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Original research

Alcohol use, heavy episodic drinking, and associated cardiovascular risk in Guyana

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ABSTRACT

Objective. To determine associations between demographic characteristics, alcohol use, heavy episodic drinking (HED), and cardiovascular risk factors using the 2016 Guyana World Health Organization (WHO) STEPwise noncommunicable diseases risk factor survey.

Methods. A weighted sample was used in a secondary analysis of data obtained from an online database. Descriptive statistics, binary logistic regression, and linear regression models were applied to identify which subpopulations were at highest risk of HED or cardiovascular disease.

Results. Data from 2 662 individuals (77% response rate) were analyzed. In the unweighted sample, females made up 59.9% (95% CI [58.04, 61.76]) of the respondents and the average age was 40.7 years. Indo-Guyanese comprised 39.4% (95% CI [37.54, 41.26]) of the sample. The maximum educational level completed was primary level in 44.5% (95% CI [42.61, 46.39]) and secondary in 32.5% (95% CI [30.72, 34.28]). Of those who had ever drunk, 80.1% (95% CI [78.30, 81.90]) confirmed alcohol use in the past 12 months. Younger males were significantly more likely to consume alcohol. Using the weighted sample, Amerindian individuals had lower odds of alcohol use (odds ratio [OR] 0.36; 95% CI [0.25, 0.51]) compared to Indo-Guyanese. Residents of the Demerara-Mahaica region had the highest use at 86.1% (OR 4.74; 95% CI [2.86, 7.86]). Regarding HED, 16.4% (95% CI [14.73, 18.07]) of the entire sample, and 41.1% (95% CI [38.88, 43.32]) of those who drank in the past 30 days, reported having at least six drinks (defined as HED) in one sitting. The 25–29 age group showed an increase in odds for HED (OR 2.09; 95% CI [1.13, 3.89]). Men were more likely to engage in HED than women (OR 6.13; 95% CI [4.73, 7.95]). People of African (OR 0.78; 95% CI [0.61, 1.00]) and Amerindian descent (OR 0.48; 95% CI [0.31, 0.73]) had lower odds of HED than Indo-Guyanese. In the adjusted models, HED was positively correlated with elevated blood pressure (adjusted OR [aOR] 1.40; 95% CI [1.05, 1.88]), obesity (aOR 1.49; 95% CI [1.13, 1.95]), and elevated triglycerides (β coefficient 28.38, $p = 0.004$). For each OR and aOR above, $p \leq 0.05$.

Conclusions. This secondary analysis identifies that the population along the central and eastern coastal regions, young males, and those of Indo-Guyanese descent might benefit from focused public health interventions on alcohol and cardiovascular risk in Guyana.

Keywords Alcohol drinking; binge drinking; heart disease risk factors; Caribbean region; Guyana.

Alcohol is a carcinogenic, addictive, toxic, and teratogenic substance. In 2007, the Member States of the Caribbean Community (CARICOM) acknowledged alcohol as a risk factor for noncommunicable diseases (NCDs) as part of the Declaration of Port of Spain (1). This declaration arose because of the challenges faced by developing countries, including small island developing states (SIDS) in the Caribbean, from NCDs on their populations and economic resources. Several United Nations, CARICOM, and national programs have acknowledged the role of alcohol as a factor in health and socioeconomic

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development (1–4). The 2011 United Nations High-level Meeting awakened the global response to NCDs (5). The 2030 Agenda for Sustainable Development and specifically Goal 3.5, adopted at the United Nations summit in September 2015, recognized NCDs and alcohol as a major challenge for sustainable development (6–7).

Guyana is situated in northeastern South America. Historically it was part of the British Commonwealth, and it is the only English-speaking country on the continent. Guyana is a member of CARICOM and has a population of approximately 825 000 inhabitants, descendants of African, South Asian, and Amerindian (Indigenous) people. In Guyana alcohol consumption is prevalent among young people: 39% of youth aged 13–15 years consumed alcohol in the past 30 days; and 29% had consumed so much that they were really drunk at least once in their life (8).

In 2020, Guyanese male drinkers over the age of 15 were reported to consume 8.2 liters of pure alcohol per capita per year (9). As a population, Guyanese consumed 5 liters of alcohol per capita in 2020, compared to the World Health Organization (WHO) global figure of 5.5 liters (2019) (9). Among countries in the English-speaking Caribbean (ESC), Guyana ranks first for alcohol use disorder (AUD) among adults at 7.2% (10), and a predicted prevalence of alcohol consumption during pregnancy of 18.2% (95% CI [16.1, 20.2]) has been published (11).

Alcohol has exacted a high disease burden in Guyana, with an age-standardized rate of 54.3 deaths per 100 000 reported in 2016 (12). In the Americas, Guyana ranks fifth among males (54 per 100 000) and first in the ESC (10) for alcohol-attributable liver cirrhosis death rates; 21% of those involved in injuries reported alcohol use in the preceding six hours (13). Cherpitel et al. reported that in Guyana 44.7% of intentional interpersonal violence-related injuries presenting to emergency departments were associated with drinking before the injury occurred (14). Globally, Guyana reports the ninth-highest age-standardized rate of suicide (15). A global school health-based survey that examined suicidal ideation in Guyana reported that students who abused alcohol were 21% (adjusted odds ratio [aOR] 1.21; 95% CI [1.17, 1.25]) more likely to have suicidal thoughts compared to students who did not abuse alcohol (16). Indo-Guyanese males have been identified as more likely to die from suicide (15).

The debate on the effects of low to moderate alcohol intake and cardiovascular outcomes is ongoing (17–19). Heavier alcohol intake has been consistently associated with negative cardiovascular outcomes (20, 21). In the ESC, one cohort trial from Plymouth, Trinidad and Tobago, identified that high sessional alcohol intake was linked to premature mortality among males (22). This 2016 WHO STEPwise dataset (23, 24) from Guyana provides an opportunity to examine the associations between heavy episodic drinking (HED) and the increase in cardiovascular risk factors in another ESC population.

The international research on the harmful effects of alcohol is decades old but limited in the developing world. Our current knowledge of alcohol use in the populations of the ESC is based on many of the WHO STEPwise surveys conducted in the last two decades. However, for many of these only descriptive results have been presented. There are no analyses to reveal the education level, household income, location, or self-reported ethnicity where these habits are prevalent. Such insights will help to focus public health approaches.

Therefore, this study aims to determine associations between demographic characteristics, alcohol use, HED, and cardiovascular risk factors through a secondary analysis of the 2016 Guyana WHO STEPwise NCDs risk factor survey data.

MATERIALS AND METHODS

In 2016, Guyana implemented the WHO STEPwise Approach to Chronic Disease Risk Factor Surveillance (STEPS) (23). The survey data are available by application online (24).

Guyana was divided into 10 administrative regions, each further subdivided into enumeration districts (EDs). A total of 288 EDs were selected using systematic sampling with probability proportional to size, based on the 2012 census frame. Within each of the selected EDs, 12 households were randomly selected using simple random sampling for a total of 3 456 households. The selection was performed primarily in an office setting using a computer, while remote areas used simple random tables in the field. One individual per household was selected for the survey. In Guyana, the selection of the individual from each household was based on availability (who was home at the time) and willingness (whoever volunteered). For those who refused, enumerators were asked to collect age and sex data (25).

Step 1 involved the collection of sociodemographic and behavioral information. Step 2 gathered physical measurements, including height, weight, and blood pressure. Step 3 focused on biochemical assessments, measuring blood glucose, lipid profiles, and screening for hemoglobinopathies such as sickle cell anemia and thalassemia.

Each step comprised core, expanded, and optional questions. The survey gathered demographic data (age, sex, education, ethnicity, marital status, employment, income), behavioral data (tobacco and alcohol use, diet, physical activity), physical measurements (blood pressure, height, weight, waist circumference, heart rate), and metabolic risk factors (blood glucose, lipid profiles, hemoglobinopathies). Optional modules on dietary salt, nutrition, mental health, and violence were also included.

For biochemical data collection in step 3, 50% of the sample, or 1 728 individuals, were randomly selected. The sample size was calculated using parameters, including a 95% confidence level, an estimated prevalence of 50%, a design effect of 1.5, two age-sex groups, a margin of error of 0.05, and an expected response rate of 66.68% (26).

Statistical analyses

The data were weighted to align key demographic variables (age categories [18–69], gender, ethnicity, and geographic location by region). This was done using the Rake Weight command (SPSS), which calculates weights for each respondent to ensure a calibrated sample in keeping with the Guyanese population, according to 2012 census data.

Descriptive data are presented using frequency counts and percentages for categorical data. Continuous data were described using means and standard deviation for normally distributed data, and medians with interquartile range limits (Q1, Q3) for non-normally distributed data. Binary logistic regression was used to explore predictors of dichotomous outcomes. Odds ratios (OR) and adjusted OR (aOR) were determined using binary logistic regression and presented with

95% confidence intervals (CI) and *p*-values. Linear regression models were used for continuous outcomes with inclusion of sociodemographic covariates for adjusted coefficients. Comparison of medians was done for two groups using Mann–Whitney U tests, and for three or more groups Kruskal–Wallis tests were used with post hoc Bonferroni adjusted *p*-values. A *p*-value of <0.05 was deemed statistically significant. All analyses were conducted in SPSS version 25.0.

Variables

Outcomes. The primary outcomes assessed in this study were alcohol consumption and cardiometabolic risk factors. Alcohol consumption was evaluated based on self-reported intake, with alcohol users defined as those who had consumed any alcohol in the past 12 months. Heavy episodic drinking (HED) was defined as the consumption of six or more standard alcoholic drinks on a single occasion within the past 30 days.

Cardiometabolic risk factors included elevated blood pressure (BP), obesity, and elevated triglycerides. Elevated BP was classified as systolic BP ≥140 mmHg or diastolic BP ≥90 mmHg, regardless of a prior hypertension diagnosis or the use of antihypertensive medications. Obesity was determined using both body mass index (BMI) and waist circumference (WC). BMI classifications followed the WHO and National Institutes of Health (NIH) guidelines, with non-Asians categorized as underweight (<18.5 kg/m²), normal weight (18.5–24.9 kg/m²), overweight (25.0–29.9 kg/m²), and obese (≥30 kg/m²). For Asian individuals (Chinese and East Indian populations), the BMI thresholds were adjusted, defining overweight as 23.0–24.9 kg/m² and obesity as ≥25 kg/m². WC was assessed using ethnicity-specific cutoffs, with abnormal WC defined as ≥80 cm for Asian females and ≥90 cm for Asian males; while for non-Asian populations, elevated WC was considered ≥88 cm for females and ≥102 cm for males. Additionally, lipid profiles consisting of triglycerides, total cholesterol, low density lipoprotein, high density lipoprotein, and fasting blood sugar were measured for a randomly selected subset of the sample.

Exposures. The primary exposure variable in this study was HED, defined as consuming six or more standard drinks on a single occasion in the past 30 days. Additionally, alcohol use was assessed as a secondary exposure variable, referring to any alcohol consumption within the past 12 months.

Confounders. Several potential confounding variables were accounted for in the analysis. Sociodemographic factors included age, sex, ethnicity, marital status, employment status, income level, and geographic region. Age was categorized based on the national census groupings, while annual income was classified into predefined brackets according to self-reported earnings, either as estimated averages or categorized ranges. Employment status was categorized as government-employed, private-sector employed, self-employed, unemployed, or homemaker. Ethnicity was self-identified and grouped into Afro-Guyanese, Indo-Guyanese, Amerindian, or mixed ethnicity.

RESULTS

A total of 2 662 participant responses were analyzed. A 77% response rate was obtained for step 1 and step 2 and 40% for step 3 of the survey. In the unweighted sample, females made up 59.9% (95% CI [58.04, 61.76]) of the respondents, and the average age was 40.7 years. Indo-Guyanese comprised 39.4% (95% CI [37.54, 41.26]) of the sample. The maximum educational level completed was primary level in 44.5% (95% CI [42.61, 46.39]) and secondary in 32.5% (95% CI [30.72, 34.28]). The demographic characteristics of this sample are shown in Table 1, both unweighted and weighted.

Based on the weighted dataset, the mean age was 38.6 years (SD = 13.4). There was an approximately equal gender

TABLE 1. Comparison of the sociodemographic characteristics of unweighted and weighted samples of participants in the 2016 WHO STEPwise survey in Guyana (*N* = 2 662)

Sociodemographic characteristics	Unweighted sample *n* (%)	Weighted sample[a] *n* (%)
Age (years)	40.7 (14.2)	38.6 (13.4)
Age group (years)		
18–19	129 (4.8%)	105 (3.9%)
20–24	306 (11.5%)	392 (14.7%)
25–29	295 (11.1%)	322 (12.1%)
30–34	285 (10.7%)	329 (12.4%)
35–39	294 (11.0%)	319 (12.0%)
40–44	292 (11.0%)	297 (11.2%)
45–49	250 (9.4%)	267 (10.0%)
50–54	230 (8.6%)	232 (8.7%)
55–59	239 (9.0%)	180 (6.8%)
60–64	204 (7.7%)	133 (5.0%)
65–69	138 (5.2%)	86 (3.2%)
Gender		
Male	1 068 (40.1%)	1 317 (49.5%)
Female	1 594 (59.9%)	1 344 (50.5%)
Ethnicity		
East Indian	1 048 (39.4%)	1 060 (39.8%)
African	747 (28.1%)	778 (29.2%)
Amerindian	354 (13.3%)	280 (10.5%)
Chinese	2 (0.1%)	5 (0.2%)
Portuguese	7 (0.3%)	7 (0.3%)
Mixed	497 (18.7%)	529 (19.9%)
White	6 (0.2%)	2 (0.1%)
Marital status		
Never married	786 (29.6%)	845 (31.8%)
Currently married	940 (35.4%)	891 (33.5%)
Separated	125 (4.7%)	125 (4.7%)
Divorced	77 (2.9%)	70 (2.6%)
Widowed	132 (5.0%)	92 (3.5%)
Cohabitating/common-law	598 (22.5%)	634 (23.9%)
Years of education*	9.5 (3.6)	9.7 (3.5)
Highest level of education attained		
No formal schooling	58 (2.2%)	50 (1.9%)
Less than primary school	205 (7.7%)	182 (6.9%)
Primary school completed	1 185 (44.5%)	1 167 (43.9%)
Secondary school completed	865 (32.5%)	893 (33.6%)
Tertiary	250 (9.4%)	270 (10.2%)
College/university	81 (3.0%)	82 (3.1%)
Postgraduate	16 (0.6%)	16 (0.6%)
Income category (Guyanese dollars, GYD)		
<500 000 [b]	790 (36.8%)	733 (33.9%)
500–700 000	286 (13.3%)	286 (13.2%)
700–900 000	312 (14.5%)	325 (15.0%)
900–1 100 000	232 (10.8%)	250 (11.6%)
1 100–1 500 000	143 (6.7%)	156 (7.2%)
1 500–2 300 000	151 (7.0%)	168 (7.7%)
2 300–3 500 000	67 (3.1%)	75 (3.5%)
>3 500 000	167 (7.8%)	172 (7.9%)

(Continued)

TABLE 1. (Cont.)

Sociodemographic characteristics	Unweighted sample *n* (%)	Weighted sample[a] *n* (%)
Employment status		
Government employee	331 (12.4%)	367 (13.8%)
Non-government employee	484 (18.2%)	544 (20.5%)
Self-employed	824 (31.0%)	881 (33.2%)
Non-paid	36 (1.4%)	30 (1.1%)
Student	41 (1.5%)	42 (1.6%)
Homemaker	570 (21.4%)	476 (17.9%)
Retired	116 (4.4%)	82 (3.1%)
Unemployed (able to work)	193 (7.3%)	184 (6.9%)
Unemployed (unable to work)	64 (2.4%)	51 (1.9%)
Region		
Region 1 (Barima-Waini)	125 (4.7%)	98 (3.7%)
Region 2 (Pomeroon-Supenaam)	201 (7.6%)	167 (6.3%)
Region 3 (Essequibo Islands-West Demerara)	396 (14.9%)	384 (14.4%)
Region 4 (Demerara-Mahaica)	1 049 (39.4%)	1 110 (41.7%)
Region 5 (Mahaica-Berbice)	193 (7.3%)	177 (6.7%)
Region 6 (East Berbice-Corentyne)	327 (12.3%)	391 (14.7%)
Region 7 (Cuyuni-Mazaruni)	82 (3.1%)	65 (2.5%)
Region 8 (Potaro-Siparuni)	43 (1.6%)	39 (1.5%)
Region 9 (Upper Takutu-Upper Essequibo)	92 (3.5%)	86 (3.2%)
Region 10 (Upper Demerara-Berbice)	154 (5.8%)	142 (5.4%)

Note: [a] Weighted to match by age, sex, ethnicity, and regional distribution of Guyana population.
Source: Prepared by the authors based on the study data.

distribution, with 49.5% males and 50.5% females. The majority identified as East Indian (39.8%), followed by African (29.2%), mixed ethnicity (19.9%), and Amerindian (10.5%) descent. Regarding education, the mean number of years of education was 9.7 years (SD = 3.5); 33.6% completed secondary school, 43.9% completed primary school, and 10.2% had tertiary education.

Alcohol use

Alcohol users vs. non-users. Of the 1 878 (70.6%) respondents who had ever drunk, 1 504 (80.1%; 95% CI [78.30, 81.90])) reported alcohol use in the past 12 months. Of the 374 participants who had ever drunk alcohol, but not in the last 12 months, 78 (20.8%) had stopped drinking because of a negative impact on their health or on the advice of their doctor or other health worker. Table 2 shows the associations between alcohol users and socio-demographic characteristics.

Analysis revealed several significant predictors of alcohol use. Older age groups, specifically those aged 55–59 and 60–64, had significantly lower odds of alcohol use compared to the youngest age group. Males were significantly more likely to consume alcohol than females. Among ethnic groups, Amerindian individuals had lower odds of alcohol use compared to East Indians. Marital status also played a role, with currently married, widowed, and cohabitation or common-law individuals showing lower odds of alcohol use compared to those who were never married. There were, however, no significant differences in alcohol use across different education levels. Higher-income categories, particularly those earning between GYD 900 000 and 2 300 000, were associated with higher odds

TABLE 2. Association between sociodemographic characteristics and alcohol users in a sample of participants in the 2016 WHO STEPwise survey in Guyana (*N* = 2 662)

Sociodemographic characteristics	Alcohol users (past 12 months) *n* (%)	Odds ratio for users (95% CI)	*p*-value[a]
Age group (years)			
18–19 [b]	64 (83.1%)	1	
20–24	243 (85.0%)	1.13 (0.57, 2.25)	0.724
25–29	210 (87.1%)	1.36 (0.67, 2.78)	0.396
30–34	204 (82.3%)	0.92 (0.46, 1.83)	0.813
35–39	189 (81.1%)	0.85 (0.43, 1.70)	0.652
40–44	169 (81.3%)	0.86 (0.43, 1.72)	0.659
45–49	146 (80.7%)	0.83 (0.41, 1.69)	0.614
50–54	120 (75.0%)	0.60 (0.30, 1.21)	0.154
55–59	68 (61.8%)	0.33 (0.16, 0.66)	0.002
60–64	55 (64.0%)	0.36 (0.17, 0.75)	0.007
65–69	36 (73.5%)	0.54 (0.23, 1.28)	0.162
Gender			
Male	969 (86.5%)	2.67 (2.12, 3.37)	<0.001
Female [b]	535 (70.6%)	1	
Ethnicity			
East Indian [b]	582 (82.7%)	1	
African	462 (81.9%)	0.95 (0.71, 1.27)	0.733
Amerindian	120 (63.2%)	0.36 (0.25, 0.51)	<0.001
Chinese	0%	[c]	[c]
Portuguese	4 (80.0%)	1.20 (0.11, 13.60)	0.882
Mixed	334 (81.1%)	0.90 (0.66, 1.23)	0.501
White	2 (100.0%)	[c]	0.999
Marital status			
Never married [b]	542 (85.1%)	1	
Currently married	439 (74.2%)	0.50 (0.38, 0.67)	<0.001
Separated	74 (79.6%)	0.69 (0.40, 1.20)	0.185
Divorced	48 (94.1%)	3.12 (0.89, 10.91)	0.075
Widowed	31 (64.6%)	0.32 (0.17, 0.61)	<0.001
Cohabitating/common-law	367 (80.7%)	0.73 (0.53, 1.00)	0.050
Highest level of education attained			
No formal schooling [b]	21 (70.0%)	1	
Less than primary school	97 (73.5%)	1.18 (0.49, 2.85)	0.710
Primary school completed	643 (79.7%)	1.68 (0.75, 3.77)	0.208
Secondary school completed	518 (81.7%)	1.91 (0.84, 4.31)	0.120
Tertiary	175 (82.9%)	2.06 (0.86, 4.89)	0.104
College/university	42 (76.4%)	1.43 (0.52, 3.93)	0.488
Postgraduate	8 (88.9%)	5.31 (0.38, 74.81)	0.216
Income category (Guyanese dollars, GYD)			
<500 000 [b]	391 (76.4%)	1	
500–700 000	152 (80.0%)	1.25 (0.83, 1.88)	0.292
700–900 000	184 (81.8%)	1.38 (0.93, 2.05)	0.109
900–1 100 000	165 (86.4%)	1.97 (1.24, 3.13)	0.004
1 100–1 500 000	99 (88.4%)	2.33 (1.26, 4.28)	0.007
1 500–2 300 000	108 (85.0%)	1.76 (1.04, 2.99)	0.037
2 300–3 500 000	57 (89.1%)	2.71 (1.17, 6.25)	0.020
>3 500 000	109 (78.4%)	1.14 (0.72, 1.80)	0.574
Employment status			
Government employee [b]	233 (80.1%)	1	
Non-government employee	368 (86.0%)	1.52 (1.02, 2.26)	0.038
Self-employed	561 (84.9%)	1.39 (0.98, 2.00)	0.069
Non-paid	15 (78.9%)	0.85 (0.28, 2.56)	0.766
Student	26 (83.9%)	1.20 (0.45, 3.19)	0.710
Homemaker	157 (64.3%)	0.45 (0.30, 0.66)	<0.001
Retired	39 (69.6%)	0.57 (0.30, 1.09)	0.088
Unemployed (able to work)	90 (73.2%)	0.68 (0.42, 1.12)	0.127
Unemployed (unable to work)	13 (56.5%)	0.32 (0.14, 0.78)	0.012

(Continued)

TABLE 2. (Cont.)

Sociodemographic characteristics	Alcohol users (past 12 months) *n* (%)	Odds ratio for users (95% CI)	*p*-value[a]
Region			
Region 1 (Barima-Waini)[b]	41 (56.2%)	1	
Region 2 (Pomeroon-Supenaam)	91 (71.1%)	1.88 (1.03, 3.43)	0.039
Region 3 (Essequibo Islands-West Demerara)	224 (80.3%)	3.13 (1.80, 5.41)	0.000
Region 4 (Demerara-Mahaica)	674 (86.1%)	4.74 (2.86, 7.86)	0.000
Region 5 (Mahaica-Berbice)	107 (79.3%)	3.00 (1.61, 5.60)	0.001
Region 6 (East Berbice-Corentyne)	172 (79.3%)	2.91 (1.65, 5.12)	0.000
Region 7 (Cuyuni-Mazaruni)	36 (67.9%)	1.65 (0.79, 3.47)	0.185
Region 8 (Potaro-Siparuni)	19 (70.4%)	1.86 (0.72, 4.80)	0.200
Region 9 (Upper Takutu-Upper Essequibo)	49 (73.1%)	2.10 (1.03, 4.27)	0.042
Region 10 (Upper Demerara-Berbice)	90 (78.3%)	2.74 (1.45, 5.20)	0.002

Notes:
[a] Logistic regression.
[b] Referent category.
[c] Value incalculable.
Source: Prepared by the authors based on the study data.

of alcohol use compared to those earning less than GYD 500 000 (USD 1 = ~GYD 200 [2016]) (27).

Over the past 30 days, the median number of occasions on which individuals consumed at least one standard alcoholic drink was two occasions. On average, the median number of standard drinks per drinking occasion was three, with the largest number of drinks on a single occasion being four. Furthermore, the median number of times individuals consumed six or more standard drinks in a single occasion over the past month was one time.

Heavy episodic drinking. Of those who drank in the past 30 days, 41.1% (95% CI [38.88, 43.32]) reported having six or more drinks in one sitting. Of the entire sample, 16.4% (95% CI [14.73, 18.07]) reported such HED. Table 3 shows the sociodemographic associations with HED.

Compared to the 18–19 age group, only the 25–29 age group showed a significant increase in odds for HED (OR 2.09; 95% CI [1.13, 3.89]; $p = 0.020$). Men were more likely to engage in HED than women (OR 6.13; 95% CI [4.73, 7.95]; $p < 0.001$). People of African (OR 0.78; 95% CI [0.61, 1.00]; $p = 0.050$) and Amerindian descent (OR 0.48; 95% CI [0.31, 0.73]; $p = 0.001$) had lower odds than those of East Indian descent. Widowed individuals had lower odds than those never married (OR 0.26; 95% CI [0.10, 0.65]; $p = 0.004$). Those with less than primary school education had higher odds (OR 3.39; 95% CI [1.05, 10.94]; $p = 0.041$) when compared with no formal schooling. Higher income was associated with increased odds, with the highest being for the >GYD 3 500 000 income bracket (OR 2.62; 95% CI [1.76, 3.91]; $p < 0.001$). Homemakers (OR 0.22; 95% CI [0.13, 0.36]; $p < 0.001$) and retired individuals (OR 0.35; 95% CI [0.15, 0.83]; $p = 0.017$) had lower odds compared to government employees. Several regions had higher odds when compared with Region 1, especially Region 8 (OR 4.41; 95% CI [1.56, 12.50]; $p = 0.005$).

Frequency of alcohol use. Male sex was significantly associated with the largest number of drinks on one occasion. In

TABLE 3. Association between sociodemographic characteristics and heavy episodic drinking in a sample of participants from the 2016 WHO STEPwise survey in Guyana (*N* = 2 662)

Sociodemographic characteristics	Heavy episodic drinkers *n* (%)	Odds ratio for heavy episodic drinking (95% CI)	[a]*p*-value
Age group (years)			
18–19[b]	14 (13.3%)	1	
20–24	67 (17.1%)	1.36 (0.73, 2.53)	0.338
25–29	78 (24.1%)	2.09 (1.13, 3.89)	0.020
30–34	50 (15.2%)	1.18 (0.62, 2.24)	0.612
35–39	61 (19.2%)	1.57 (0.84, 2.95)	0.160
40–44	58 (19.5%)	1.59 (0.85, 3.01)	0.150
45–49	41 (15.4%)	1.20 (0.62, 2.31)	0.592
50–54	30 (13.0%)	1.00 (0.50, 1.97)	0.989
55–59	21 (11.7%)	0.87 (0.42, 1.80)	0.710
60–64	11 (8.3%)	0.59 (0.26, 1.36)	0.217
65–69	6 (7.0%)	0.51 (0.19, 1.38)	0.182
Gender			
Male	360 (27.3%)	6.13 (4.73, 7.95)	<0.001
Female[b]	77 (5.8%)	1	
Ethnicity			
East Indian[b]	197 (18.6%)	1	
African	118 (15.1%)	0.78 (0.61, 1.00)	0.050
Amerindian	27 (9.7%)	0.48 (0.31, 0.73)	0.001
Chinese	0 (0.0%)	[c]	[c]
Portuguese	1 (14.3%)	1.00 (0.15, 6.83)	0.998
Mixed	94 (17.8%)	0.95 (0.72, 1.24)	0.686
White	0 (0.0%)	[c]	[c]
Marital status			
Never married[b]	150 (17.8%)	1	
Currently married	129 (14.5%)	0.78 (0.61, 1.01)	0.062
Separated	28 (22.4%)	1.33 (0.84, 2.10)	0.222
Divorced	11 (15.7%)	0.84 (0.43, 1.64)	0.602
Widowed	5 (5.4%)	0.26 (0.10, 0.65)	0.004
Cohabitating/common-law	114 (18.0%)	1.02 (0.78, 1.33)	0.885
Highest level of education attained			
No formal schooling[b]	3 (6.1%)	1	
Less than primary school	36 (19.7%)	3.39 (1.05, 10.94)	0.041
Primary school completed	203 (17.4%)	2.94 (0.95, 9.03)	0.060
Secondary school completed	141 (15.8%)	2.62 (0.85, 8.10)	0.094
Tertiary	45 (16.7%)	2.79 (0.88, 8.88)	0.083
College/university	9 (11.0%)	1.72 (0.46, 6.38)	0.420
Postgraduate	1 (6.3%)	0.78 (0.07, 9.18)	0.846
Income category (Guyanese dollars, GYD)			
<500 000[b]	93 (12.7%)	1	
500–700 000	56 (19.6%)	1.68 (1.17, 2.42)	0.005
700–900 000	54 (16.6%)	1.38 (0.96, 1.98)	0.085
900–1 100 000	44 (17.5%)	1.46 (0.99, 2.16)	0.059
1 100–1 500 000	31 (19.9%)	1.73 (1.10, 2.70)	0.017
1 500–2 300 000	42 (25.0%)	2.30 (1.52, 3.47)	<0.001
2 300–3 500 000	17 (22.7%)	2.00 (1.12, 3.58)	0.020
>3 500 000	47 (27.5%)	2.62 (1.76, 3.91)	<0.001
Employment status			
Government employee[b]	68 (18.5%)	1	
Non-government employee	126 (23.1%)	1.31 (0.95, 1.83)	0.105
Self-employed	182 (20.7%)	1.14 (0.84, 1.55)	0.410
Non-paid	2 (6.7%)	0.37 (0.10, 1.44)	0.151
Student	10 (24.4%)	1.45 (0.69, 3.08)	0.329
Homemaker	23 (4.8%)	0.22 (0.13, 0.36)	<0.001
Retired	6 (7.3%)	0.35 (0.15, 0.83)	0.017
Unemployed (able to work)	17 (9.2%)	0.45 (0.26, 0.79)	0.005
Unemployed (unable to work)	3 (5.9%)	0.31 (0.10, 0.96)	.043

(Continued)

TABLE 3. (Cont.)

Sociodemographic characteristics	Heavy episodic drinkers *n* (%)	Odds ratio for heavy episodic drinking (95% CI)	[a]*p*-value
Region			
Region 1 (Barima-Waini) [b]	7 (7.1%)	1	
Region 2 (Pomeroon-Supenaam)	24 (14.4%)	2.12 (0.88, 5.07)	0.093
Region 3 (Essequibo Islands-West Demerara)	66 (17.2%)	2.66 (1.19, 5.94)	0.017
Region 4 (Demerara-Mahaica)	203 (18.3%)	2.84 (1.31, 6.17)	0.008
Region 5 (Mahaica-Berbice)	26 (14.6%)	2.16 (0.91, 5.13)	0.082
Region 6 (East Berbice-Corentyne)	63 (16.1%)	2.43 (1.09, 5.45)	0.031
Region 7 (Cuyuni-Mazaruni)	14 (21.2%)	3.35 (1.27, 8.79)	0.014
Region 8 (Potaro-Siparuni)	10 (25.6%)	4.41 (1.56, 12.50)	0.005
Region 9 (Upper Takutu-Upper Essequibo)	9 (10.5%)	1.49 (0.54, 4.15)	0.445
Region 10 (Upper Demerara-Berbice)	15 (10.6%)	1.54 (0.61, 3.88)	0.361

Notes:
[a] Logistic regression.
[b] Referent category.
[c] Value incalculable.
Source: Prepared by the authors based on the study data.

additional pairwise comparisons, those of East Indian descent were more likely to report more drinks consumed compared to those of African descent ($p = 0.003$). Respondents in the >GYD 3 500 000 income bracket were more likely to consume more drinks when compared to those in the <GYD 500 000 ($p < 0.001$) and GYD 900 000–1 100 000 ($p = 0.001$) income brackets.

Regarding the frequency of HED, there were also significant associations. Male gender was significantly associated with the frequency of HED, as was the age group 65–69 vs. 55–59 ($p = 0.045$). Indo-Guyanese were more likely to report higher frequencies of HED compared to Afro-Guyanese ($p = 0.007$).

Correlates with cardiometabolic conditions. In terms of ethnicity-defined obesity as measured by both BMI and WC, 56.3% were classified as obese ($n = 1\,484$), with 23.3% having a blood pressure that exceeded a systolic reading of 140 mmHg or a diastolic reading of 90 mmHg ($n = 2\,642$). Of 2 647 respondents, 8.9% reported taking blood pressure medicines in the previous week. Of these 235 respondents who reported antihypertensive medication use, 57.6% had an elevated blood pressure as defined above.

The average fasting blood sugar (FBS) level was 91.09 mg/dL (SD = 53.29, $n = 886$). Total cholesterol (TC) had a mean of 195.74 mg/dL (SD = 48.47, $n = 885$). Triglycerides (TG) averaged 159.62 mg/dL (SD = 100.19, $n = 886$), while high density lipoprotein (HDL) levels averaged 51.21 mg/dL (SD = 20.44, $n = 886$), and low density lipoprotein (LDL) levels showed a mean of 111.93 mg/dL (SD = 45.04, $n = 886$). BP readings showed an average systolic value of 126.73 mm Hg (SD = 19.29, $n = 2\,642$) and a diastolic value of 78.68 mm Hg (SD = 13.62, $n = 2\,642$). Lastly, the average BMI was 26.77 (SD = 7.64, $n = 2\,637$).

Table 4 explores the associations between alcohol use and HED with cardiovascular risk factor variables.

As shown in the fully adjusted models (adjusted for age, gender, ethnicity, marital status, income, employment, and region), HED was positively correlated with elevated BP (aOR 1.40; 95% CI [1.05, 1.88]; $p = 0.024$), obesity (aOR 1.49; 95% CI [1.13, 1.95]; $p = 0.004$), and triglycerides (β coefficient 28.38, $p = 0.004$).

DISCUSSION

We conducted a secondary analysis of weighted data, examining specifically the factors associated with alcohol use and HED, and the links between HED and cardiovascular risk factors. The data were collected from the 2016 WHO STEPwise risk factor surveillance for Guyana.

We found that a high proportion of the population used alcohol in the past 12 months and that the use of alcohol and HED were pronounced in young males, with higher levels of both recent alcohol use and HED among males of Indo-Guyanese descent. Of those who drank in the past 30 days, two-fifths reported having six drinks or more in one sitting. Of the entire sample, one in seven reported such HED.

Participants with higher levels of income were more likely to consume alcohol, and higher income was associated with increased odds of HED. This is well described internationally (28).

TABLE 4. Heavy episodic drinking of alcohol as a predictor of cardiometabolic risk factors in a sample of participants from the 2016 WHO STEPwise survey in Guyana (*N* = 2 662)

	BP >140/90[a]	Obesity[a]	FBS[b]	TC[b]	TG[b]	HDL[b]	LDL[b]
			Unadjusted models				
Alcohol user vs. non-user	0.92 (0.71, 1.20) (*p*=0.543)	0.72 (0.57, 0.91) (*p*=0.006)	–10.11 (*p*=0.049)	–1.25 (*p*=0.788)	–2.35 (*p*=0.828)	–0.32 (*p*=0.882)	–1.41 (*p*=0.753)
HED vs. non HED	1.16 (0.92, 1.48) (*p*=0.212)	0.70 (0.57, 0.86) (*p*<0.001)	–2.34 (*p*=0.620)	–0.45 (*p*=0.916)	26.10 (*p*=0.003)	–0.21 (*p*=0.909)	–3.92 (*p*=0.236)
			Adjusted models[c]				
	BP >140/90[a]	Obesity[a]	FBS[b]	TC[b]	TG[b]	HDL[b]	LDL[b]
Alcohol user vs. non-user	1.17 (0.82, 1.66) (*p*=0.395)	1.20 (0.86, 1.71) (*p*=0.291)	3.54 (*p*=0.526)	9.25 (*p*=0.063)	11.46 (*p*=0.364)	–0.65 (*p*=0.797)	5.91 (*p*=0.232)
HED vs. non HED	1.40 (1.05, 1.88) (*p*=0.024)	1.49 (1.13, 1.95) (*p*=0.004)	3.81 (*p*=0.463)	5.58 (*p*=0.216)	28.38 (*p*=0.004)	0.66 (*p*=0.746)	0.18 (*p*=0.966)

BP, blood pressure; FBS, fasting blood sugar; HDL, high density lipoprotein; HED, heavy episodic drinking; LDL, low density lipoprotein; TC, total cholesterol; TG, triglycerides.
Notes:
[a] Odds ratio with 95% CI (*p*-value).
[b] Beta coefficient (*p*-value).
[c] Fully adjusted model (by age, gender, ethnicity, marital status, income, employment, region).
Source: Prepared by the authors based on the study data.

After adjusting for age, gender, ethnicity, marital status, income, employment, and region, HED positively correlated with cardiovascular disease risk factors, specifically, elevated blood pressure, obesity, and elevated triglycerides.

What does this paper add to the international literature?

A major gap in making the claim for wider regulation of alcohol is the lack of evidence from the developing world and in SIDS. When Caribbean advocates discuss alcohol issues with regional politicians or the alcohol industry, the latter retort that international evidence is not applicable to these SIDS. Consequently, this work is critical to take us to the point where regional change becomes inevitable.

How do these findings compare with neighboring nations?

In countries neighboring Guyana, similar proportions consume alcohol. In Trinidad and Tobago 66% of households reported alcohol use (29), and in Suriname over 70% of a large population sample had ever used alcohol (30). Similarly, males have been identified globally as the main consumers of alcohol and as engaging in HED. HED has been identified in 33.9% of male drinkers in the last 30 days in Trinidad and Tobago (31), and in Suriname 17% of males were identified as having alcohol use disorder in the population studied (30). In Trinidad and Tobago, those of East Indian and mixed ethnicity were statistically more likely to engage in HED (29). Although Guyana has been reported as having some of the worst alcohol-use statistics in the Americas and in the ESC, the other Caribbean countries are not far behind. Guyana's greater struggles may have arisen because of its less developed economy or healthcare system challenges. Alcohol has also been shown to affect populations of South Asian descent disproportionately (32, 33), and Guyana has a larger proportion of South Asian population than the other ESC nations. These are areas for further investigation.

How have the Guyanese authorities approached this situation?

The Government of Guyana has recognized that alcohol represents a challenge. In 2018 it was reported that the Ministry of Health requested the Pan American Health Organization (PAHO)/WHO to assist in developing a national alcohol policy (34). Also, the Government of Guyana passed the Bill No. 20 of 2022 – Intoxicating Liquor Licensing (Amendment) Act 2022, which legislated that persons holding liquor licenses must "conspicuously post signs … and ensure that announcements are made, on the premises," that discourage drinking and driving (35). The penalties include significant fines (35).

What's next?

The Guyana Strategic Plan for the Integrated Prevention and Control of Chronic Noncommunicable Diseases and Their Risk Factors 2013–2020 targets a 15% reduction in the harmful use of alcohol (36). Internationally, the WHO "Best Buys" have been identified as cost-effective and acceptable interventions for alcohol control (37). Public health officials and policymakers should consider implementing these steps to protect their population and reach the goals identified in the regional health plans. Such interventions have been acknowledged in the strategic plans of other Caribbean nations. For example, the Jamaican National Strategic and Action Plan on NCDs for 2013–2018 calls for the reduction of the harmful effects of alcohol via the following mechanisms: tax increases, bans on alcohol advertising, restricted access to retailed alcohol, and reduced drunk driving (38). All are derived from the WHO Best Buys.

A key finding of this study is the link between HED and increased risk factors for cardiovascular disease, namely elevated blood pressure, obesity, and elevated triglycerides. Guyana has the highest cardiovascular disease death rate (291.9/100 000) (39) compared to other countries in the Americas. Given this link between alcohol and NCDs, addressing HED through the WHO Best Buys might eventually improve the cardiovascular health of the Guyanese population.

The Bill No. 20 of 2022 – Intoxicating Liquor Licensing (Amendment) Act 2022 (35) mentioned above is an example of responsible beverage service (RBS) programs. However, the results of such interventions show mixed evidence and are described as "inadequate as the sole approach to reduce over-service of alcohol" (40). Mechanisms should be put in place to evaluate the implementation and success of this Bill.

Strengths and weaknesses of the study

This study had several strengths, most notably, the large sample size taken from a random sample of households drawn from 288 enumeration districts. The sample was weighted for the analysis, which can help correct for sampling bias and nonresponse bias and ensure that underrepresented groups are represented equally in the final data (41). At the time of writing these data are now eight years old, and it is five years since the data were made available online, in September 2019. There are opportunities to standardize the timing of such surveys, and the release of the resulting datasets for secondary analysis.

There are several weaknesses attached to cross-sectional studies (42). Cross-sectional studies cannot determine causality, and the following biases, among others, may play a part in large cross-sectional studies such as this: incidence–prevalence bias, sampling bias, nonresponse bias, recall bias, and social desirability bias.

Finally, the Complex Samples module was not used in the analysis, given the random selection of households and random selection of one participant per household on the weighted dataset. This may have resulted in an underestimation of standard errors and inflation of significance.

Conclusion

The Guyanese population along the central and eastern coastal regions, young males, and those of Indo-Guyanese descent engage in HED, and HED is associated with an elevation of risk factors for cardiovascular disease. These findings provide the public health authorities with specific at-risk populations and opportunities for tailored messages.

Author contributions. RGM conceived the original idea, planned the analysis, applied for and acquired the data. MSM analyzed the data. RG and RK provided local content and

regional perspectives. All authors contributed to the interpretation of the results and wrote and revised the paper. All authors reviewed and approved the final version.

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Consumo de alcohol, consumo excesivo episódico y riesgo cardiovascular asociado en Guyana

RESUMEN

Objetivo. Determinar las asociaciones entre las características demográficas, el consumo de alcohol, el consumo excesivo episódico (CEE) y los factores de riesgo cardiovascular, utilizando la encuesta realizada por la Organización Mundial de la Salud (OMS) en Guyana en el 2016 sobre factores de riesgo de enfermedades no transmisibles con el método STEPS.

Métodos. Se utilizó una muestra ponderada en un análisis secundario de la información obtenida de una base de datos en línea. Se aplicaron métodos de estadística descriptiva y modelos de regresión logística binaria y de regresión lineal para determinar los subgrupos poblacionales con mayor riesgo de CEE o de enfermedad cardiovascular.

Resultados. Se analizaron los datos de 2662 personas (porcentaje de respuesta del 77%). En la muestra no ponderada, las mujeres constituían el 59,9% (IC del 95%: 58,04 - 61,76) de las personas encuestadas, y la media de edad era de 40,7 años. Las personas indoguyanesas constituían el 39,4% (IC del 95%: 37,54 - 41,26) de la muestra. El nivel máximo de estudios completado fue el primario en el 44,5% (IC del 95%: 42,61 - 46,39) y el secundario en el 32,5% (IC del 95%: 30,72 - 34,28). De las personas participantes que habían tomado alcohol alguna vez, el 80,1% (IC del 95%: 78,30 - 81,90) confirmó haber consumido alcohol en los últimos 12 meses. Los hombres jóvenes tenían una probabilidad significativamente mayor de consumir alcohol. En el análisis de la muestra ponderada, las personas amerindias presentaban una menor probabilidad de consumo de alcohol (razón de posibilidades [OR, por su sigla en inglés]: 0,36; IC del 95%: 0,25 - 0,51) en comparación con las indoguyanesas. Los residentes en la región de Demerara-Mahaica fueron los que tuvieron un mayor porcentaje de personas con consumo de alcohol, con un 86,1% (OR: 4,74; IC del 95%: 2,86 - 7,86). Por lo que respecta al CEE, el 16,4% (IC del 95%: 14,73 - 18,07) de toda la muestra, y el 41,1% (IC el 95%: 38,88 - 43,32) de las personas que habían bebido los últimos 30 días, declararon que habían consumido menos de 6 copas en un mismo episodio (lo cual corresponde a la definición del CEE). El grupo etario de 25-29 años mostró una mayor probabilidad de CEE (OR: 2,09; IC del 95%: 1,13 - 3,89). Los hombres eran más propensos al CEE que las mujeres (OR: 6,13; IC del 95%: 4,73 - 7,95). Las personas de origen africano (OR: 0,78; IC del 95%: 0,61 - 1,00) y las de ascendencia amerindia (OR: 0,48; IC del 95%: 0,31 - 0,73) tenían una probabilidad de CEE inferior a las de las indoguyanesas. En los modelos con ajuste, el CEE mostró una correlación positiva con la presión arterial elevada (OR ajustada [aOR]: 1,40; IC del 95%: 1,05 - 1,88), la obesidad (aOR: 1,49; IC95%: 1,13 - 1,95) y el aumento de los triglicéridos (coeficiente β: 28,38; $p = 0,004$). Para cada uno de los valores de OR y aOR indicados, el valor de p fue igual o inferior a 0,05.

Conclusiones. Este análisis secundario determina que, en la población de las regiones costeras central y oriental de Guyana, en los hombres jóvenes y en las personas de ascendencia indoguyanesa podría obtenerse un beneficio con intervenciones de salud pública centradas en el consumo de alcohol y el riesgo cardiovascular.

Palabras clave Consumo de bebidas alcohólicas; consumo excesivo de bebidas alcohólicas; factores de riesgo de enfermedad cardiaca; región del Caribe; Guyana.

Associação entre consumo de álcool, beber pesado episódico e risco cardiovascular na Guiana

RESUMO

Objetivo. Determinar a associação entre características demográficas, consumo de álcool, beber pesado episódico (BEP) e fatores de risco cardiovascular usando dados de 2016 referente à Guiana obtidos pela aplicação do método progressivo para a vigilância de fatores de risco para doenças não transmissíveis (STEPS) da Organização Mundial da Saúde (OMS).

Métodos. Uma amostra ponderada foi usada para uma análise secundária de dados obtidos de uma base de dados on-line. Foram aplicadas estatísticas descritivas, regressão logística binária e modelos de regressão linear para identificar quais subpopulações tinham maior risco de BEP ou doença cardiovascular.

Resultados. Foram analisados dados de 2 662 indivíduos (taxa de resposta de 77%). Na amostra não ponderada, as mulheres representavam 59,9% (IC 95%: 58,04–61,76) dos entrevistados, e a idade média era de 40,7 anos. Os indo-guianenses representavam 39,4% (IC 95%: 37,54–41,26) da amostra. Os níveis mais altos de escolaridade completa eram o primário, que correspondia a 44,5% (IC 95%: 42,61–46,39) da amostra, e o secundário, 32,5% (IC 95%:30,72–34,28). Dentre as pessoas que já haviam consumido alguma bebida alcoólica, 80,1% (IC 95%: 78,30–81,90) confirmaram ter consumido álcool nos 12 meses anteriores. Homens mais jovens tinham uma probabilidade significativamente maior de consumir álcool. Na amostra ponderada, os indígenas tinham menor probabilidade de consumir álcool (razão de chances [RC]: 0,36; IC 95%: 0,25–0,51) que os indo-guianenses. Os residentes da região de Demerara-Mahaica apresentaram a maior taxa de consumo, 86,1% (RC: 4,74; IC 95%: 2,86–7,86). Com relação ao BEP, 16,4% (IC 95%: 14,73–18,07) de toda a amostra e 41,1% (IC 95%: 38,88–43,32) dos que haviam consumido bebida alcoólica nos 30 dias anteriores informaram ter tomado ao menos seis doses de álcool (a definição de BEP) em uma única ocasião. A faixa etária de 25 a 29 anos apresentava maior chance de BEP (RC: 2,09; IC 95%: 1,13–3,89). Os homens tinham maior probabilidade de BEP que as mulheres (RC: 6,13; IC 95%: 4,73–7,95). A chance de BEP era menor entre afro-guianenses (RC: 0,78; IC 95%: 0,61–1,00) e indígenas (RC: 0,48; IC 95%: 0,31–0,73) que entre indo-guianenses. Nos modelos ajustados, o BEP estava positivamente correlacionado com pressão arterial elevada (RC ajustada [RCa]: 1,40; IC 95%: 1,05–1,88), obesidade (RCa: 1,49; IC 95%: 1,13–1,95) e triglicérides elevados (coeficiente β: 28,38, $p = 0,004$). Para cada RC e RCa acima, foi utilizado $p \leq 0,05$.

Conclusões. Esta análise secundária identifica que a população da região costeira central e oriental, jovens do sexo masculino e pessoas de ascendência indo-guianense poderiam se beneficiar de intervenções de saúde pública para reduzir o consumo de álcool e o risco cardiovascular na Guiana.

Palavras-chave Consumo de bebidas alcoólicas; consumo excessivo de bebidas alcoólicas; fatores de risco de doenças cardíacas; região do Caribe; Guiana.