
Other	7 (100)	0		1 (100)	0	
SES			<0.001			0.123
Low	2 892 (84.6)	328 (15.4)		772 (77.0)	230 (23.0)	
High	554 (75.7)	179 (24.3)		233 (72.8)	87 (27.2)	
HIV status (self-report)			0.021			0.315
HIV positive	262 (82.1)	57 (17.9)		76 (73.8)	27 (26.2)	
HIV negative	2 280 (82.0)	499 (18.0)		698 (76.0)	220 (24.0)	
Did not get result	807 (85.2)	140 (14.8)		221 (77.8)	63 (22.2)	
Prefer not to say	97 (90.7)	10 (9.3)		10 (58.8)	7 (41.2)	
HIV status (lab test)			0.071			0.465
HIV positive	431 (80.3)	106 (19.7)		143 (78.1)	40 (21.9)	
HIV negative	3 013 (83.4)	600 (16.6)		861 (75.7)	277 (24.3)	
Still taking ART			0.181			0.77
No	31 (70.5)	13 (29.5)		15 (75.0)	5 (25.0)	
Yes	200 (81.6)	45 (18.4)		64 (78.0)	18 (22.0)	
Prefer not to say	2 (100)	0		0	0	
ART exposure			0.115			0.709
No	193 (77.2)	57 (22.8)		69 (76.7)	21 (23.3)	
Yes	238 (82.6)	50 (17.4)		75 (79.0)	20 (21.0)	
Viral load category			0.992			0.26
<1 000 (suppressed)	279 (80.2)	69 (19.8)		88 (75.2)	29 (24.8)	
>1 000 (not suppressed)	154 (80.2)	38 (19.8)		56 (82.4)	12 (17.6)	
Total	4 152			1 322		

IQR = interquartile range; SES = socioeconomic status; ART = antiretroviral therapy.
*225 participants excluded after not responding to all three items on the AUDIT-C tool.
†8 participants excluded who reported that they never drink in item 1.
‡Unless otherwise indicated.

Table 3. Univariate and multivariate regression for hazardous and binge drinking

	Hazardous drinking				Binge drinking			
	Univariate analysis		Multivariate analysis		Univariate analysis		Multivariate analysis	
Variable	OR	95% CI	aOR	95% CI	OR	95% CI	aOR	95% CI
Age category, years								
15 - 19	1.00				1.00		1.00	
20 - 24	1.22	0.95 - 1.56			1.15	0.86 - 1.53		
District								
King Cetshwayo	1.00		1.00		1.00		1.00	
Cape Town	2.25**	1.36 - 3.72	1.84**	1.03 - 3.27	7.86***	4.11 - 15.01	7.51***	3.9 - 14.45
Ehlanzeni	1.08	0.69 - 1.17	0.98	0.60 - 1.61	2.91***	1.51 - 5.6	2.97***	1.54 - 5.74
OR Tambo	1.47	0.89 - 2.42	1.45	0.85 - 2.48	3.32***	1.67 - 6.6	3.44***	1.72 - 6.86
Tshwane	1.34	0.88 - 2.04	0.85	0.54 - 1.35	4.9***	2.69 - 8.94	4.68***	2.56 - 8.59
Zululand	0.89	0.56 - 1.41	0.97	0.59 - 1.60	2.3**	1.13 - 4.72	2.3**	1.12 - 4.73
In school								
Yes	1.00		1.00		1.00		1.00	
No	1.42**	1.11 - 1.82	0.85	0.61 - 1.19	1.42*	1.06 - 1.91	0.75	0.56 - 1.02
SES								
Low	1.00				1.00		1.00	
High	1.31	0.97 - 1.75			1.46*	1.06 - 2.02	1.11	0.79 - 1.58
HIV laboratory result								
Negative	1.00				1.00			
Positive	1.11	0.78 - 1.57			0.75	0.49 - 1.16		
ART exposure								
Yes	1.00				1.00			
No	1.31	0.68 - 2.52			0.90	0.4 - 2.02		
Viral suppression								
No	1.00				1.00			
Yes	1.27	0.65 - 2.50			1.35	0.57 - 3.21		

OR = odds ratio; CI = confidence interval; aOR = adjusted odds ratio; SES = socioeconomic status; ART = antiretroviral therapy.
*p<0.05; **p<0.010; ***p<0.001.

Table 4. HIV care cascade overall and by hazardous and binge drinking patterns

HIV outcome	Total, *n* (%)	Non-hazardous, *n* (%)	Hazardous, *n* (%)	*p*-value	Non-binge, *n* (%)	Binge, *n* (%)	*p*-value
Diagnosed (self-reported and laboratory tested)				0.849			0.613
Yes	283 (61.3)	46 (9.9)	57 (10.2)		76 (9.8)	27 (10.9)	
No	179 (38.7)	419 (90.1)	499 (89.8)		698 (90.1)	220 (89.1)	
Total	462 (100)*	465 (100)	556 (100)		774 (100)	247 (100)	
On ART (laboratory tested)				0.414			0.806
Yes	227 (80.8)	38 (58.5)	44 (51.8)		65 (54.2)	17 (56.7)	
No	54 (19.2)	27 (41.5)	41 (48.2)		55 (45.8)	13 (43.3)	
Total	281 (100)	65 (100)	85 (100)		120 (100)	30 (100)	
Viral suppression				0.483			0.494
Yes	246 (91.8)	38 (58.5)	44 (51.8)		76 (63.3)	21 (70.0)	
No	22 (8.2)	27 (41.5)	41 (48.2)		44 (36. 7)	9 (30.0)	
Total	268 (100)	65 (100)	85 (100)		120 (100)	30 (100)	

ART = antiretroviral therapy.
*106 participants did not provide a self-reported HIV status and were excluded from this analysis.

in farm areas, contribute to high levels of drinking.[37] In contrast, the other four districts encompass more rural areas and smaller towns, where access to alcohol outlets is more limited and social drinking patterns may be more restrictive. Findings on the association between alcohol use and school attendance were not consistent. Desai *et al.*[38] reported 2.58-fold higher odds of consuming alcohol among females who dropped out of school in a rural area in KwaZulu-Natal, but this association was not observed in urban areas. Flisher *et al.*[39] did not find any significant association between alcohol use and school drop-out (aOR 0.92, 95% CI 0.60 - 1.42). In our study, school attendance was associated with a lower likelihood of hazardous and binge drinking patterns in univariate analysis; however, this association was lost in multivariate analysis. The attenuation of this association may be due to confounding factors such as access to alcohol and other socioeconomic factors that outweigh the direct protective effects of school attendance. Similarly, findings on the association of SES with hazardous or binge drinking behaviours yielded mixed results. Probst *et al.*[33] reported that low SES was associated with a

1.5 - 2 times higher alcohol-attributable fraction in the SA population aged ≥15 years. The finding was reversed in young women aged 15 - 34 years, among whom high SES was associated with an elevated alcohol-attributable fraction. Morojele *et al.*[35] did not find any association between alcohol use and SES among adolescents. In a recent study, Fontes Marx *et al.*[40] reported a 1.2% increase in binge drinking from 2008 to 2015 among individuals of the lowest SES.

Surprisingly, we did not find any significant association between hazardous or binge drinking behaviours and HIV status, ART use or viral load suppression, despite the high prevalence of these drinking patterns in this cohort. It is possible that our numbers were too small for each of the HIV outcomes measured. Nevertheless, these results contribute valuable data to a paucity of information on alcohol use among AGYW in SSA, highlighting the importance of routine screening for alcohol and substance use in this age group.

An important limitation of this analysis was the use of an interviewer-administered, self-reported questionnaire. Self-reported questionnaires on alcohol use are subject to response bias and, therefore, under-reporting of alcohol use and quantity consumed.[41] Future studies could consider using self-administered questionnaires combined with biomarker testing.

Another important limitation stems from the amount of missing data on alcohol use. Among all participants, 8.4% either declined to respond to item 1 of the AUDIT-C tool (ever drinking alcohol) or did not complete one of the other two items in the questionnaire. Among those who reported ever consuming alcohol, almost one-third did not respond to the question about binge drinking. As a result, the true prevalence of binge drinking in this study group may have been underestimated.

Conclusion

We found alcohol use among AGYW living in high HIV-risk areas in SA to be higher than that reported in national survey reports for the same age group. Half of the study participants who reported consuming alcohol were hazardous drinkers, and about a third were binge drinkers. Living in the Tshwane or Cape Town districts was associated with hazardous and binge drinking patterns. School attendance was a protective factor against hazardous and binge drinking behaviours. Measures to reduce alcohol consumption in this age group should consider increasing screening for alcohol use among AGYW, and supporting strategies that promote school attendance and participation in after-school activities.

Data availability. Data used for this study are available from the authors on request.

Declaration. This study was done in partial fulfilment of MRT's MMed (Public Health) degree at the University of Cape Town, SA.

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