



## Drinking and Driving among University Students in 22 Low, Middle Income and Emerging Economy Countries

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### Abstract

**Background:** The aim of this study was investigate drinking, driving, and socio-behavioral factors among university students in low and middle income and emerging economy countries.

**Methods:** Using anonymous questionnaires, data were collected from 18476 university students, of which 15151 (82.0%) were drivers of a car or motorcycle (41.3% men and 58.7% women), with a mean age of 20.7 years (SD=2.9), from 22 countries across Africa, Asia and Americas.

**Results:** Overall, 17.3% reported to have been driving a car or motorcycle after having had too much to drink in the past 12 months, ranging from below 5% in Bangladesh, Indonesia and Kyrgyzstan to above 35% in China, Singapore and Thailand. In multivariate logistic regression analysis, among both men and women, earlier year of study, living in an upper middle income or high income country (OR=3.58, CI=3.00-4.27 and OR=2.95, CI=2.52-3.46), low intrinsic religiosity (OR=0.67, CI=0.54-0.83 and OR=0.34, CI=0.28-0.42), injury from motorcycle accidents (OR=4.29, CI=2.69-6.82 and OR=3.24, CI=2.26-4.63), and weak belief in the importance of not drinking (OR=1.78, CI=1.50-2.11 and OR=1.61, CI=1.37-1.88) and driving were associated with drinking and driving. Further, among men, older age (OR=1.04, CI=1.01-1.07), binge drinking (OR=1.53, CI=1.27-1.86) and illicit drug use (OR=1.22, CI=1.01-1.47), and among women, younger age (OR=0.95, CI=0.97-0.98), and a lower country BAC limit (OR=0.01, CI=0.001-0.18) was associated with drinking and driving.

**Conclusion:** This study confirms low to high levels of drinking and driving in different cultures across Africa, Asia and the Americas. Various factors identified can be used to guide interventions to reduce drinking and driving among university students.

**Keywords:** Drink driving, Health behaviour, Health beliefs, University students, Multi-country

### Introduction

A high public health burden among young people between 20 and 24 years in low- and middle-income countries is road traffic injuries, alcohol use and alcohol-related accidents (1-3). University students seem to be particularly vulnerable to driving under the influence of alcohol (4, 5). Various studies among university students, mainly from high income countries found high levels of drinking

and driving: in USA: 25.8% driving after having too much to drink (5); 19.1% driven after 3 or more drinks in the past 3 months (6); 41% after any drinking in the past 30 days (7); driving under the influence of alcohol in the past year 28.1% (8); 10.8% drove after more than 4 drinks in the past month (4); 23% drove after alcohol use (9); New Zealand driven (past 4 weeks) after having "per-

haps too much to drink to be able to drive safely" 3.4% of women and 8.4% of men (10); university students from 19 high income and 4 middle income countries, past year driving after drinking too much, men 20% and women 7% (11).

Factors associated with drinking and driving have been identified, among others, as follows: 1) sociodemographic: male gender (4,9,12), older age (4); younger age (13); senior year of study (4), low religious commitment/importance (5,9), not living with parents or guardians (4,9); Gross Domestic Product (GPD) country for women (11); 2) substance use: binge drinking, heavy drinker (6,8,14-16), smoking (15), and cannabis use (8); 3) other traffic related behaviour: not always using seatbelts (15) and traffic injuries (4,7,17,18) health beliefs: weak belief in the importance of not drinking and driving (6,11); 5) personality characteristics: lack of self-control (19); and 6) drinking and driving legislation: lower country legal BAC limits (11,20).

There is a lack of studies investigating drinking, driving, and social-behavioural factors among university students in low and middle income and emerging economy countries over the same time, using a standard questionnaire allowing for direct comparison, which prompted this study.

## Methods

### *Sample and procedure*

This cross-sectional study was carried out with a network of collaborators in participating countries (see Acknowledgments). The anonymous, self-administered questionnaire used for data collection was developed in English, then translated and back translated into languages (Arabic, Bahasa, French, Lao, Russian, Spanish, Thai, and Turkish) of the participating countries. Questionnaires were tested in each country and language and found valid. The study was initiated through personal academic contacts of the principal investigators. These collaborators arranged for data to be collected from intended 400 male and 400 female undergraduate university students aged 16-30 years by trained research assistants in 2013 in one

or two universities in their respective countries. The universities involved were located in the capital cities or other major cities in the participating countries. Research assistants working in the participating universities asked classes of undergraduate students to complete the questionnaire at the end of a teaching class. In each study country, undergraduate students were surveyed in classrooms selected through a stratified random sample procedure. A university department formed a cluster and was used as a primary sampling unit. One department was randomly selected from each faculty. For each selected department, undergraduate courses offered by the department were randomly ordered. The students who completed the survey varied in the number of years for which they had attended the university. A variety of majors were involved, including education, humanities and arts, social sciences, business and law, science, engineering, manufacturing and construction, agriculture, health and welfare and services. Informed consent was obtained from participating students, and the study was conducted in 2013. Response rates were in most countries over 90%. Ethics approvals were obtained from institutional review boards from all participating institutions.

### *Measures*

**Drinking and driving.** Participants were asked, "Over the last year, how many times did you drive a car or ride a motorcycle when you felt that you had perhaps had too much to drink? Response options were "never", or a numerical indication of the number of times (11).

**Substance use**

**Binge drinking** was assessed with one item, "How often do you have (for men) five or more and (for women) four or more drinks on one occasion?" Response options ranged from 1=never to 5=daily or almost daily (21).

**Tobacco use** was assessed with the question: Do you currently use one or more of the following tobacco products (cigarettes, snuff, chewing tobacco, cigars, etc.)? Response options were "yes" or "no" (22).

*Illicit drug use* was assessed with the question, "How often have you taken drugs in the past 12 months; other than prescribed by the health care provider."

Other traffic related behaviour

*Seat belt use* was assessed with the question, "When driving or riding in the front seat of a car do you wear a seat belt?" Response options were, All the time, Some of the time, Never, I don't ride in cars (23).

*Traffic injury*. Participants were asked, "During the past 12 months, how many times you were seriously injured?" Serious injury was defined as "When it makes you miss at least one full day of usual activities, such as university, sports, or a job, or requires treatment by a doctor or nurse." Further, "During the past 12 months, what was the major cause of the most serious injury that happened to you?" Among the different response options, two related to traffic injury, i.e., "I was in a motor vehicle accident or hit by a motor vehicle." And "I was on a motorcycle." (24).

*Health beliefs* in the importance of "never to drive after drinking alcohol". The response option ranged from 1=of very low importance to 10=of very high importance (11).

*Personality characteristics* in the form of a sense of control were operationalized with the dimension of three items of personal mastery. An example is, "I can do just about anything I really set my mind to" (25). Cronbach's alpha for personal mastery in this sample was .75.

*Socio-demographic* questions included age, gender, and residential status. We assessed *religiousness* with the 3 item intrinsic (or subjective) religiosity sub-scale of Duke University Religion Index (DUREL; (26). Cronbach's alpha for the intrinsic religiosity sub-scale was .96 for this sample.

### Data analysis

The data were analyzed using STATA 11.00 (StatCorp LP, College Station, TX). Descriptive statistics were used for reporting the proportion of drinking and driving and Pearson Chi-square for gender differences in proportion of drinking and driving. The product - moment correlation was

used to compare the country Blood Alcohol Concentration (BAC) limits with drinking and driving prevalence. Logistic regression was used to assess the association between social-behavioral variables and drinking and driving. Variance inflation factor (VIF) and tolerance values for each model indicate multi collinearity was not a concern in any of the multivariate analyses. Since the study used a clustered design, country was included as a clustering variable in the regression models.

## Results

### Sample characteristics

The sample included 18476 university students, of which 15151 (82.0%) were drivers of a car or motorcycle (41.3% men and 58.7% women), with a mean age of 20.7 years (SD=2.9), from 22 countries across Africa, Asia and Americas. Overall, 17.3% reported to have been driving a car or motorcycle after having had too much to drink in the past 12 months; 19.2% among men and 16.1% among women. The overall prevalence of drinking and driving among university students differed by country, ranging from below 5% in Bangladesh, Indonesia and Kyrgyzstan to above 35% in China, Singapore and Thailand. Overall, men were more frequently drinking and driving than women were ( $P<0.001$ ). Although the preponderance of drinking and driving among men was true for students from 13 study countries, there were no significant gender differences in drinking and driving in 8 countries, and in Indonesia, more women than men were drinking and driving. The proportion of drinking and driving was not correlated across study countries with national BAC limits ( $r=0.02$ ,  $P=0.059$ ) (Table 1).

### Associations with drinking and driving

In multivariate logistic regression analysis, among both men and women, earlier year of study, living in an upper middle income or high income country, low intrinsic religiosity, injury from motorcycle accidents, and weak belief in the importance of not drinking and driving were associated with drinking and driving.

**Table 1:** Drinking and driving prevalence in the past 12 months among drivers or riders by country and gender (n=14651)

Sample	Men		Women		Statistic for sex differences  <i>P</i> -Value	All	
	Car or motor-cycle driver	Drinking and driving (all drivers)	Car or motor-cycle driver	Drinking and driving (all drivers)		Drinking and driving (all drivers)	Country Blood Alcohol concentration (BAC) limits(27,28)
	n	%	%	%		% (95% CI)	
<b>All</b>	<b>6147</b>	<b>19.2</b>	<b>8504</b>	<b>16.1</b>	<0.001	<b>17.3 (16.7-17.9)</b>	
<b>Caribbean and South America</b>							
Barbados <sup>4</sup>	261	18.0	175	4.6	<0.001	12.6 (9.5-15.7)	0.00
Grenada <sup>3</sup>	130	16.9	262	3.4	<0.001	7.9 (5.2-10.6)	0.08
Jamaica <sup>3</sup>	148	4.7	501	5.8	0.612	5.5 (3.8-7.3)	0.08
Colombia <sup>3</sup>	351	27.4	440	6.4	<0.001	15.7 (13.1-18.2)	0.039
Venezuela <sup>3</sup>	221	19.5	328	8.5	<0.001	12.9 (10.1-15.7)	0.08
<b>Sub-Saharan Africa</b>							
Cameroon <sup>2</sup>	268	6.7	358	5.0	0.369	5.8 (3.9-7.6)	0.08
Ivory Coast <sup>2</sup>	313	11.8	247	5.7	0.012	9.1 (6.7-11.5)	0.08
Madagascar <sup>1</sup>	355	10.7	342	2.9	<0.001	6.9 (5.0-8.8)	0.08
Namibia <sup>3</sup>	192	19.6	253	5.9	<0.001	9.5 (6.5-12.4)	0.08
Nigeria <sup>2</sup>	324	34.7	271	21.1	0.046	29.7 (23.3-36.2)	0.05
<b>North Africa, Neareast and Central Asia</b>							
Tunesia <sup>3</sup>	171	26.3	234	9.0	<0.001	16.4 (12.8-20.0)	0.05
Turkey <sup>3</sup>	354	13.6	344	5.5	<0.001	9.6 (7.4-11.8)	0.05
Russia <sup>3</sup>	223	6.7	266	10.2	0.178	8.6 (6.1-11.1)	0.00
Kyrgyzstan <sup>1</sup>	358	5.3	478	0.6	<0.001	2.6 (1.5-3.7)	0.05
<b>South Asia and China</b>							
Bangladesh <sup>1</sup>	385	4.9	294	3.4	0.431	4.2 (2.7-5.7)	0.00
India <sup>2</sup>	469	6.0	218	5.5	0.808	5.8 (4.1-7.6)	0.03
China <sup>3</sup>	267	74.9	811	58.1	<0.001	62.2 (59.3-65.1)	0.02
<b>Southeast Asia</b>							
Indonesia <sup>2</sup>	231	0.0	519	3.5	0.004	2.4 (1.3-3.5)	---
Laos <sup>2</sup>	268	33.2	533	26.8	0.060	28.9 (25.8-32.1)	0.08
Philippines <sup>2</sup>	200	9.0	580	5.2	0.052	6.2 (4.5-7.8)	0.05
Singapore <sup>4</sup>	428	41.6	425	46.1	0.183	43.7 (40.4-47.0)	0.08
Thailand <sup>3</sup>	230	40.4	625	34.1	0.086	35.8 (32.6-39.0)	0.05

<sup>1</sup>Low income country; <sup>2</sup>Lower middle income country; <sup>3</sup>Upper middle income country; <sup>4</sup>High income country (Source: World Bank, 2013)(29).

Further, among men, older age, binge drinking and illicit drug use, and among women, younger

age, and a lower country BAC limit was associated with drinking and driving (Table 2).

Table 2: Logistic regression analyses predicting drinking and driving by gender

Variables (N,% or M, SD)	Men			Women		
	Drink and drive % or M	Crude OR (95% CI)	Ad-justed OR (95% CI)	Drink and drive % or M	Crude OR (95% CI)	Ad-justed OR (95% CI)
<b>Socio-demographic variables</b>						
Age in years	21.1	1.03 (1.01-1.06)**	1.04 (1.01-1.07)*	20.3	0.96 (0.94-0.98)***	0.95 (0.97-0.98)**
Year of study						
1	20.8	1.00	1.00	21.5	1.00	1.00
2	15.6	0.70 (0.59-0.84)***	0.64 (0.51-0.81)***	13.3	0.56 (0.47-0.66)***	0.61 (0.51-0.73)***
3	24.0	1.20 (1.01-1.43)*	1.23 (0.99-1.52)	15.6	0.67 (0.58-0.78)***	0.69 (0.59-0.82)***
4	16.4	0.75 (0.62-0.90)**	0.85 (0.68-1.06)	11.4	0.47 (0.40-0.56)***	0.61 (0.50-0.74)***
Residence						
With parents/relatives	17.5	1.00	1.00	14.2	1.00	1.00
On campus/Off campus (on their own)	20.9	1.25 (1.10-1.42)***	1.04 (0.88-1.22)	18.1	1.33 (1.18-1.50)***	1.03 (0.91-1.18)
Intrinsic religiosity						
Low (3-10)	25.3	1.00	1.00	27.2	1.00	1.00
Medium (11-13)	15.3	0.53 (0.46-0.62)***	0.70 (0.58-0.84)***	10.2	0.30 (0.26-0.35)***	0.43 (0.37-0.51)***
High (14-15)	14.6	0.50 (0.42-0.60)***	0.67 (0.54-0.83)***	8.0	0.23 (0.20-0.28)***	0.34 (0.28-0.42)***
Country income						
Low income/Lower middle income	10.4	1.00	1.00	7.5	1.00	1.00
Upper middle income/High income	28.4	3.41 (2.95-3.94)***	3.58 (3.00-4.27)***	23.5	3.80 (3.30-4.38)***	2.95 (2.52-3.46)***
<b>Substance use</b>						
Binge drinking (past month)	30.1	2.14 (1.84-2.49)***	1.53 (1.27-1.86)***	12.0	1.17 (0.97-1.42)	---
Tobacco use (current)	18.5	0.97 (0.83-1.15)	---	14.5	0.74 (0.67-0.98)*	0.76 (0.57-1.03)
Illicit drug use (past year)	19.9	1.16 (1.00-1.36)*	1.22 (1.01-1.47)*	18.1	1.03 (0.88-1.20)	---
<b>Other traffic related behaviour</b>						
Not always using seatbelt (base=always)	19.3	0.99 (0.86-1.14)	---	16.5	1.03 (0.90-1.17)	---
Injury in motorcycle accident (past year) (base=none)	41.3	3.10 (2.14-4.48)***	4.29 (2.69-6.82)***	38.5	3.34 (2.42-4.62)***	3.24 (2.26-4.63)***
Injury in car accident (past year) (base=none)	21.4	1.16 (0.74-1.82)	---	9.7	0.55 (0.28-1.10)	---
<b>Health beliefs</b>						
Weak belief in the importance of not drinking and driving (weak=1-8; base=strong=9-10)	27.7	2.05 (1.79-2.35)***	1.78 (1.50-2.11)***	23.3	1.78 (1.55-2.05)***	1.61 (1.37-1.88)***
<b>Personality characteristics</b>						
Personal mastery						
Low	23.1	1.00	1.00	20.8	1.00	1.00
Medium (11-13)	18.3	0.75 (0.64-0.87)***	0.75 (0.63-0.91)**	17.2	0.79 (0.70-0.90)***	0.86 (0.74-1.00)*
High (14-15)	15.9	0.63 (0.53-0.74)***	0.60 (0.49-0.74)***	9.3	0.39 (0.33-0.46)***	0.49 (0.41-0.59)***
<b>Drinking and driving legislation</b>						
Study country BAC limits	0.052	7.06 (0.71-70.16)	---	0.048	0.00 (0.00-0.001)***	0.01 (0.001-0.179)***

## Discussion

The study found, among a large sample of university students from 22 low, middle income and emerging economy countries across Asia, Africa and the Americas, a high proportion (17.3%) reporting to have been driving a car or motorcycle after having had too much to drink in the past

12 months, which is comparable to a previous study among university students from 19 high income and 4 middle income countries (11), but seems much lower than in the College student samples in the USA (4-9,11). However, the study found a large country variation in the overall prevalence drinking and driving among university students, ranging from below 5% in Bangladesh,

Indonesia and Kyrgyzstan to above 35% in China, Singapore and Thailand. Some studies have identified a serious problem of drinking and driving road crashes in China (14, 30). Using the same measurement instrument, one previous older study (1999) in Thailand (31) found a much higher prevalence of drink driving among university students in Northeast Thailand (83.7% among male and 92.2% of female students), and one newer study (2003) found a much lower prevalence of drinking and driving in university students (10% and 3%, in males and females, respectively) in Thailand (11). Although no studies were found reporting drinking and driving in Singapore, it was found that Singapore has a relatively high prevalence of 12-month heavy drinking of 12.6% (32). In some predominantly Muslim countries, including Bangladesh, Indonesia and Kyrgyzstan university students had a low prevalence of drinking and driving, but in other Muslim countries such as Turkey and Tunisia medium rates of drinking and driving were found.

In concordance with a number of other studies (e.g.,4,9,12), the study found across the countries that men engaged more frequently in drinking and driving than women. However, the preponderance of drinking and driving among men was only true for students from 13 study countries, while there were no significant gender differences in 8 countries, and in Indonesia the preponderance of drinking and driving was among women. Although the preponderance of drinking and driving among men was true for students from 13 study countries, there were no significant gender differences in drinking and driving in 8 countries, and in Indonesia, more women than men were drinking and driving. No gender differences in drinking and driving were found in students from some low prevalence drinking Hindu or Muslim cultures, medium prevalence in countries such as Russia and in high prevalence drinking and driving students from Laos, Singapore and Thailand. Gender differences in drinking and driving may be influenced by biological and cultural factors such as self-restraint of drinking by women (33) and women's position in society (34). It is possible that in the study countries, Laos, Singapore and

Thailand, with a high prevalence of drinking and driving among both men and women, a higher women's position in the society reduces the difference between men and women drinking and driving rates. In relation to the age or year of study, we found that older students and earlier year of study were more likely to report drinking and driving. This can be explained in that drinking and driving sharply increases from age 16 to 18, peaks at 18 years (20.8%), with the largest number of students at in their first year (27.4%), and then gradually reduces from 19 to 30 years. The peak of 18 years may be attributed to the reason that in the majority of the study countries the minimum legal drinking age is set at 18 years (35). Further, our findings are in agreement with a study among US university students, where older age was associated with drinking and driving (4), but in contrast to another study in American university students where the younger age was associated with lower levels of drinking and driving (13). Unlike in some other studies (4, 9), this study did not find that living with parents or guardians was associated with less frequent drinking and driving. University students in the upper middle income and high-income countries were much more likely to engage in drinking and driving (25.3%) than students from low income and lower middle-income countries (8.8%). A similar trend was found among women in a study among university students from 19 high income and 4 upper middle-income countries comparing GPD of these countries (11). It is possible that if income levels rise, alcohol use as well as drinking and driving levels increase. Further, in agreement with previous studies (5,9), this study found that low intrinsic religiosity was highly associated with drinking and drinking. It is possible that students with higher intrinsic religiosity are more likely to abstain or limit drinking and contravene traffic regulations of BAC limits.

This study found that among men binge drinking and illicit drug use was associated with drinking and driving. This finding is confirmed from previous studies (6,8,14-16). Interventions, particularly among men, may need to consider in cooperating the co-occurrence of other drug use. This study

found a high correlation between drinking and driving and injury from a motorcycle accident. Previous studies (7,17,18,36) have clearly shown the relationship between drinking and driving and traffic injuries. Unlike a previous study (15), this study did not find an association between not always using seat belts and drinking and driving. Further, university students with a weaker belief in the importance of not drinking and driving were more likely drinking and driving, as found in other studies (6,11). This finding that attitudes played a role in drinking and driving may call for the development of an intervention to address the modification of these health beliefs (11). Low personal mastery as a form of lack of self-control was previously also found to be associated with drinking and driving (19). Students with lower personal mastery may less likely engage in drink planning in terms of long-term planning, resulting in drinking and driving (19). Contrary to previous studies (11,20), this study did not find that lower country legal BAC limits were associated with less drinking and driving. Possible reasons for this may be lack of enforcement of the BAC limit law and/or low penalties for violations (13,37).

#### Study limitations

This study had several limitations. The study was cross-sectional, so causal conclusions cannot be drawn. The investigation was carried out with students from one or two universities in each country, and inclusion of other centers could have resulted in different results. University students are not representative of young adults in general, and the drinking and driving levels, socio demographic and health variables may be different in other sectors of the population. A further limitation of the study was that all information collected in the study was based on self-reporting. It is possible that certain behaviors were under or over reported. Underreporting of self-reported drinking and driving may be attributed to social stigma with possible legal implications (13). However, in this study the questionnaire was self-administered rather than interview-administered which may have helped to mitigate under-reporting of drinking and driving (13).

## Conclusion

This study confirms low to high levels of drinking and driving in different cultures across Africa, Asia and the Americas. Various factors identified, such as socioeconomic status (having low intrinsic religiosity and coming from a higher income country), weak beliefs in the importance of not drinking and driving, injury from motorcycle accidents and co-occurrence of substance use (binge drinking and illicit drug use) among men can be used to guide interventions to reduce drinking and driving among university students.

## Ethical considerations

Ethical issues (Including plagiarism, informed consent, misconduct, data fabrication and/or falsification, double publication and/or submission, redundancy, etc.) have been completely observed by the authors.

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