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Drunk driving: a secondary analysis of factors associated with driving under the influence of alcohol in Jamaica

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Drunk driving: a secondary analysis of factors associated with driving under the influence of alcohol in Jamaica

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ABSTRACT

Objectives To determine the prevalence of alcohol use, sociodemographic factors and risk of alcohol dependence amongst vehicle drivers in Jamaica.

Design A secondary data analysis.

Setting This study was conducted utilizing the dataset of the Jamaica National Drug Prevalence Survey 2016.

Participants This included 1,060 vehicle drivers derived from the population sample of 4,623. The participants from each household were randomly selected as the respondent for the survey.

Primary and secondary outcome measures Alcohol use and dependence was measured using the Alcohol Use Disorders Identification Test (AUDIT) questionnaire. Driving under the influence of alcohol (DUIA) was assessed by questions regarding its use in the past 12 months. The analysis involved the use of Pearson's Chi-Square test and logistic regression.

Results 75% of Jamaicans reported lifetime alcohol use. Approximately 65% of drivers indicated that they currently drink alcohol. 18% of drivers who currently drink alcohol admitted to DUIA. Reportedly, 54.5% of these drivers were alcohol binge drinkers with 41.5% also driving under the influence of cannabis. The bivariate analysis demonstrated DUIA was higher among Christian participants and those who worked in non-machine operator jobs ($p=0.002$ and $p=0.008$ respectively). Vehicle drivers altogether and drivers who drive under the influence of alcohol had significant associations with hazardous drinking ($p=0.011$ and $p=0.000$ respectively). Logistic regressions highlighted drivers 34 years and under ($p=0.012$), male drivers ($p=0.002$) and the head of the household ($p=0.050$) were 1.82, 3.30 and 1.86 times more likely respectively, to report driving under the influence of alcohol in the past year.

Conclusions The prevalence of alcohol use amongst Jamaica's total population and vehicle drivers is high. That one in five drivers, who currently consume alcohol, also admit to driving under the influence, suggests the urgent need for mitigation strategies and legislative action as part of a preventative effort to reduce drunk driving.

(Word count 300)

Keywords: Drivers, Alcohol use, Jamaica, Household survey, Prevalence

Article Summary

Strengths and limitations of this study

- The random selection of participants to survey, likely enhanced both the sample representation within the national population and the ability to generalize the research findings. Moreover, the large sample size helped to increase the power of the study.
- The use of robust multivariable logistic regression in the analysis provides a baseline for future research endeavours.
- This study was a cross-sectional design and thus is limited to creating associations and may not be used to conclude causality.
- The respondents providing answers they consider to be socially acceptable might also introduce a response bias.

INTRODUCTION

Road Traffic Injury (RTI) represents a major global public health issue, accounting for approximately fifty million non-fatal injuries and 1.35 million annual fatalities worldwide (1). At the turn of the century, road traffic fatality rates in the Caribbean and Latin America soared by more than 20% over the ensuing decade (2), indicating that just shy of one million people died in road traffic accidents over that period (3).

Jamaica is no exception, as road traffic accidents represent a massive public health problem that continues to be one of the major causes of injury and death (4,5) in the largest English-speaking island in the West Indies, that is residence to just under 3 million citizens (6). Given that road transport is the predominant mode of travelling, available statistics indicate that road traffic fatalities in Jamaica have steadily increased over the past five years, from 389 in 2018 to 488 in 2022 (7), the latest figure representing the highest tally in the last decade.

An avoidable risk factor for road traffic injury is driving under the influence of alcohol (DUIA), where research has demonstrated a dose-dependent influence on driving performance and an increased risk and severity of vehicular crash (8–10). Extant literature suggests DUIA poses a serious safety concern because alcohol has been shown to be responsible for a high number of fatal vehicular crashes in many countries (11,12). In Jamaica, a number of studies have demonstrated an association between victims of vehicular accidents and a blood alcohol concentration (BAC) level in excess of the legal limit of 0.08 g/dl (13,14). However, research consistently indicates an increased risk of a driver being involved in a road traffic accident after exceeding a BAC level of 0.05 g/dl (15). At this level, drivers are more likely to speed, misjudge distance, and display impaired cognitive functioning (16–18). Current national legislation endorses a blood alcohol concentration (BAC) limit of ≤ 0.08 g/dl for both general and

young/first-time drivers (19), that are higher than international recommendations of ≤ 0.05 g/dl for the general population and ≤ 0.02 g/dl for young or first-time drivers (20).

The most recent Global Status Report on Road Safety suggested that almost 20% of road traffic deaths in Jamaica were due to DUIA (21). To date, no studies in the Caribbean have used nationally representative data to assess the alcohol use patterns, risk of alcohol dependence and the associated sociodemographic characteristics of vehicle drivers that may drive under the influence of alcohol.

Studies both regionally and globally indicate a higher prevalence of DUIA in males and young adults (3,9). As such, the relevant findings of this study may help provide the impetus in prioritizing legislation and intervention among the driving subpopulation in Jamaica, in accordance with best practice recommendations in guarding against drunk-driving as outlined by the World Health Organization SAFER initiative (20).

OBJECTIVES

1. To determine the prevalence of alcohol use patterns amongst vehicle drivers, including those who drive under the influence of alcohol (DUIA), those who are binge drinkers that drive under the influence of alcohol, and those who drive under the influence of alcohol and cannabis.
2. To examine and compare the risk of alcohol dependence amongst two sets of driver groups - (a) drivers versus non-drivers and (b) drivers who drive under the influence of alcohol versus drivers who do not drive under the influence of alcohol.
3. To investigate the sociodemographic factors associated with driving under the influence of alcohol.

METHODS

Study Design, Sample Size and Data Source

The original study was a cross-sectional survey of a Jamaican population sample examining drug use prevalence and patterns (22). The sample consisted of 4,623 participants living in 14 parishes in Jamaica. The survey utilized a stratified multi-stage sampling design of which the primary sampling units (PSU) were the Enumeration Areas (EAs). In each EA, systematic random sampling was used to draw 16 households, from which one individual between the age of 12 and 65 years served as the survey respondent. Data was collected between April and July 2016 from a standardized questionnaire developed by the Inter-American Drug Abuse Control Commission (CICAD) and the Inter-American Observatory on Drugs (OID) and conducted through partnership with Jamaica's National Council on Drug Abuse (NCDA). Sampling weights were determined to account for selection probability, non-response, and population distribution (22).

This study is a secondary data analysis of the National Drug Prevalence Survey, Jamaica 2016. The target population comprised of 1,060 participants that represented persons that drive vehicles. This research extracted variables relevant to driving under the influence of alcohol, alcohol use patterns, dependence and the associated sociodemographic characteristics that might influence alcohol use in vehicle drivers. This study contained no identifying data of respondents, and no direct or indirect contact was made with any respondents.

Study Variables

Alcohol Use Prevalence

The prevalence of alcohol use was determined for the periods of lifetime or 'ever' use, past year use, and past month/current use by using the target variables. Responses were coded as 1 = Yes and 2 = No. For current and heavy/binge drinking alcohol use, respondents were asked to state

had they taken 5 drinks or more for males or 4 drinks or more for females, on a single occasion in the past 2 weeks. Seven response options were re-categorized into 1 = No and 2 = Yes.

Alcohol Dependence

Alcohol use was assessed using The Alcohol Use Disorders Identification Test (AUDIT), a 10-item scale developed by the World Health Organization in which the answers to each question are rated on a scale ranging from 0 to 4, giving a maximum score of 40 (23). A score of 8 or more is associated with harmful or hazardous drinking, whereas a score of 13 or more in women, and 15 or more in men, is likely to indicate alcohol dependence. For this study, the AUDIT scores were re-categorized into two groups where a score greater than or equal to 8 was defined as harmful or hazardous drinking and a score of less than or equal to 7 was defined as not harmful or hazardous drinking.

Driving under the influence

The National Drug Prevalence Survey questionnaire asked respondents “Have you driven a vehicle in the past 12 months?” the response options were 1 = Yes (Drivers) and 2 = No (Non-Drivers). For the item “During the past 12 months, have you driven a vehicle while you were under the influence of alcohol?” the response options were 1 = Yes (DUIA), and 2 = No (Non-DUIA). Statistical computations were utilized to extract respondents who were current alcohol users that also answered “Yes” to the question “During the past 12 months, have you driven a vehicle while you were under the influence of alcohol?” Statistical computations were utilized to extract respondents who were current cannabis users that also answered “Yes” to the question “During the past 12 months, have you driven a vehicle while you were under the influence of illegal drugs?” to denote those drive under the influence of cannabis (DUIC) for analytical purposes.

Sociodemographic characteristics

Sociodemographic characteristics that might influence alcohol use in drivers were included as covariates. Survey questions that contained the option “don’t know” or “no response” was treated as missing variables (Li et al., 2019). Respondents were asked to state their age. This was categorized into 2 groups – 1 = 34 years and under, representing young adults as suggested by Franssen and colleagues (24) and 0 = 35 years and over. Respondents were asked to state their gender (1 = male, 0 = female) and geographical location (re-categorized into 1 = urban and 0 = rural). Educational status was assessed with the question, “What is the highest educational level that you have achieved?” There were 10 response options. These were re-categorized into 1 = tertiary level, 0 = below tertiary level. The respondents were asked to state their marital status. This item had seven response options; these were re-categorized into two options: 1 = married, 0 = unmarried. The question on religious affiliation had 26 response options. These were re-categorized into two, namely, 1 = Christian, 0 = Non-Christian. Respondents were asked “Are you the head of household?”. The response options were 1 = Yes, 0 = No. The respondents were asked to choose the household’s total monthly income from a list of 15 options. These were re-categorized into 1 = JA\$50,000 and under or 0 = over JA\$50,000. For occupation description, respondents were asked to describe their job from a list of 11 options. These were re-categorized into 1 = machine operators or 0 = non-machine operators.

Statistical Analysis

Descriptive statistical analysis was performed to determine the prevalence of alcohol use in the total population and amongst vehicle drivers as well as to describe the sociodemographic characteristics of vehicle drivers and represented in frequencies, means and percentages. Bivariate analysis examining the association between vehicle drivers who drive and do not drive

under the influence of alcohol and level of use according to the AUDIT questionnaire was done using Pearson’s Chi-Square test. Bivariate analysis was also conducted to examine the association between vehicle drivers and non-vehicle drivers and level of use according to the AUDIT questionnaire. Predictive tests were done to identify risk and protective sociodemographic factors and driving under the influence of alcohol using logistic regression analyses. All statistical analyses were conducted using R software, version 4.2.0. The data were presented in the form of tables and text. Odds ratios and 95% confidence intervals were recorded. A p-value of <0.05 was considered statistically significant.

Ethical Considerations

Respondent participation was voluntary and the survey undertaken in accordance with the international guidelines for research on human subjects. The Ministry of National Security granted approval for the National Drug Use Prevalence Survey. Informed consent was obtained from each participant and assurance of the confidentiality and anonymity of the data was provided through the non-retention of names. Data was stored in a secured database (22).

RESULTS

Prevalence

Table 1 displays the prevalence of alcohol use in the total population (n=4,623) and amongst the population of vehicle drivers (n=1,060). Approximately 1 in 4 individuals was a vehicle driver (23%). Among those in the population who reported lifetime alcohol use, 72.9% reported use in the past year and 54.3% reported use in the past month. Of the 1060 vehicle drivers, 685 persons were drivers who admitted to being current alcohol users and 137 drivers admitted to driving under the influence of alcohol in the past year. Of the 685 drivers, 123 persons were drivers who admitted to driving under the influence and being current alcohol users. This is approximately 18% and indicates that 1 in 5 Jamaicans, who are drivers and are current alcohol users, operate a

vehicle under the influence of alcohol. Of these 123 respondents, 67 drivers were alcohol binge drinkers. This is approximately 54.5% and indicates that 1 in 2 Jamaicans that were current alcohol users and admitted to driving under the influence were alcohol binge drinkers. Of these 123 respondents, 51 drivers (41.5%) were also current cannabis users that admitted to driving under the influence.

Table 1: Alcohol use prevalence amongst the total population and vehicle drivers

Alcohol Use	Frequency	Percentage
Population Lifetime Use	3460	74.8%
Population Past Year Use	2522	72.9%
Population Past Month/Current Use	1879	54.3%
Current Users who Drive	685	64.6%
Current Users who DUIA	123	18.0%
Current & Binge Drinkers who DUIA	67	54.5%
Current Users who DUIA and DUIC	51	41.5%

Sociodemographic factor findings

Table 2 shows the sociodemographic characteristics of vehicle drivers in the population. Most drivers were male (70.6%), unmarried (61.0%), employed (72.6%), of Christian affiliation (72.8%), inhabiting rural areas (54.5%) and with a less than tertiary level scholastic achievement (83.3%). The age range of respondents was between 12–65 years with a mean age of 36.56 years (s.d.±12.582).

Table 2: Sociodemographic characteristics of vehicle drivers in the population

Variable	Frequency	Percentage
Gender		
Male	748	70.6%
Female	312	29.4%
Age		
34 years and under	551	52.0%
Over 35 years	509	48.0%
Education		
Tertiary level	177	16.7%
Below tertiary level	883	83.3%

Religion		
Christian	772	72.8%
Non-Christian	288	27.2%
Employment		
Employed	770	72.6%
Unemployed	290	27.4%
Marital Status		
Married	413	39.0%
Unmarried	647	61.0%
Geographic Location		
Urban	482	45.5%
Rural	578	54.5%
Head of Household		
Yes	700	66.0%
No	360	34.0%
Household Income		
JA\$50,000 and under	416	45.1%
Over JA\$50,000	507	54.9%
Occupation		
Machine Operators	267	34.6%
Non-Machine Operators	504	65.4%

Table 3 shows the sociodemographic characteristics of vehicle drivers that drive under the influence of alcohol (DUIA) and those that do not (Non-DUIA). A significant difference was found in the gender distribution for both the drivers who drank influence of alcohol and those that did not. Among the DUIA group, 92% were males compared to 8% who were female ($p=0.000$). A statistically significant difference was also noted amongst religion distribution. Among the DUIA group, 61.3% were Christian and 38.7% were Non-Christian ($p=0.002$). A significant difference was also found amongst those who were the head of the household and DUIA ($p=0.020$). Likewise, a significant association was found among drivers who operated machinery as part of their job description in the DUIA group ($p=0.008$).

Although there were higher numbers of employed drivers and drivers who earned more than JA\$50,000 monthly than their counterparts among the DUIA group, this association was not statistically significant ($p=0.101$ and $p=0.159$ respectively).

Table 3: Sociodemographic characteristics of vehicle drivers that drive under the influence and did not drive under the influence of alcohol in the past year.

	Vehicle Drivers (Non-DUIA)	Vehicle Drivers (DUIA)	
Variable	Frequency	Frequency	p-value
Gender			
Male	622 (67.4%)	126 (92.0%)	0.000***
Female	301 (32.6%)	11 (08.0%)	
Age			
34 years and under	475 (51.5%)	76 (55.5%)	0.432
Over 35 years	448 (48.5%)	61 (44.5%)	
Education			
Tertiary level	157 (17.0%)	20 (12.7%)	0.560
Below tertiary level	766 (83.0%)	117 (87.3%)	
Religion			
Christian	688 (74.5%)	84 (61.3%)	0.002**
Non-Christian	235 (25.5%)	53 (38.7%)	
Employment			
Employed	662 (71.7%)	108 (78.8%)	0.101
Unemployed	261 (28.3%)	29 (21.2%)	
Marital Status			
Married	363 (39.3%)	50 (36.5%)	0.589
Unmarried	560 (70.7%)	87 (63.5%)	
Geographic Location			
Urban	422 (45.7%)	60 (43.8%)	0.741
Rural	501 (54.3%)	77 (56.2%)	
Head of Household			
Yes	597 (64.7%)	103 (75.2%)	0.020**
No	326 (35.3%)	34 (24.8%)	
Household Income			
JA\$50,000 and under	370 (46.0%)	46 (38.7%)	0.159
Over JA\$50,000	434 (54.0%)	73 (61.3%)	
Occupation			
Machine Operators	217 (32.7%)	50 (46.3%)	0.008**
Non-Machine Operators	446 (67.3%)	58 (53.7%)	
p-value significant at the 0.05 level*; p-value significant at the 0.01 level**; p-value significant at the 0.001 level***			

Alcohol dependence findings

Table 4 summarizes the level of use according to the AUDIT questionnaire amongst two driver groups. Approximately 13% of non-drivers reported harmful or hazardous drinking behaviour (AUDIT $\geq$ 8), whereas 16% of drivers reported harmful or hazardous drinking behaviour

(AUDIT ≥ 8). This indicates that drivers were more likely to develop dependence to alcohol than non-drivers and this difference was statistically significant ($p=0.011$).

Approximately 12% of drivers who did not drive under the influence of alcohol reported harmful or hazardous drinking behaviour (AUDIT ≥ 8), whereas 41% of drivers who did drive under the influence of alcohol (DUIA), reported harmful or hazardous drink behaviour (AUDIT ≥ 8). This indicates that DUIA drivers were more likely to develop dependence to alcohol than Non-DUIA drivers and this difference was statistically significant ($p=0.000$).

Table 4: Chi-square test of independence between the AUDIT questionnaire and drivers versus non-drivers and DUIA versus Non-DUIA drivers

	AUDIT ≤ 7	AUDIT ≥ 8
Non-Drivers	1455	209
Drivers	718	140
$X^2 = 6.390, df = 1, p\text{-value} = 0.011^{**}$		
	AUDIT ≤ 7	AUDIT ≥ 8
Non-DUIA Drivers	644	87
DUIA Drivers	77	53
$X^2 = 65.447, df = 1, p\text{-value} = 0.000^{***}$		
p-value significant at the 0.05 level*; p-value significant at the 0.01 level**; p-value significant at the 0.001 level***		

Estimation of Odd Ratios for sociodemographic factors associated with DUIA

Table 5 shows the results of a logistic regression analysis performed to assess the associations between driving under the influence of alcohol in the past year and select sociodemographic factors. The model illustrates statistically significant relationships for several factors.

Drivers who were 34 years and under were 1.82 times more likely than those 35 years and older, to report driving under the influence of alcohol in the past year. Male drivers were 3.30 times more likely than females to report driving under the influence of alcohol in the past year. In addition, those drivers who were the head of household were 1.86 times more likely than those who were not, to report driving under the influence of alcohol in the past year.

Being married, being a Christian, and having a household income of JA\$50,000 and under, reduce the risk of driving under the influence of alcohol in the past year. These inverse associations are, however, not statistically significant.

Table 5: Logistic regression analysis model of select sociodemographic factors associated with driving under the influence of alcohol in the past year

Variables	Estimate	OR	95% CI	p-value
Age (34 years and under)	0.60127	1.82	1.15, 2.92	0.012**
Occupation (machine operators)	0.40566	1.50	0.94, 2.40	0.091
Marital status (married)	-0.27291	0.76	0.47, 1.21	0.250
Gender (male)	1.19514	3.30	1.62, 7.49	0.002**
Education (tertiary level)	0.11925	1.13	0.57, 2.13	0.720
Religion (Christian)	-0.44583	0.64	0.40, 1.03	0.064
Household Income (JA\$50,000 and under)	-0.39084	0.68	0.41, 1.10	0.120
Head of household (yes)	0.62223	1.86	1.02, 3.57	0.050*
Geographical location (urban)	0.01995	1.02	0.64, 1.63	0.930
p-value significant at the 0.05 level*; p-value significant at the 0.01 level**; p-value significant at the 0.001 level***				

DISCUSSION

Alcohol is the most commonly used substance among both young and older people in Jamaica (22), with most persons beginning use in early adolescence (25). This is the first study in Jamaica and the Caribbean that demonstrates the prevalence of alcohol use, risk of alcohol dependence and associations with sociodemographic factors amongst vehicle drivers. This research found that approximately 1 in 5 Jamaican drivers was a current alcohol consumer whom admitted to driving under its influence (DUIA). Furthermore, more than 40% and 50% of these drivers respectively, admitted to driving under the influence of cannabis (DUIC) and being a binge drinker. Driving under the influence of alcohol, especially at higher levels of consumption or in combination with cannabis have been associated with greater driving impairment (8,9,26,27) and risk of fatal crash (28). Extant literature highlights alcohol and cannabis co-use is associated with an increased risk of vehicular crash fatality by 25 to 40 times in comparison to drivers who used

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no substance or a singular drug (29,30). These findings represent a drug use pattern of concern amongst Jamaican drivers that dually fill a pre-existent gap in the national and regional literature, and catalyze the need for further research to construct appropriate reduction strategies and legislation in dealing with a potential public health problem.

This study also revealed a number of sociodemographic variables associated with DUIA. Bivariate analysis revealed significant associations with gender, religious affiliation, occupational description and head of household status. Multivariate regression analysis indicated that being a young adult, of male gender and the head of the household were predictive of driving under the influence of alcohol. Young adults and males respectively were approximately two and three times more likely to report driving under the influence of alcohol. This is in keeping with previous research that found similar higher prevalence of DUIA amongst males and younger adults in the United States (31–33) and Norway (34). This is likely attributable to a young male’s willingness to engage in risky behaviours (35) such as binge drinking (36,37) and polysubstance use (38) and women being more cautious with regards to driving under the influence of alcohol (39). Moreover, research theorizes that gender role is influential, wherein possessing the aptitude to consume and cope with the effects of high-risk drug use is seen as an undeniable sign of male bravado and prowess (40).

This study also reported that the head of the household was two times more likely to drive under the influence of alcohol. The head of the household is the main provider of financial sustenance for the family (41). Driving under the influence of alcohol places the main breadwinner to risks of arrest by law enforcement (42), devastating injury and/or loss of life (43), further predisposing the family unit to increased financial and emotional stress (44).

Although not reflected in the logistic regression model, bivariate analysis indicated a significant association between religious affiliation and DUIA. While religious affiliation is protective against drug use (45) and the majority of the Jamaican population identifies with the Christian faith (6), this study indicated that DUIA was higher among Christian than non-Christian drivers. Strong socio-cultural use of alcohol in religious and social settings likely explains this finding (46), albeit at variance with studies that indicated religious affiliation reduced the risks associated with alcohol use (47) and encouraged safe driving practices like seatbelt use (48). This finding is unique and encourages further study given that modest research to date has focused on cultural factors like religious involvement as a possible determinant or deterrent of DUIA behaviour. This may prove insightful in crafting a religious-based response as an adjunct to enforcing the drink driving countermeasures in line with the SAFER framework recommendations as outlined by the World Health Organization (20). Bivariate analysis additionally indicated a significant difference between occupational description and DUIA, although the proportion of non-machine operators and machine operators was close (53.7% and 46.3% respectively). Drivers who drive under the influence of alcohol are likely to display similar impairment in motor coordination, concentration and depth perception (49), whilst operating machines as part of their job and result in an increased rate of work accidents (50).

A most recent population-based study in the United States, demonstrated that alcohol abuse/dependence was positively associated with DUIA (51). This study indicated a similar finding in that drivers who admitted to DUIA reportedly engaged in harmful and hazardous drinking behaviours in comparison to drivers who did not DUIA. This finding emphasizes the importance of targeting drivers with alcohol misuse and addiction, and implementing screening and treatment programs as part of a national DUIA prevention effort that have found favour

elsewhere (52). Of interest, this study also highlights that drivers overall, engaged in harmful and hazardous drinking in comparison to non-drivers. This may be due to the finding that being able to drive is associated with increased access to social participation and experiences (53), a common denominator that endears itself to alcohol consumption (54). Preventative efforts can include a court-mandated alcohol consumption monitoring programme for DUIA offenders, inclusive of alcohol monitoring bracelets and random urine and breathalyzer tests (55).

The strengths of this study are that it is the first study to examine the factors associated with DUIA amongst drivers from a nationally representative sample in the Caribbean and that it used robust multivariable logistic regression in the analysis. The AUDIT questionnaire for alcohol dependence further enhances the reliability of the findings given its noted validity and use in multiple studies internationally (56-59). One of the limitations of the study is that this study was a cross-sectional design and thus is limited to creating association. In addition this study utilized a self-report survey related to alcohol use and thus underreporting bias may be implicated in the findings. Notwithstanding, the evidence in this study provide a foundation for future research.

CONCLUSION

One in 5 Jamaican drivers who currently consume alcohol operates a vehicle under its influence, with over 50% being an alcohol binge drinker. These findings have likely implications towards increasing road traffic casualties, rising workplace accidents and an elevated burden on healthcare systems. Prevention and mitigation strategies should target these individuals to reduce driving under the influence of alcohol. Furthermore, the findings indicate that ongoing legislation discourse is best guided by the World Health Organization’s SAFER initiative that focuses on drunk-driving countermeasures as part of its alcohol policy interventions.

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Author Contributions KL contributed to the conception, design, drafting of the work; interpreted the data that was analyzed; critically revised the work for important intellectual content; and approved of the final version to be published. CS contributed to the conception of the work; analysis and interpretation of data for the work; and approved the final version to be published. GF contributed to the analysis and interpretation of data for the work and approved the final version to be published. WA contributed to the conceptualizing of the design of this paper, writing of first and subsequent drafts of the paper and critically revised the work for important intellectual content; and approved of the final version to be published. All authors read and approved the final manuscript and have agreed both to be personally accountable for the author's own contributions and to ensure that questions related to the accuracy or integrity of any part of the work, even ones in which the author was not personally involved, are appropriately investigated, resolved, and the resolution documented in the literature.

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Competing interests None declared

Patient consent Consent to participate was requested from the participants in the consent form prior to the collection of data. Informed consent was obtained from all subjects, where confidentiality and anonymity were protected through the non-retention of names.

Ethics approval The Ministry of National Security granted approval for the National Drug Use Prevalence Survey.

Data sharing statement The full dataset is available through the National Council on Drug Abuse Jamaica (info@ncda.org.jm).

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Reporting checklist for cross sectional study.

Based on the STROBE cross sectional guidelines.

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Complete this checklist by entering the page numbers from your manuscript where readers will find each of the items listed below.

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			Page
Reporting Item			Number
Title and abstract			
Title	#1a	Indicate the study's design with a commonly used term in the title or the abstract	1
Abstract	#1b	Provide in the abstract an informative and balanced summary	1

of what was done and what was found

Introduction

Background / [#2](#) Explain the scientific background and rationale for the 3-4
rationale investigation being reported

Objectives [#3](#) State specific objectives, including any prespecified 4
hypotheses

Methods

Study design [#4](#) Present key elements of study design early in the paper 5

Setting [#5](#) Describe the setting, locations, and relevant dates, including 5
periods of recruitment, exposure, follow-up, and data collection

Eligibility criteria [#6a](#) Give the eligibility criteria, and the sources and methods of 5
selection of participants.

[#7](#) Clearly define all outcomes, exposures, predictors, potential n/a
confounders, and effect modifiers. Give diagnostic criteria, if
applicable

Data sources / [#8](#) For each variable of interest give sources of data and details of 5-8
measurement methods of assessment (measurement). Describe
comparability of assessment methods if there is more than one
group. Give information separately for for exposed and
unexposed groups if applicable.

Bias [#9](#) Describe any efforts to address potential sources of bias n/a

Study size [#10](#) Explain how the study size was arrived at 5-6

1	Quantitative	#11	Explain how quantitative variables were handled in the	5-8
2				
3	variables		analyses. If applicable, describe which groupings were chosen,	
4			and why	
5				
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8				
9	Statistical	#12a	Describe all statistical methods, including those used to control	5-8
10				
11	methods		for confounding	
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14	Statistical	#12b	Describe any methods used to examine subgroups and	5-8
15				
16	methods		interactions	
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19	Statistical	#12c	Explain how missing data were addressed	n/a
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21	methods			
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25	Statistical	#12d	If applicable, describe analytical methods taking account of	n/a
26				
27	methods		sampling strategy	
28				
29				
30	Statistical	#12e	Describe any sensitivity analyses	n/a
31				
32	methods			
33				
34				
35				
36	Results			
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39	Participants	#13a	Report numbers of individuals at each stage of study—eg	n/a
40				
41			numbers potentially eligible, examined for eligibility, confirmed	
42				
43			eligible, included in the study, completing follow-up, and	
44				
45			analysed. Give information separately for for exposed and	
46				
47			unexposed groups if applicable.	
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51	Participants	#13b	Give reasons for non-participation at each stage	n/a
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54	Participants	#13c	Consider use of a flow diagram	n/a
55				
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57	Descriptive data	#14a	Give characteristics of study participants (eg demographic,	n/a
58				
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clinical, social) and information on exposures and potential confounders. Give information separately for exposed and unexposed groups if applicable.

Descriptive data	#14b	Indicate number of participants with missing data for each variable of interest	n/a
Outcome data	#15	Report numbers of outcome events or summary measures. Give information separately for exposed and unexposed groups if applicable.	8-13
Main results	#16a	Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included	8-13
Main results	#16b	Report category boundaries when continuous variables were categorized	8-13
Main results	#16c	If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period	n/a
Other analyses	#17	Report other analyses done—e.g., analyses of subgroups and interactions, and sensitivity analyses	8-13
Discussion			
Key results	#18	Summarise key results with reference to study objectives	13-16
Limitations	#19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias.	16

1 Interpretation [#20](#) Give a cautious overall interpretation considering objectives, `13-16
2
3 limitations, multiplicity of analyses, results from similar studies,
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5 and other relevant evidence.
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9 Generalisability [#21](#) Discuss the generalisability (external validity) of the study n/a
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14 **Other Information**
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17 Funding [#22](#) Give the source of funding and the role of the funders for the n/a
18
19 present study and, if applicable, for the original study on which
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25 None The STROBE checklist is distributed under the terms of the Creative Commons Attribution
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BMJ Open

Drunk driving: a secondary analysis of factors associated with driving under the influence of alcohol in Jamaica

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Drunk driving: a secondary analysis of factors associated with driving under the influence of alcohol in Jamaica

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ABSTRACT

Objectives To determine the prevalence of alcohol use patterns, sociodemographic factors and risk of alcohol dependence amongst vehicle drivers in Jamaica.

Design A secondary data analysis.

Setting This study was conducted utilizing the Jamaica National Drug Prevalence Survey 2016 dataset.

Participants This included 1,060 vehicle drivers derived from the population sample of 4,623. The participants from each household were randomly selected as the respondent for the survey.

Primary and secondary outcome measures Alcohol use and dependence were measured using the Alcohol Use Disorders Identification Test (AUDIT) questionnaire. Driving under the influence of alcohol (DUIA) was assessed by questions regarding its use in the past 12 months. The analysis involved the use of Pearson’s Chi-Square test and logistic regression.

Results 75% of Jamaicans reported lifetime alcohol use. Approximately 65% of drivers indicated that they currently drink alcohol. 18% of drivers who currently drink alcohol admitted to DUIA. Reportedly, 54.5% of these drivers were alcohol binge drinkers, with 41.5% also driving under the influence of cannabis. The bivariate analysis demonstrated that DUIA was higher among Christian participants and those who worked in non-machine operator jobs (p=0.002 and p=0.008, respectively). Vehicle drivers altogether and drivers who drive under the influence of alcohol had significant associations with hazardous drinking (p=0.011 and p=0.000, respectively). Logistic regressions highlighted drivers 34 years and under (p=0.012), male drivers (p=0.002) and the head of the household (p=0.050) were 1.82, 3.30 and 1.86 times more likely, respectively, to report driving under the influence of alcohol in the past year.

Conclusions The prevalence of alcohol use amongst Jamaica's population and vehicle drivers is high. That one in five drivers, who currently consume alcohol, also admits to driving under the influence suggests the urgent need for mitigation strategies and legislative action as part of a preventative effort to reduce drunk driving.

(Word count 299)

Keywords: Drivers, Alcohol use, Jamaica, Household survey, Prevalence

Article Summary

Strengths and limitations of this study

- The random selection of survey participants likely enhanced both the sample representation within the national population and the ability to generalize the research findings. Moreover, the large sample size helped increase the study’s power.
- The use of robust multivariable logistic regression in the analysis provides a baseline for future research endeavours.
- This study was a cross-sectional design and thus is limited to creating associations and may not be used to conclude causality.
- The respondents providing answers they consider socially acceptable might also introduce a response bias.

INTRODUCTION

Road Traffic Injury (RTI) represents a significant global public health issue, accounting for approximately fifty million non-fatal injuries and 1.35 million annual fatalities worldwide (1). At the turn of the century, road traffic fatality rates in the Caribbean and Latin America soared by more than 20% over the ensuing decade (2), indicating that just shy of one million people died in road traffic accidents (3).

Jamaica is no exception, as road traffic accidents represent a massive public health problem that continues to be one of the major causes of injury and death (4,5) in the largest English-speaking island in the West Indies, which is residence to just under 3 million citizens (6). Since the year 2000, Jamaica has seen an increase in traffic-related mortality rates (7), similar to other low and middle-income countries (LMICs) that evidently report a three times higher risk of road traffic deaths in comparison to high-income countries (HIC) (1). Given that road transport is the predominant mode of travelling, available statistics also indicate that road traffic fatalities in Jamaica have steadily increased over the past five years, from 389 in 2018 to 488 in 2022 (8), the latest figure representing the highest tally in the last decade.

An avoidable risk factor for road traffic injury is driving under the influence of alcohol (DUIA), where research has demonstrated a dose-dependent influence on driving performance and an increased risk and severity of vehicular crash (9-11). Extant literature suggests DUIA poses a serious safety concern because alcohol has been shown to be responsible for a high number of fatal vehicular crashes in many countries (12,13). In Jamaica, a number of studies have demonstrated an association between victims of vehicular accidents and a blood alcohol concentration (BAC) level in excess of the legal limit of 0.08 g/dl (14,15). However, research consistently indicates an increased risk of a driver being involved in a road traffic accident after

exceeding a BAC level of 0.05 g/dl (16). At this level, drivers are more likely to speed, misjudge distance, and display impaired cognitive functioning (17-19). Current national legislation endorses a blood alcohol concentration (BAC) limit of ≤ 0.08 g/dl for both general and young/first-time drivers (20), that are higher than international recommendations of ≤ 0.05 g/dl for the general population and ≤ 0.02 g/dl for young or first-time drivers (21).

The most recent Global Status Report on Road Safety suggested that almost 20% of road traffic deaths in Jamaica were due to DUIA (22). To date, no studies in the Caribbean have used nationally representative data to assess the alcohol use patterns, risk of alcohol dependence and the associated sociodemographic characteristics of vehicle drivers that may drive under the influence of alcohol.

Studies both regionally and globally indicate a higher prevalence of DUIA in males, and young adults (3,10). As such, the relevant findings of this study may help provide the impetus in prioritizing legislation and intervention among the driving subpopulation in Jamaica, in accordance with best practice recommendations in guarding against drunk-driving as outlined by the World Health Organization SAFER initiative (21).

OBJECTIVES

1. To determine the prevalence of alcohol use patterns amongst vehicle drivers, including those who drive under the influence of alcohol (DUIA), binge drinkers who drive under the influence of alcohol, and those who drive under the influence of alcohol and cannabis.
2. To examine and compare the risk of alcohol dependence amongst two sets of driver groups - (a) drivers versus non-drivers and (b) drivers who drive under the influence of alcohol versus drivers who do not drive under the influence of alcohol.

3. To investigate the sociodemographic factors associated with driving under the influence of alcohol.

METHODS

Study Design, Sample Size and Data Source

The original study was a cross-sectional survey of a Jamaican population sample examining drug use prevalence and patterns (23). The sample consisted of 4,623 participants living in 14 parishes in Jamaica. The survey utilized a stratified multi-stage sampling design of which the primary sampling units (PSU) were the Enumeration Areas (EAs). Sampling weights were determined to account for selection probability, non-response, and population distribution. To ensure accurate representation, post-stratification weights were applied based on age and sex categories at the parish level. This helped match the distribution of the weighted sample with the population distribution of age and sex groups. In each EA, systematic random sampling was used to draw 16 households, from which one individual between the age of 12 and 65 years served as the survey respondent. Data was collected between April and July 2016 from a standardized questionnaire developed by the Inter-American Drug Abuse Control Commission (CICAD) and the Inter-American Observatory on Drugs (OID) and conducted through partnership with Jamaica's National Council on Drug Abuse (NCDA) (23).

This study is a secondary data analysis of the National Drug Prevalence Survey, Jamaica 2016. The target population comprised 1,060 participants that represented persons that drive vehicles. This research extracted variables relevant to driving under the influence of alcohol, alcohol use patterns, dependence and the associated sociodemographic characteristics that might influence alcohol use in vehicle drivers. This study contained no identifying data of respondents, and no direct or indirect contact was made with any respondents.

Study Variables

Alcohol Use Prevalence

The prevalence of alcohol use was determined for the periods of lifetime or ‘ever’ use, past year use, and past month/current use by using the target variables. Responses were coded as 1 = Yes and 2 = No. For current and heavy/binge drinking alcohol use, respondents were asked to state had they taken 5 drinks or more for males or 4 drinks or more for females, on a single occasion in the past 2 weeks. Seven response options were re-categorized into 1 = No and 2 = Yes.

Alcohol Dependence

Alcohol use was assessed using The Alcohol Use Disorders Identification Test (AUDIT), a 10-item scale developed by the World Health Organization in which the answers to each question are rated on a scale ranging from 0 to 4, giving a maximum score of 40 (24). A score of 8 or more is associated with harmful or hazardous drinking, whereas a score of 13 or more in women, and 15 or more in men, is likely to indicate alcohol dependence. For this study, the AUDIT scores were re-categorized into two groups where a score greater than or equal to 8 was defined as harmful or hazardous drinking and a score of less than or equal to 7 was defined as not harmful or hazardous drinking.

Driving under the influence

The National Drug Prevalence Survey asked respondents, “Have you driven a vehicle in the past 12 months?” the response options were 1 = Yes (Drivers) and 2 = No (Non-Drivers). For the item “During the past 12 months, have you driven a vehicle while you were under the influence of alcohol?” the response options were 1 = Yes (DUIA) and 2 = No (Non-DUIA). Statistical computations were utilized to extract respondents who were current alcohol users that also answered “Yes” to the question, “During the past 12 months, have you driven a vehicle while

you were under the influence of alcohol?” Statistical computations were utilized to extract respondents who were current cannabis users that also answered “Yes” to the question “During the past 12 months, have you driven a vehicle while you were under the influence of illegal drugs?” to denote those drive under the influence of cannabis (DUIC) for analytical purposes.

Sociodemographic characteristics

Sociodemographic characteristics that might influence alcohol use in drivers were included as covariates. Survey questions that contained the option “don’t know” or “no response” were treated as missing variables. Respondents were asked to state their age. Responses were categorized into two groups – 1 = 34 years and under, representing young adults as suggested by Franssen and colleagues (25) and 0 = 35 years and over. Respondents were asked to state their gender (1 = male, 0 = female) and geographical location (re-categorized into 1 = urban and 0 = rural). Educational status was assessed with the question, “What is the highest educational level that you have achieved?” There were ten response options. These were re-categorized into 1 = tertiary level, 0 = below tertiary level. The respondents were asked to state their marital status. This item had seven response options; these were re-categorized into two options: 1 = married, 0 = unmarried. The question on religious affiliation had twenty-six response options. These were re-categorized into two, namely, 1 = Christian, 0 = Non-Christian. Respondents were asked “Are you the head of household?”. The response options were 1 = Yes, 0 = No. The respondents were asked to choose the household’s total monthly income from a list of fifteen options. These were re-categorized into 1 = JA\$50,000 and under or 0 = over JA\$50,000. For occupation description, respondents were asked to describe their job from a list of eleven options. These were re-categorized into 1 = machine operators or 0 = non-machine operators.

Statistical Analysis

Descriptive statistical analysis was performed to determine the prevalence of alcohol use in the total population and amongst vehicle drivers as well as to describe the sociodemographic characteristics of vehicle drivers and represented in frequencies, means and percentages. Bivariate analysis examining the association between vehicle drivers who drive and do not drive under the influence of alcohol and the level of use according to the AUDIT questionnaire was done using Pearson's Chi-Square test. Bivariate analysis was also conducted to examine the association between vehicle and non-vehicle drivers, and the level of use according to the AUDIT questionnaire. Predictive tests were done to identify risk and protective sociodemographic factors and driving under the influence of alcohol using logistic regression analyses. All statistical analyses were conducted using R software, version 4.2.0. Multicollinearity between the study variables was explored using variance inflation factor (VIF) (with multicollinearity being defined as $VIF > 2.5$) and Hosmer-Lemeshow statistic was used to test for goodness of fit of the regression model. The data were presented in the form of tables and text. Odds ratios and 95% confidence intervals were recorded. A p-value of < 0.05 was considered statistically significant.

Patient and public involvement

There was no involvement of patients or members of the public in the conceptualization, design, analysis, or interpretation of the results or reporting of this research.

Ethical Considerations

Respondent participation was voluntary, and the survey was undertaken in accordance with the international guidelines for research on human subjects. The Ministry of National Security granted approval for the National Drug Use Prevalence Survey. Informed consent was obtained

from each participant, and assurance of the confidentiality and anonymity of the data was provided through the non-retention of names. Data was stored in a secure database (23).

RESULTS

Prevalence

Table 1 displays the prevalence of alcohol use in the total population (n=4,623) and amongst the population of vehicle drivers (n=1,060). Approximately 1 in 4 individuals was a vehicle driver (23%). Among those in the population who reported lifetime alcohol use, 72.9% reported use in the past year, and 54.3% reported use in the past month. Of the 1060 vehicle drivers, 685 persons were drivers who admitted to being current alcohol users, and 137 drivers admitted to driving under the influence of alcohol in the past year. Of the 685 drivers, 123 persons were drivers who admitted to driving under the influence and being current alcohol users. This is approximately 18% and indicates that 1 in 5 Jamaicans, who are drivers and are current alcohol users, operate a vehicle under the influence of alcohol. Of these 123 respondents, 67 drivers were alcohol binge drinkers. This is approximately 54.5% and indicates that 1 in 2 Jamaicans who were current alcohol users and admitted to driving under the influence were alcohol binge drinkers. Of these 123 respondents, 51 drivers (41.5%) were also current cannabis users that admitted to driving under the influence.

Table 1: Alcohol use prevalence amongst the total population and vehicle drivers

Alcohol Use	Frequency	Percentage
Population Lifetime Use	3460	74.8%
Population Past Year Use	2522	72.9%
Population Past Month/Current Use	1879	54.3%
Current Users who Drive	685	64.6%
Current Users who DUIA	123	18.0%
Current & Binge Drinkers who DUIA	67	54.5%
Current Users who DUIA and DUIC	51	41.5%

Sociodemographic factor findings

Table 2 shows the sociodemographic characteristics of vehicle drivers in the population. Most drivers were male (70.6%), unmarried (61.0%), employed (72.6%), of Christian affiliation (72.8%), inhabiting rural areas (54.5%) and with a less than tertiary level scholastic achievement (83.3%). The age range of respondents was between 12–65 years, with a mean age of 36.56 years (s.d.±12.582).

Table 2: Sociodemographic characteristics of vehicle drivers in the population

Variable	Frequency	Percentage
Gender		
Male	748	70.6%
Female	312	29.4%
Age		
34 years and under	551	52.0%
Over 35 years	509	48.0%
Education		
Tertiary level	177	16.7%
Below tertiary level	883	83.3%
Religion		
Christian	772	72.8%
Non-Christian	288	27.2%
Employment		
Employed	770	72.6%
Unemployed	290	27.4%
Marital Status		
Married	413	39.0%
Unmarried	647	61.0%
Geographical Location		
Urban	482	45.5%
Rural	578	54.5%
Head of Household		
Yes	700	66.0%
No	360	34.0%
Household Income		
JA\$50,000 and under	416	45.1%
Over JA\$50,000	507	54.9%
Occupation		
Machine Operators	267	34.6%

Non-Machine Operators	504	65.4%
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Table 3 shows the sociodemographic characteristics of vehicle drivers that drive under the influence of alcohol (DUIA) and those that do not (Non-DUIA). A significant difference was found in the gender distribution for both the drivers who drive under the influence of alcohol and those that did not. Among the DUIA group, 92% were males compared to 8% who were female ($p=0.000$). A statistically significant difference was also noted in religion distribution. Among the DUIA group, 61.3% were Christian, and 38.7% were Non-Christian ($p=0.002$). A significant difference was also found amongst those who were the head of the household and DUIA ($p=0.020$). Likewise, a significant association was found among drivers who operated machinery as part of their job description in the DUIA group ($p=0.008$).

Although there were higher numbers of employed drivers and drivers who earned more than JA\$50,000 monthly than their counterparts among the DUIA group, this association was not statistically significant ($p=0.101$ and $p=0.159$, respectively). There was no multicollinearity found among the independent variables used in the analysis.

Table 3: Sociodemographic characteristics of vehicle drivers that drive under the influence and did not drive under the influence of alcohol in the past year.

	Vehicle Drivers (Non-DUIA)	Vehicle Drivers (DUIA)	
Variable	Frequency	Frequency	p-value
Gender			
Male	622 (67.4%)	126 (92.0%)	0.000***
Female	301 (32.6%)	11 (08.0%)	
Age			
34 years and under	475 (51.5%)	76 (55.5%)	0.432
Over 35 years	448 (48.5%)	61 (44.5%)	
Education			
Tertiary level	157 (17.0%)	20 (12.7%)	0.560
Below tertiary level	766 (83.0%)	117 (87.3%)	
Religion			
Christian	688 (74.5%)	84 (61.3%)	0.002**

Non-Christian	235 (25.5%)	53 (38.7%)	
Employment			
Employed	662 (71.7%)	108 (78.8%)	0.101
Unemployed	261 (28.3%)	29 (21.2%)	
Marital Status			
Married	363 (39.3%)	50 (36.5%)	0.589
Unmarried	560 (70.7%)	87 (63.5%)	
Geographical Location			
Urban	422 (45.7%)	60 (43.8%)	0.741
Rural	501 (54.3%)	77 (56.2%)	
Head of Household			
Yes	597 (64.7%)	103 (75.2%)	0.020**
No	326 (35.3%)	34 (24.8%)	
Household Income			
JA\$50,000 and under	370 (46.0%)	46 (38.7%)	0.159
Over JA\$50,000	434 (54.0%)	73 (61.3%)	
Occupation			
Machine Operators	217 (32.7%)	50 (46.3%)	0.008**
Non-Machine Operators	446 (67.3%)	58 (53.7%)	
p-value significant at the 0.05 level*; p-value significant at the 0.01 level**; p-value significant at the 0.001 level***			

Alcohol dependence findings

Table 4 summarizes the level of use according to the AUDIT questionnaire amongst two driver groups. Approximately 13% of non-drivers reported harmful or hazardous drinking behaviour (AUDIT $\geq$ 8), whereas 16% of drivers reported harmful or hazardous drinking behaviour (AUDIT $\geq$ 8). This indicates that drivers were more likely to develop alcohol dependence than non-drivers, and this difference was statistically significant (p=0.011).

Approximately 12% of drivers who did not drive under the influence of alcohol reported harmful or hazardous drinking behaviour (AUDIT $\geq$ 8), whereas 41% of drivers who did drive under the influence of alcohol (DUIA) reported harmful or hazardous drinking behaviour (AUDIT $\geq$ 8). This indicates that DUIA drivers were more likely to develop alcohol dependence than Non-DUIA drivers, and this difference was statistically significant (p=0.000).

Table 4: Chi-square test of independence between the AUDIT questionnaire and drivers versus non-drivers and DUIA versus Non-DUIA drivers

	AUDIT ≤ 7	AUDIT ≥ 8
Non-Drivers	1455	209
Drivers	718	140
$X^2 = 6.390$, df = 1, p-value = 0.011**		
	AUDIT ≤ 7	AUDIT ≥ 8
Non-DUIA Drivers	644	87
DUIA Drivers	77	53
$X^2 = 65.447$, df = 1, p-value = 0.000***		
p-value significant at the 0.05 level*; p-value significant at the 0.01 level**; p-value significant at the 0.001 level***		

Estimation of odd ratios for sociodemographic factors associated with DUIA

Table 5 shows the results of a logistic regression analysis performed to assess the associations between driving under the influence of alcohol in the past year and select sociodemographic factors. The Hosmer-Lemeshow test shows the p value at 0.662 ($p > .05$) which shows the model fits the data. The model illustrates statistically significant relationships for several factors.

Drivers who were 34 years and under were 1.82 times more likely than those 35 years and older to report driving under the influence of alcohol in the past year. Male drivers were 3.30 times more likely than females to report driving under the influence of alcohol in the past year. In addition, those drivers who were the head of household were 1.86 times more likely than those who were not to report driving under the influence of alcohol in the past year.

Being married, being a Christian, and having a household income of JA\$50,000 and under reduce the risk of driving under the influence of alcohol in the past year. These inverse associations are, however, not statistically significant.

Table 5: Logistic regression analysis model of select sociodemographic factors associated with driving under the influence of alcohol in the past year

Variables	Estimate	OR	95% CI	p-value
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Age (34 years and under)	0.60127	1.82	1.15, 2.92	0.012**
Occupation (machine operators)	0.40566	1.50	0.94, 2.40	0.091
Marital status (married)	-0.27291	0.76	0.47, 1.21	0.250
Gender (male)	1.19514	3.30	1.62, 7.49	0.002**
Education (tertiary level)	0.11925	1.13	0.57, 2.13	0.720
Religion (Christian)	-0.44583	0.64	0.40, 1.03	0.064
Household Income (JA\$50,000 and under)	-0.39084	0.68	0.41, 1.10	0.120
Head of household (yes)	0.62223	1.86	1.02, 3.57	0.050*
Geographical location (urban)	0.01995	1.02	0.64, 1.63	0.930
p-value significant at the 0.05 level*; p-value significant at the 0.01 level**; p-value significant at the 0.001 level***				

DISCUSSION

Alcohol is the most commonly used substance among young and older people in Jamaica (23), with most persons beginning use in early adolescence (26). This is the first study in Jamaica and the Caribbean demonstrating the prevalence of alcohol use, risk of alcohol dependence and associations with sociodemographic factors amongst vehicle drivers. This research found that approximately 1 in 5 Jamaican drivers was a current alcohol consumer who admitted to driving under the influence (DUIA). Furthermore, more than 40% and 50% of these drivers admitted to driving under the influence of cannabis (DUIC) and being binge drinkers respectively. Driving under the influence of alcohol, especially at higher levels of consumption or in combination with cannabis, has been associated with greater driving impairment (9,10,27,28) and risk of fatal crash (29). Extant literature highlights alcohol and cannabis co-use is associated with an increased risk of a vehicular crash fatality by 25 to 40 times in comparison to drivers who used no substance or a singular drug (30,31).

These findings represent a drug use pattern of concern amongst Jamaican drivers that necessitate implementing evidence-based interventions in dealing with a potential public health problem. Alcohol and cannabis co-use amongst the driver population is likely due to the misconception that drug driving is not perceived as a risky behaviour (32). Indeed, within the

Jamaican context, this belief is likely endorsed by strong sociocultural practice, religious beliefs (33,34) and recent amendments to the island's Dangerous Drugs Act that has endorsed decriminalization (35). Delivering a national education campaign emphasizing the detrimental effects of cannabis use on driving, particularly in combination with alcohol geared towards young adults and males, is a critical and welcomed intervention (36). Furthermore, legislation must keep pace with international standards regarding drink and drug-driving laws. Well-founded evidence supports lowering Jamaica's legislative limit on blood alcohol concentrations from 0.08 to 0.05 grams per deciliter (g/dl), a countermeasure that is associated with more significant reductions in alcohol-associated road traffic injuries and fatalities (37-39). Reducing the legal threshold will further aid in screening for recidivist drivers that are associated with binge drinking and heavy alcohol use (40), that prior analyses associate with having increased odds of drunk driving (41) and driving impairment (42). In addition, decreased odds of binge drinking and subsequent vehicular crashes have been achieved by implementing higher taxation on alcoholic beverages (43) and appropriate mandatory fine amounts for offender drivers (44). Monetary penalties may deter motorists' non-compliance with the island's Road Traffic Act. However, fines approximating US\$325 and US\$65 for driving under the influence of alcohol and cannabis, respectively (20), are unlikely to discourage offender motorists from breaking the law and therefore urge revision. Lastly, despite reporting a national excise tax on alcoholic beverages in 2016, ensuing inflation in Jamaica and wage increases would have likely diminished the intended effect with consequent affordability for increased consumption (45). This observation endorses the need to review and update the existing policy.

This study also revealed several sociodemographic variables associated with DUIA. Bivariate analysis revealed significant associations with gender, religious affiliation,

occupational description and head of household status. Multivariate regression analysis indicated that being a young adult, of the male gender and the head of the household were predictive of driving under the influence of alcohol.

Young adults and males were approximately two and three times more likely to report driving under the influence of alcohol. This outcome is in keeping with previous research that found a similar higher prevalence of DUIA amongst males and younger adults in the United States (42,46,47) and Norway (48). In Jamaica, the legal age limit for purchasing alcohol and acquiring a driver's license is 18 years (20,49). These legal coincidences likely explain this observation amongst younger drivers, as research has shown an association between securing a driver's license and increased substance use (50). Raising the legal drinking age in Jamaica from 18 to 21 thereby represents a worthwhile strategy that has successfully reduced road traffic fatalities and drink-driving behaviors amongst young drivers elsewhere (51,52). This strategy can expect to garner further support as these aberrant driving habits are likely attributable to a young male's willingness to engage in risky behaviours (53) such as binge drinking (54,55) and polysubstance use (56), more so than women who tend to be cautious with regards to driving under the influence of alcohol (57).

This study also reported that the head of the household was two times more likely to drive under the influence of alcohol. The head of the household is the family's leading provider of financial sustenance (58). Driving under the influence of alcohol places the primary breadwinner at risk of arrest by law enforcement (59), devastating injury and loss of life (60), further predisposing the family unit to increased financial and emotional stress (61).

Although not reflected in the logistic regression model, the bivariate analysis indicated a significant association between religious affiliation and DUIA. While religious affiliation is

protective against drug use (62) and the majority of the Jamaican population identifies with the Christian faith (6), this study indicated that DUIA was higher among Christian than non-Christian drivers. Strong sociocultural use of alcohol in religious and social settings likely explains this finding (63), albeit at variance with studies that indicated religious affiliation reduced the risks associated with alcohol use (64) and encouraged safe driving practices like seatbelt use (65). This finding is unique and encourages further study, given that modest research to date has focused on cultural factors like religious involvement as a possible determinant or deterrent of DUIA behaviour. This may prove insightful in crafting a religious-based response as an adjunct to enforcing the drink-driving countermeasures in line with the SAFER framework recommendations outlined by the World Health Organization (21). The bivariate analysis also indicated a significant difference between occupational description and DUIA, although the proportion of non-machine and machine operators was close (53.7% and 46.3%, respectively). Drivers who drive under the influence of alcohol are likely to display similar impairment in motor coordination, concentration and depth perception (66), whilst operating machines as part of their job, resulting in an increased rate of work accidents (67).

A most recent population-based study in the United States, demonstrated that alcohol abuse/dependence was positively associated with DUIA (68). This study indicated a similar finding as drivers who admitted to DUIA reported harmful and hazardous drinking behaviours in comparison to drivers who did not DUIA. This finding emphasizes the importance of targeting drivers with alcohol misuse and addiction. This level of triage can allow for offender drivers to be assigned to a drink-driving remediation programme that has demonstrated significant reductions in aberrant driving behaviours (69) as part of a national DUIA prevention effort that has found favour elsewhere (70). Further preventative efforts can include a court-mandated

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3 alcohol consumption monitoring programme for DUIA offenders, inclusive of alcohol
4 monitoring bracelets and random urine and breathalyzer tests (71). In Jamaica, creating a local
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6 Drug Treatment Court (DTC) in the early 2000s allowed persons with substance use dependence
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8 to be redirected from the traditional judicial system towards a course of treatment and,
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10 ultimately, reintegration into their communities (72). However, limited in-patient services,
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12 particularly in the rural areas of the island, limit the mandate the policy seeks to fulfil (73).
13
14 Notwithstanding, the existing legislation presents opportunity for policymakers to build capacity
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16 in addressing the alcohol-related problems of recidivist drivers.
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22 Of interest, this study also highlights that drivers, overall, engaged in harmful and
23
24 hazardous drinking in comparison to non-drivers. This may be due to the finding that being able
25
26 to drive is associated with increased access to social participation and experiences (74), a
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28 common denominator that endears itself to alcohol consumption (75). In a society where alcohol
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30 use is culturally endorsed and essential in promoting social reciprocity (63), the use of a
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32 designated driver or an alternative transportation program may be beneficial (76). Indeed, the
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34 plethora of all-inclusive recreational events on offer in Jamaica year-round, where alcohol use is
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36 heavily promoted, invite event promoters to offer patrons free transportation home as part of the
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38 package (77).
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43 Research surrounding road safety in low and middle-income countries (LMICs) is
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45 minimal (78), despite accounting for nine out of ten road traffic deaths worldwide (1). Increasing
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47 sobriety checkpoints, collecting data regarding drink-driving behaviours and reducing speed
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49 limits in high-volume pedestrian areas, are cost-effective strategies that have found success in
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51 reducing traffic fatalities in one sister LMIC country (79). More research is needed in these
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53 countries to craft effective strategies that fellow LMICs may adopt. The cumulative findings
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observed in this study amongst the Jamaican population, add to the existing dearth of research in LMICs.

Additional strengths of this study are that it is the first study to examine the factors associated with DUIA amongst drivers from a nationally representative sample in the Caribbean and that it used robust multivariable logistic regression in the analysis. The AUDIT questionnaire for alcohol dependence further enhances the reliability of the findings, given its noted validity and use in multiple studies internationally (80-83). One of the limitations of the study is that this study was a cross-sectional design and thus is limited to creating association. This study also utilized a self-report survey related to alcohol use, and thus underreporting bias may be implicated in the findings. The data used in the analysis was collected in 2016, and findings may not be reflective of the current situation. Notwithstanding, the evidence in this study provides a foundation for future research.

CONCLUSION

One in 5 Jamaican drivers who currently consume alcohol operates a vehicle under its influence, with over 50% being an alcohol binge drinker. These findings have likely implications towards increasing road traffic casualties, rising workplace accidents, and an elevated burden on healthcare systems. Prevention and mitigation strategies should target these individuals to reduce driving under the influence of alcohol. Furthermore, the findings indicate that ongoing legislation discourse is best guided by the World Health Organization's SAFER initiative that focuses on drunk-driving countermeasures as part of its alcohol policy interventions.

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Patient consent Consent to participate was requested from the participants in the consent form prior to the collection of data. Informed consent was obtained from all subjects, where confidentiality and anonymity were protected through the non-retention of names.

Ethics approval The Ministry of National Security in Jamaica granted approval for the National Drug Use Prevalence Survey.

Data sharing statement The data that support the findings of this study are available from the National Council on Drug Abuse, Jamaica, and the Inter-American Drug Abuse Control Commission (CICAD) but restrictions apply to the availability of these data, which were used under license for the current study and are not publicly available. Data are, however, available upon reasonable request and with permission of the National Council on Drug Abuse, Jamaica, and the Inter-American Drug Abuse Control Commission (CICAD). For access to the database, contact Mrs Uki Atkinson, research analyst, at uatkinson@ncda.org.jm.

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STROBE Statement

Checklist of items that should be included in reports of observational studies

Section/Topic	Item No	Recommendation	Reported on Page No
Title and abstract	1	(a) Indicate the study’s design with a commonly used term in the title or the abstract	1,2
		(b) Provide in the abstract an informative and balanced summary of what was done and what was found	2
Introduction			
Background/rationale	2	Explain the scientific background and rationale for the investigation being reported	3,4
Objectives	3	State specific objectives, including any prespecified hypotheses	4-5
Methods			
Study design	4	Present key elements of study design early in the paper	5,6
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection	5,6
Participants	6	(a) Cohort study—Give the eligibility criteria, and the sources and methods of selection of participants. Describe methods of follow-up	5,6
		Case-control study—Give the eligibility criteria, and the sources and methods of case ascertainment and control selection. Give the rationale for the choice of cases and controls	
		Cross-sectional study—Give the eligibility criteria, and the sources and methods of selection of participants	
		(b) Cohort study—For matched studies, give matching criteria and number of exposed and unexposed	
Variables	7	Case-control study—For matched studies, give matching criteria and the number of controls per case	N/A
		Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable	6,7,8
Data sources/measurement	8*	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group	6,7,8
Bias	9	Describe any efforts to address potential sources of bias	5,8
Study size	10	Explain how the study size was arrived at	6
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why	6,7,8
Statistical methods	12	(a) Describe all statistical methods, including those used to control for confounding	8
		(b) Describe any methods used to examine subgroups and interactions	8
		(c) Explain how missing data were addressed	7
		(d) Cohort study—If applicable, explain how loss to follow-up was addressed	5,8
		Case-control study—If applicable, explain how matching of cases and controls was addressed	
		Cross-sectional study—If applicable, describe analytical methods taking account of sampling strategy	
		(e) Describe any sensitivity analyses	N/A

Section/Topic	Item No	Recommendation	Reported on Page No
Results			
Participants	13*	(a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed	N/A
		(b) Give reasons for non-participation at each stage	N/A
		(c) Consider use of a flow diagram	NA/
Descriptive data	14*	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders	9
		(b) Indicate number of participants with missing data for each variable of interest	N/A
		(c) Cohort study—Summarise follow-up time (eg, average and total amount)	N/A
Outcome data	15*	Cohort study—Report numbers of outcome events or summary measures over time	N/A
		Case-control study—Report numbers in each exposure category, or summary measures of exposure	N/A
		Cross-sectional study—Report numbers of outcome events or summary measures	9-12
Main results	16	(a) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included	13,14
		(b) Report category boundaries when continuous variables were categorized	13,14
		(c) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period	N/A
Other analyses	17	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses	9-13
Discussion			
Key results	18	Summarise key results with reference to study objectives	14
Limitations	19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias	19
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence	14-19
Generalisability	21	Discuss the generalisability (external validity) of the study results	19
Other Information			
Funding	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based	21

*Give information separately for cases and controls in case-control studies and, if applicable, for exposed and unexposed groups in cohort and cross-sectional studies.

Note: An Explanation and Elaboration article discusses each checklist item and gives methodological background and published examples of transparent reporting. The STROBE checklist is best used in conjunction with this article (freely available on the Web sites of PLoS Medicine at <http://www.plosmedicine.org/>, Annals of Internal Medicine at <http://www.annals.org/>, and Epidemiology at <http://www.epidem.com/>). Information on the STROBE Initiative is available at www.strobe-statement.org.

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Drunk driving: a secondary analysis of factors associated with driving under the influence of alcohol in Jamaica

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ABSTRACT

Objectives To determine the prevalence of alcohol use patterns, sociodemographic factors and risk of alcohol dependence amongst vehicle drivers in Jamaica.

Design A secondary data analysis.

Setting This study was conducted utilizing the Jamaica National Drug Prevalence Survey 2016 dataset.

Participants This included 1,060 vehicle drivers derived from the population sample of 4,623. The participants from each household were randomly selected as the respondent for the survey.

Primary and secondary outcome measures Alcohol use and dependence were measured using the Alcohol Use Disorders Identification Test (AUDIT) questionnaire. Driving under the influence of alcohol (DUIA) was assessed by questions regarding its use in the past 12 months. The analysis involved the use of Pearson’s Chi-Square test and logistic regression.

Results 75% of Jamaicans reported lifetime alcohol use. Approximately 65% of drivers indicated that they currently drink alcohol. 18% of drivers who currently drink alcohol admitted to DUIA. Reportedly, 54.5% of these drivers were alcohol binge drinkers, with 41.5% also driving under the influence of cannabis. The bivariate analysis demonstrated that DUIA was higher among Christian participants and those who worked in non-machine operator jobs ($p=0.002$ and $p=0.008$, respectively). Vehicle drivers altogether and drivers who drive under the influence of alcohol had significant associations with hazardous drinking ($p=0.011$ and $p<0.001$, respectively). Logistic regressions highlighted drivers 34 years and under ($p=0.012$), male drivers ($p=0.002$) and the head of the household ($p=0.050$) were 1.82, 3.30 and 1.86 times more likely, respectively, to report driving under the influence of alcohol in the past year.

Conclusions The prevalence of alcohol use amongst Jamaica’s population and vehicle drivers is high. That one in five drivers, who currently consume alcohol, also admits to driving under the influence suggests the urgent need for mitigation strategies and legislative action as part of a preventative effort to reduce drunk driving.

(Word count 299)

Keywords: Drivers, Alcohol use, Jamaica, Household survey, Prevalence

Article Summary

Strengths and limitations of this study

- The random selection of survey participants likely enhanced both the sample representation within the national population and the ability to generalize the research findings. Moreover, the large sample size helped increase the study’s power.
- The use of robust multivariable logistic regression in the analysis provides a baseline for future research endeavours.
- This study was a cross-sectional design and thus is limited to creating associations and may not be used to conclude causality.
- The respondents providing answers they consider socially acceptable might also introduce a response bias.

INTRODUCTION

Road Traffic Injury (RTI) represents a significant global public health issue, accounting for approximately fifty million non-fatal injuries and 1.35 million annual fatalities worldwide (1). At the turn of the century, road traffic fatality rates in the Caribbean and Latin America soared by more than 20% over the ensuing decade (2), indicating that just shy of one million people died in road traffic accidents (3).

Jamaica is no exception, as road traffic accidents represent a massive public health problem that continues to be one of the major causes of injury and death (4,5) in the largest English-speaking island in the West Indies, which is residence to just under 3 million citizens (6). Since the year 2000, Jamaica has seen an increase in traffic-related mortality rates (7), similar to other low and middle-income countries (LMICs) that evidently report a three times higher risk of road traffic deaths in comparison to high-income countries (HIC) (1). Given that road transport is the predominant mode of travelling, available statistics also indicate that road traffic fatalities in Jamaica have steadily increased over the past five years, from 389 in 2018 to 488 in 2022 (8), the latest figure representing the highest tally in the last decade.

An avoidable risk factor for road traffic injury is driving under the influence of alcohol (DUIA), where research has demonstrated a dose-dependent influence on driving performance and an increased risk and severity of vehicular crash (9-11). Extant literature suggests DUIA poses a serious safety concern because alcohol has been shown to be responsible for a high number of fatal vehicular crashes in many countries (12,13). In Jamaica, a number of studies have demonstrated an association between victims of vehicular accidents and a blood alcohol concentration (BAC) level in excess of the legal limit of 0.08 g/dl (14,15). However, research consistently indicates an increased risk of a driver being involved in a road traffic accident after

exceeding a BAC level of 0.05 g/dl (16). At this level, drivers are more likely to speed, misjudge distance, and display impaired cognitive functioning (17-19). Current national legislation endorses a blood alcohol concentration (BAC) limit of ≤ 0.08 g/dl for both general and young/first-time drivers (20), that are higher than international recommendations of ≤ 0.05 g/dl for the general population and ≤ 0.02 g/dl for young or first-time drivers (21).

The most recent Global Status Report on Road Safety suggested that almost 20% of road traffic deaths in Jamaica were due to DUIA (22). To date, no studies in the Caribbean have used nationally representative data to assess the alcohol use patterns, risk of alcohol dependence and the associated sociodemographic characteristics of vehicle drivers that may drive under the influence of alcohol.

Studies both regionally and globally indicate a higher prevalence of DUIA in males, and young adults (3,10). As such, the relevant findings of this study may help provide the impetus in prioritizing legislation and intervention among the driving subpopulation in Jamaica, in accordance with best practice recommendations in guarding against drunk-driving as outlined by the World Health Organization SAFER initiative (21).

OBJECTIVES

1. To determine the prevalence of alcohol use patterns amongst vehicle drivers, including those who drive under the influence of alcohol (DUIA), binge drinkers who drive under the influence of alcohol, and those who drive under the influence of alcohol and cannabis.
2. To examine and compare the risk of alcohol dependence amongst two sets of driver groups - (a) drivers versus non-drivers and (b) drivers who drive under the influence of alcohol versus drivers who do not drive under the influence of alcohol.

3. To investigate the sociodemographic factors associated with driving under the influence of alcohol.

METHODS

Study Design, Sample Size and Data Source

The original study was a cross-sectional survey of a Jamaican population sample examining drug use prevalence and patterns (23). The sample consisted of 4,623 participants living in 14 parishes in Jamaica. The survey utilized a stratified multi-stage sampling design of which the primary sampling units (PSU) were the Enumeration Areas (EAs). Sampling weights were determined to account for selection probability, non-response, and population distribution. To ensure accurate representation, post-stratification weights were applied based on age and sex categories at the parish level. This helped match the distribution of the weighted sample with the population distribution of age and sex groups. In each EA, systematic random sampling was used to draw 16 households, from which one individual between the age of 12 and 65 years served as the survey respondent. Data was collected between April and July 2016 from a standardized questionnaire developed by the Inter-American Drug Abuse Control Commission (CICAD) and the Inter-American Observatory on Drugs (OID) and conducted through partnership with Jamaica's National Council on Drug Abuse (NCDA) (23).

This study is a secondary data analysis of the National Drug Prevalence Survey, Jamaica 2016. The target population comprised 1,060 participants that represented persons that drive vehicles. This research extracted variables relevant to driving under the influence of alcohol, alcohol use patterns, dependence and the associated sociodemographic characteristics that might influence alcohol use in vehicle drivers. This study contained no identifying data of respondents, and no direct or indirect contact was made with any respondents.

Study Variables

Alcohol Use Prevalence

The prevalence of alcohol use was determined for the periods of lifetime or ‘ever’ use, past year use, and past month/current use by using the target variables. Responses were coded as 1 = Yes and 2 = No. For current and heavy/binge drinking alcohol use, respondents were asked to state had they taken 5 drinks or more for males or 4 drinks or more for females, on a single occasion in the past 2 weeks. Seven response options were re-categorized into 1 = No and 2 = Yes.

Alcohol Dependence

Alcohol use was assessed using The Alcohol Use Disorders Identification Test (AUDIT), a 10-item scale developed by the World Health Organization in which the answers to each question are rated on a scale ranging from 0 to 4, giving a maximum score of 40 (24). A score of 8 or more is associated with harmful or hazardous drinking, whereas a score of 13 or more in women, and 15 or more in men, is likely to indicate alcohol dependence. For this study, the AUDIT scores were re-categorized into two groups where a score greater than or equal to 8 was defined as harmful or hazardous drinking and a score of less than or equal to 7 was defined as not harmful or hazardous drinking.

Driving under the influence

The National Drug Prevalence Survey asked respondents, “Have you driven a vehicle in the past 12 months?” the response options were 1 = Yes (Drivers) and 2 = No (Non-Drivers). For the item “During the past 12 months, have you driven a vehicle while you were under the influence of alcohol?” the response options were 1 = Yes (DUIA) and 2 = No (Non-DUIA). Statistical computations were utilized to extract respondents who were current alcohol users that also answered “Yes” to the question, “During the past 12 months, have you driven a vehicle while

you were under the influence of alcohol?” Statistical computations were utilized to extract respondents who were current cannabis users that also answered “Yes” to the question “During the past 12 months, have you driven a vehicle while you were under the influence of illegal drugs?” to denote those drive under the influence of cannabis (DUIC) for analytical purposes.

Sociodemographic characteristics

Sociodemographic characteristics that might influence alcohol use in drivers were included as covariates. Survey questions that contained the option “don’t know” or “no response” were treated as missing variables. Respondents were asked to state their age. Responses were categorized into two groups – 1 = 34 years and under, representing young adults as suggested by Franssen and colleagues (25) and 0 = 35 years and over. Respondents were asked to state their gender (1 = male, 0 = female) and geographical location (re-categorized into 1 = urban and 0 = rural). Educational status was assessed with the question, “What is the highest educational level that you have achieved?” There were ten response options. These were re-categorized into 1 = tertiary level, 0 = below tertiary level. The respondents were asked to state their marital status. This item had seven response options; these were re-categorized into two options: 1 = married, 0 = unmarried. The question on religious affiliation had twenty-six response options. These were re-categorized into two, namely, 1 = Christian, 0 = Non-Christian. Respondents were asked “Are you the head of household?”. The response options were 1 = Yes, 0 = No. The respondents were asked to choose the household’s total monthly income from a list of fifteen options. These were re-categorized into 1 = JA\$50,000 and under or 0 = over JA\$50,000. For occupation description, respondents were asked to describe their job from a list of eleven options. These were re-categorized into 1 = machine operators or 0 = non-machine operators.

Statistical Analysis

Descriptive statistical analysis was performed to determine the prevalence of alcohol use in the total population and amongst vehicle drivers as well as to describe the sociodemographic characteristics of vehicle drivers and represented in frequencies, means and percentages. Bivariate analysis examining the association between vehicle drivers who drive and do not drive under the influence of alcohol and the level of use according to the AUDIT questionnaire was done using Pearson's Chi-Square test. Bivariate analysis was also conducted to examine the association between vehicle and non-vehicle drivers, and the level of use according to the AUDIT questionnaire. Predictive tests were done to identify risk and protective sociodemographic factors and driving under the influence of alcohol using logistic regression analyses. All statistical analyses were conducted using R software, version 4.2.0. Multicollinearity between the study variables was explored using variance inflation factor (VIF) (with multicollinearity being defined as $VIF > 2.5$) and Hosmer-Lemeshow statistic was used to test for goodness of fit of the regression model. The data were presented in the form of tables and text. Odds ratios and 95% confidence intervals were recorded. A p-value of < 0.05 was considered statistically significant.

Patient and public involvement

There was no involvement of patients or members of the public in the conceptualization, design, analysis, or interpretation of the results or reporting of this research.

Ethical Considerations

Respondent participation was voluntary, and the survey was undertaken in accordance with the international guidelines for research on human subjects. The Ministry of National Security granted approval for the National Drug Use Prevalence Survey. Informed consent was obtained from each participant, and assurance of the confidentiality and anonymity of the data was

provided through the non-retention of names. Data was stored in a secure database (23). The secondary data analysis was approved by the University of the West Indies Ethics Committee, Mona (Ref: CREC-MN,52 20/21).

RESULTS

Prevalence

Table 1 displays the prevalence of alcohol use in the total population (n=4,623) and amongst the population of vehicle drivers (n=1,060). Approximately 1 in 4 individuals was a vehicle driver (23%). Among those in the population who reported lifetime alcohol use, 72.9% reported use in the past year, and 54.3% reported use in the past month. Of the 1060 vehicle drivers, 685 persons were drivers who admitted to being current alcohol users, and 137 drivers admitted to driving under the influence of alcohol in the past year. Of the 685 drivers, 123 persons were drivers who admitted to driving under the influence and being current alcohol users. This is approximately 18% and indicates that 1 in 5 Jamaicans, who are drivers and are current alcohol users, operate a vehicle under the influence of alcohol. Of these 123 respondents, 67 drivers were alcohol binge drinkers. This is approximately 54.5% and indicates that 1 in 2 Jamaicans who were current alcohol users and admitted to driving under the influence were alcohol binge drinkers. Of these 123 respondents, 51 drivers (41.5%) were also current cannabis users that admitted to driving under the influence.

Table 1: Alcohol use prevalence amongst the total population and vehicle drivers

Alcohol Use	Frequency	Percentage
Population Lifetime Use	3460	74.8%
Population Past Year Use	2522	72.9%
Population Past Month/Current Use	1879	54.3%
Current Users who Drive	685	64.6%
Current Users who DUIA	123	18.0%
Current & Binge Drinkers who DUIA	67	54.5%
Current Users who DUIA and DUIC	51	41.5%

Sociodemographic factor findings

Table 2 shows the sociodemographic characteristics of vehicle drivers in the population. Most drivers were male (70.6%), unmarried (61.0%), employed (72.6%), of Christian affiliation (72.8%), inhabiting rural areas (54.5%) and with a less than tertiary level scholastic achievement (83.3%). The age range of respondents was between 12–65 years, with a mean age of 36.56 years (s.d.±12.582).

Table 2: Sociodemographic characteristics of vehicle drivers in the population

Variable	Frequency	Percentage
Gender		
Male	748	70.6%
Female	312	29.4%
Age		
34 years and under	551	52.0%
Over 35 years	509	48.0%
Education		
Tertiary level	177	16.7%
Below tertiary level	883	83.3%
Religion		
Christian	772	72.8%
Non-Christian	288	27.2%
Employment		
Employed	770	72.6%
Unemployed	290	27.4%
Marital Status		
Married	413	39.0%
Unmarried	647	61.0%
Geographical Location		
Urban	482	45.5%
Rural	578	54.5%
Head of Household		
Yes	700	66.0%
No	360	34.0%
Household Income		
JA\$50,000 and under	416	45.1%
Over JA\$50,000	507	54.9%
Occupation		

Machine Operators	267	34.6%
Non-Machine Operators	504	65.4%

Table 3 shows the sociodemographic characteristics of vehicle drivers that drive under the influence of alcohol (DUIA) and those that do not (Non-DUIA). A significant difference was found in the gender distribution for both the drivers who drive under the influence of alcohol and those that did not. Among the DUIA group, 92% were males compared to 8% who were female ($p < 0.001$). A statistically significant difference was also noted in religion distribution. Among the DUIA group, 61.3% were Christian, and 38.7% were Non-Christian ($p = 0.002$). A significant difference was also found amongst those who were the head of the household and DUIA ($p = 0.020$). Likewise, a significant association was found among drivers who operated machinery as part of their job description in the DUIA group ($p = 0.008$).

Although there were higher numbers of employed drivers and drivers who earned more than JA\$50,000 monthly than their counterparts among the DUIA group, this association was not statistically significant ($p = 0.101$ and $p = 0.159$, respectively). There was no multicollinearity found among the independent variables used in the analysis.

Table 3: Sociodemographic characteristics of vehicle drivers that drive under the influence and did not drive under the influence of alcohol in the past year.

	Vehicle Drivers (Non-DUIA)	Vehicle Drivers (DUIA)	
Variable	Frequency	Frequency	p-value
Gender			
Male	622 (67.4%)	126 (92.0%)	<0.001***
Female	301 (32.6%)	11 (08.0%)	
Age			
34 years and under	475 (51.5%)	76 (55.5%)	0.432
Over 35 years	448 (48.5%)	61 (44.5%)	
Education			
Tertiary level	157 (17.0%)	20 (12.7%)	0.560
Below tertiary level	766 (83.0%)	117 (87.3%)	
Religion			

Christian	688 (74.5%)	84 (61.3%)	0.002**
Non-Christian	235 (25.5%)	53 (38.7%)	
Employment			0.101
Employed	662 (71.7%)	108 (78.8%)	
Unemployed	261 (28.3%)	29 (21.2%)	
Marital Status			0.589
Married	363 (39.3%)	50 (36.5%)	
Unmarried	560 (70.7%)	87 (63.5%)	
Geographical Location			0.741
Urban	422 (45.7%)	60 (43.8%)	
Rural	501 (54.3%)	77 (56.2%)	
Head of Household			0.020**
Yes	597 (64.7%)	103 (75.2%)	
No	326 (35.3%)	34 (24.8%)	
Household Income			0.159
JA\$50,000 and under	370 (46.0%)	46 (38.7%)	
Over JA\$50,000	434 (54.0%)	73 (61.3%)	
Occupation			0.008**
Machine Operators	217 (32.7%)	50 (46.3%)	
Non-Machine Operators	446 (67.3%)	58 (53.7%)	
p-value significant at the 0.05 level*; p-value significant at the 0.01 level**; p-value significant at the 0.001 level***			

Alcohol dependence findings

Table 4 summarizes the level of use according to the AUDIT questionnaire amongst two driver groups. Approximately 13% of non-drivers reported harmful or hazardous drinking behavior (AUDIT ≥ 8), whereas 16% of drivers reported harmful or hazardous drinking behaviour (AUDIT ≥ 8). This indicates that drivers were more likely to develop alcohol dependence than non-drivers, and this difference was statistically significant (p=0.011).

Approximately 12% of drivers who did not drive under the influence of alcohol reported harmful or hazardous drinking behaviour (AUDIT ≥ 8), whereas 41% of drivers who did drive under the influence of alcohol (DUIA) reported harmful or hazardous drinking behaviour (AUDIT ≥ 8). This indicates that DUIA drivers were more likely to develop alcohol dependence than Non-DUIA drivers, and this difference was statistically significant (p<0.001).

Table 4: Chi-square test of independence between the AUDIT questionnaire and drivers versus non-drivers and DUIA versus Non-DUIA drivers

	AUDIT ≤ 7	AUDIT ≥ 8
Non-Drivers	1455	209
Drivers	718	140
$X^2 = 6.390$, df = 1, p-value = 0.011**		
	AUDIT ≤ 7	AUDIT ≥ 8
Non-DUIA Drivers	644	87
DUIA Drivers	77	53
$X^2 = 65.447$, df = 1, p-value <0.001***		
p-value significant at the 0.05 level*; p-value significant at the 0.01 level**; p-value significant at the 0.001 level***		

Estimation of odd ratios for sociodemographic factors associated with DUIA

Table 5 shows the results of a logistic regression analysis performed to assess the associations between driving under the influence of alcohol in the past year and select sociodemographic factors. The Hosmer-Lemeshow test shows the p-value at 0.662 ($p > 0.05$) which shows the model fits the data. The model illustrates statistically significant relationships for several factors.

Drivers who were 34 years and under were 1.82 times more likely than those 35 years and older to report driving under the influence of alcohol in the past year. Male drivers were 3.30 times more likely than females to report driving under the influence of alcohol in the past year. In addition, those drivers who were the head of household were 1.86 times more likely than those who were not to report driving under the influence of alcohol in the past year.

Being married, being a Christian, and having a household income of JA\$50,000 and under reduce the risk of driving under the influence of alcohol in the past year. These inverse associations are, however, not statistically significant.

Table 5: Logistic regression model of select sociodemographic factors associated with driving under the influence of alcohol in the past year

Variables	Estimate	OR	95% CI	p-value
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Age (34 years and under)	0.60127	1.82	1.15, 2.92	0.012**
Occupation (machine operators)	0.40566	1.50	0.94, 2.40	0.091
Marital status (married)	-0.27291	0.76	0.47, 1.21	0.250
Gender (male)	1.19514	3.30	1.62, 7.49	0.002**
Education (tertiary level)	0.11925	1.13	0.57, 2.13	0.720
Religion (Christian)	-0.44583	0.64	0.40, 1.03	0.064
Household Income (JA\$50,000 and under)	-0.39084	0.68	0.41, 1.10	0.120
Head of household (yes)	0.62223	1.86	1.02, 3.57	0.050*
Geographical location (urban)	0.01995	1.02	0.64, 1.63	0.930
p-value significant at the 0.05 level*; p-value significant at the 0.01 level**; p-value significant at the 0.001 level***				

DISCUSSION

Alcohol is the most commonly used substance among young and older people in Jamaica (23), with most persons beginning use in early adolescence (26). This is the first study in Jamaica and the Caribbean demonstrating the prevalence of alcohol use, risk of alcohol dependence and the associations with sociodemographic factors amongst vehicle drivers. This research found that approximately 1 in 5 Jamaican drivers was a current alcohol consumer who admitted to driving under the influence (DUIA). Furthermore, more than 40% and 50% of these drivers admitted to driving under the influence of cannabis (DUIC) and being binge drinkers, respectively. Driving under the influence of alcohol, especially at higher levels of consumption or in combination with cannabis, has been associated with greater driving impairment (9,10,27,28) and risk of fatal crash (29). Extant literature highlights alcohol and cannabis co-use is associated with an increased risk of a vehicular crash fatality by 25 to 40 times in comparison to drivers who used no substance or a singular drug (30,31).

These findings represent a drug use pattern of concern amongst Jamaican drivers that necessitate implementing evidence-based interventions in dealing with a potential public health problem. Alcohol and cannabis co-use amongst the driver population is likely due to the misconception that drug driving is not perceived as a risky behaviour (32). Indeed, within the

Jamaican context, this belief is likely endorsed by strong sociocultural practice, religious beliefs (33,34) and recent amendments to the island's Dangerous Drugs Act that has endorsed decriminalization (35). Delivering a national education campaign emphasizing the detrimental effects of cannabis use on driving, particularly in combination with alcohol geared towards young adults and males, is a critical and welcomed intervention (36). Furthermore, legislation must keep pace with international standards regarding drink and drug-driving laws. Well-founded evidence supports lowering Jamaica's legislative limit on blood alcohol concentrations from 0.08 to 0.05 grams per deciliter (g/dl), a countermeasure that is associated with more significant reductions in alcohol-associated road traffic injuries and fatalities (37-39). Reducing the legal threshold will further aid in screening for recidivist drivers that are associated with binge drinking and heavy alcohol use (40), that prior analyses associate with having increased odds of drunk driving (41) and driving impairment (42). In addition, decreased odds of binge drinking and subsequent vehicular crashes have been achieved by implementing higher taxation on alcoholic beverages (43) and appropriate mandatory fine amounts for offender drivers (44). Monetary penalties may deter motorists' non-compliance with the island's Road Traffic Act. However, fines approximating US\$325 and US\$65 for driving under the influence of alcohol and cannabis, respectively (20), are unlikely to discourage offender motorists from breaking the law and therefore urge revision. Lastly, despite reporting a national excise tax on alcoholic beverages in 2016, ensuing inflation in Jamaica and wage increases would have likely diminished the intended effect with consequent affordability for increased consumption (45). This observation endorses the need to review and update the existing policy.

This study also revealed several sociodemographic variables associated with DUIA. Bivariate analysis revealed significant associations with gender, religious affiliation,

occupational description and head of household status. Multivariate regression analysis indicated that being a young adult, of the male gender and the head of the household were predictive of driving under the influence of alcohol.

Young adults and males were approximately two and three times more likely to report driving under the influence of alcohol. This outcome is in keeping with previous research that found a similar higher prevalence of DUIA amongst males and younger adults in the United States (42,46,47) and Norway (48). In Jamaica, the legal age limit for purchasing alcohol and acquiring a driver's license is 18 years (20,49). These legal coincidences likely explain this observation amongst younger drivers, as research has shown an association between securing a driver's license and increased substance use (50). Raising the legal drinking age in Jamaica from 18 to 21 thereby represents a worthwhile strategy that has successfully reduced road traffic fatalities and drink-driving behaviors amongst young drivers elsewhere (51,52). This strategy can expect to garner further support as these aberrant driving habits are likely attributable to a young male's willingness to engage in risky behaviours (53) such as binge drinking (54,55) and polysubstance use (56), more so than women who tend to be cautious with regards to driving under the influence of alcohol (57).

This study also reported that the head of the household was two times more likely to drive under the influence of alcohol. The head of the household is the family's leading provider of financial sustenance (58). Driving under the influence of alcohol places the primary breadwinner at risk of arrest by law enforcement (59), devastating injury and loss of life (60), further predisposing the family unit to increased financial and emotional stress (61).

Although not reflected in the logistic regression model, the bivariate analysis indicated a significant association between religious affiliation and DUIA. While religious affiliation is

protective against drug use (62) and the majority of the Jamaican population identifies with the Christian faith (6), this study indicated that DUIA was higher among Christian than non-Christian drivers. Strong sociocultural use of alcohol in religious and social settings likely explains this finding (63), albeit at variance with studies that indicated religious affiliation reduced the risks associated with alcohol use (64) and encouraged safe driving practices like seatbelt use (65). This finding is unique and encourages further study, given that modest research to date has focused on cultural factors like religious involvement as a possible determinant or deterrent of DUIA behaviour. This may prove insightful in crafting a religious-based response as an adjunct to enforcing the drink-driving countermeasures in line with the SAFER framework recommendations outlined by the World Health Organization (21). The bivariate analysis also indicated a significant difference between occupational description and DUIA, although the proportion of non-machine and machine operators was close (53.7% and 46.3%, respectively). Drivers who drive under the influence of alcohol are likely to display similar impairment in motor coordination, concentration and depth perception (66), whilst operating machines as part of their job, resulting in an increased rate of work accidents (67).

A most recent population-based study in the United States, demonstrated that alcohol abuse/dependence was positively associated with DUIA (68). This study indicated a similar finding as drivers who admitted to DUIA reported harmful and hazardous drinking behaviours in comparison to drivers who did not DUIA. This finding emphasizes the importance of targeting drivers with alcohol misuse and addiction. This level of triage can allow for offender drivers to be assigned to a drink-driving remediation programme that has demonstrated significant reductions in aberrant driving behaviours (69) as part of a national DUIA prevention effort that has found favour elsewhere (70). Further preventative efforts can include a court-mandated

alcohol consumption monitoring programme for DUIA offenders, inclusive of alcohol monitoring bracelets and random urine and breathalyzer tests (71). In Jamaica, creating a local Drug Treatment Court (DTC) in the early 2000s allowed persons with substance use dependence to be redirected from the traditional judicial system towards a course of treatment and, ultimately, reintegration into their communities (72). However, limited in-patient services, particularly in the rural areas of the island, limit the mandate the policy seeks to fulfil (73). Notwithstanding, the existing legislation presents opportunity for policymakers to build capacity in addressing the alcohol-related problems of recidivist drivers.

Of interest, this study also highlights that drivers, overall, engaged in harmful and hazardous drinking in comparison to non-drivers. This may be due to the finding that being able to drive is associated with increased access to social participation and experiences (74), a common denominator that endears itself to alcohol consumption (75). In a society where alcohol use is culturally endorsed and essential in promoting social reciprocity (63), the use of a designated driver or an alternative transportation program may be beneficial (76). Indeed, the plethora of all-inclusive recreational events on offer in Jamaica year-round, where alcohol use is heavily promoted, invite event promoters to offer patrons free transportation home as part of the package (77).

Research surrounding road safety in low and middle-income countries (LMICs) is minimal (78), despite accounting for nine out of ten road traffic deaths worldwide (1). Increasing sobriety checkpoints, collecting data regarding drink-driving behaviours and reducing speed limits in high-volume pedestrian areas, are cost-effective strategies that have found success in reducing traffic fatalities in one sister LMIC country (79). More research is needed in these countries to craft effective strategies that fellow LMICs may adopt. The cumulative findings

observed in this study amongst the Jamaican population, add to the existing dearth of research in LMICs.

Additional strengths of this study are that it is the first study to examine the factors associated with DUIA amongst drivers from a nationally representative sample in the Caribbean and that it used robust multivariable logistic regression in the analysis. The AUDIT questionnaire for alcohol dependence further enhances the reliability of the findings, given its noted validity and use in multiple studies internationally (80-83). One of the limitations of the study is that this study was a cross-sectional design and thus is limited to creating association. This study also utilized a self-report survey related to alcohol use, and thus underreporting bias may be implicated in the findings. The data used in the analysis was collected in 2016, and findings may not be reflective of the current situation. Notwithstanding, the evidence in this study provides a foundation for future research.

CONCLUSION

One in 5 Jamaican drivers who currently consume alcohol operates a vehicle under its influence, with over 50% being an alcohol binge drinker. These findings have likely implications towards increasing road traffic casualties, rising workplace accidents, and an elevated burden on healthcare systems. Prevention and mitigation strategies should target these individuals to reduce driving under the influence of alcohol. Furthermore, the findings indicate that ongoing legislation discourse is best guided by the World Health Organization's SAFER initiative that focuses on drunk-driving countermeasures as part of its alcohol policy interventions.

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Patient consent Consent to participate was requested from the participants in the consent form prior to the collection of data. Informed consent was obtained from all subjects, where confidentiality and anonymity were protected through the non-retention of names.

Ethics approval The Ministry of National Security in Jamaica granted approval for the National Drug Use Prevalence Survey. The secondary data analysis was approved by the University of the West Indies Ethics Committee, Mona (Ref: CREC-MN,52 20/21).

Data sharing statement The data that support the findings of this study are available from the National Council on Drug Abuse, Jamaica, and the Inter-American Drug Abuse Control Commission (CICAD) but restrictions apply to the availability of these data, which were used under license for the current study and are not publicly available. Data are, however, available upon reasonable request and with permission of the National Council on Drug Abuse, Jamaica, and the Inter-American Drug Abuse Control Commission (CICAD). For access to the database, contact Mrs Uki Atkinson, research analyst, at uatkinson@ncda.org.jm.

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STROBE Statement

Checklist of items that should be included in reports of observational studies

Section/Topic	Item No	Recommendation	Reported on Page No
Title and abstract	1	(a) Indicate the study’s design with a commonly used term in the title or the abstract	1,2
		(b) Provide in the abstract an informative and balanced summary of what was done and what was found	2
Introduction			
Background/rationale	2	Explain the scientific background and rationale for the investigation being reported	3,4
Objectives	3	State specific objectives, including any prespecified hypotheses	4-5
Methods			
Study design	4	Present key elements of study design early in the paper	5,6
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection	5,6
Participants	6	(a) Cohort study—Give the eligibility criteria, and the sources and methods of selection of participants. Describe methods of follow-up	5,6
		Case-control study—Give the eligibility criteria, and the sources and methods of case ascertainment and control selection. Give the rationale for the choice of cases and controls	
		Cross-sectional study—Give the eligibility criteria, and the sources and methods of selection of participants	
		(b) Cohort study—For matched studies, give matching criteria and number of exposed and unexposed	
Variables	7	Case-control study—For matched studies, give matching criteria and the number of controls per case	N/A
		Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable	6,7,8
Data sources/measurement	8*	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group	6,7,8
Bias	9	Describe any efforts to address potential sources of bias	5,8
Study size	10	Explain how the study size was arrived at	6
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why	6,7,8
Statistical methods	12	(a) Describe all statistical methods, including those used to control for confounding	8
		(b) Describe any methods used to examine subgroups and interactions	8
		(c) Explain how missing data were addressed	7
		(d) Cohort study—If applicable, explain how loss to follow-up was addressed	5,8
		Case-control study—If applicable, explain how matching of cases and controls was addressed	
		Cross-sectional study—If applicable, describe analytical methods taking account of sampling strategy	
		(e) Describe any sensitivity analyses	N/A

Section/Topic	Item No	Recommendation	Reported on Page No
Results			
Participants	13*	(a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed	N/A
		(b) Give reasons for non-participation at each stage	N/A
		(c) Consider use of a flow diagram	NA/
Descriptive data	14*	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders	9
		(b) Indicate number of participants with missing data for each variable of interest	N/A
		(c) Cohort study—Summarise follow-up time (eg, average and total amount)	N/A
Outcome data	15*	Cohort study—Report numbers of outcome events or summary measures over time	N/A
		Case-control study—Report numbers in each exposure category, or summary measures of exposure	N/A
		Cross-sectional study—Report numbers of outcome events or summary measures	9-12
Main results	16	(a) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included	13,14
		(b) Report category boundaries when continuous variables were categorized	13,14
		(c) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period	N/A
Other analyses	17	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses	9-13
Discussion			
Key results	18	Summarise key results with reference to study objectives	14
Limitations	19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias	19
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence	14-19
Generalisability	21	Discuss the generalisability (external validity) of the study results	19
Other Information			
Funding	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based	21

*Give information separately for cases and controls in case-control studies and, if applicable, for exposed and unexposed groups in cohort and cross-sectional studies.

Note: An Explanation and Elaboration article discusses each checklist item and gives methodological background and published examples of transparent reporting. The STROBE checklist is best used in conjunction with this article (freely available on the Web sites of PLoS Medicine at <http://www.plosmedicine.org/>, Annals of Internal Medicine at <http://www.annals.org/>, and Epidemiology at <http://www.epidem.com/>). Information on the STROBE Initiative is available at www.strobe-statement.org.