



Roadside surveys of drinking and driving in Cameroon

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ABSTRACT

Objective: This study aimed to assess the prevalence of drinking and driving on roadways in urban areas and highways in Cameroon, and to determine the associations between drinking and driving and socio-demographic factors.

Methods: A cross-sectional study of motor vehicle drivers was performed on Fridays, Saturdays, and Sundays between May and September 2020 with three driver groups: (1) random motor vehicle drivers (including riders) on major highways, (2) drivers recruited at car stations in Yaoundé, and (3) at fuel stations in Douala. Alcohol was measured using breathalyzers, and a questionnaire collected socio-demographic data.

Results: In total, 2402 motor vehicle drivers were asked to participate in the study and 1701 (70.8%) gave informed consent. The vast majority (98.6%) were men. Drivers aged 30-39 years constituted the largest age group on highways and in Yaoundé, whereas 18-29 years was the largest age group in Douala. The highest prevalence of alcohol was observed among drivers in Yaoundé, which included mainly clandestine taxi car drivers and motorcycle taxi riders, where about 30% had blood alcohol concentrations (BAC) above the legal limit of 0.08%. The proportion with BACs above the legal limit was about 6% among the drivers in Douala, which included mainly motorcycle taxi riders, and about 4% among drivers on highways.

Conclusions: The findings indicate that drinking and driving is a major traffic safety problem on Cameroonian public roads, especially among motorcycle taxi riders and clandestine taxi drivers in towns, which represent the major mass transportation means in the country. Drinking and driving education and legislation should be better developed and enforced in order to reduce the number road traffic crashes.

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Introduction

Driving under the influence (DUI) of alcohol is a public health problem worldwide as it is one of the main causes of road traffic crashes (RTCs). In 2019, WHO estimated that 1.35 million road users die each year as a result of RTCs (WHO 2018). In high-income countries, about 20% of fatally injured drivers have alcohol in their blood, while in some low- and middle-income countries, the proportion of alcohol-related RTCs are often higher (GRSP 2007). Unfortunately, 93% of the world's road fatalities occur in low- and middle-income countries, even though these countries only have approximately 60% of the world's vehicles (WHO 2018).

The estimated pooled rate for road traffic injury in Africa is 65.2 per 100,000 inhabitants (Adeloye et al. 2016). The estimated road traffic death rate is 26.6 per 100,000 inhabitants, whereas countries in the Americas and Europe have

regional rates of 15.6 and 9.3 deaths per 100,000 people respectively (WHO 2018). Several high-income countries have death rates of less than five per 100,000 (IRTAD 2020).

The statistics on RTCs in Cameroon are incomplete because they are under-reported (Sobngwi-Tambekou et al. 2010). According to unpublished data received from the Cameroon Ministry of Transports, 111,062 RTCs were reported during 2010-2019, with 6,149 total deaths and 24,887 injured. However, unpublished statistics from the National Gendarmerie indicate that 13,848 people lost their lives in Cameroon due to RTCs from 2010 to 2019. On the other hand, the WHO estimated that 7,066 road users were killed in Cameroon RTCs in 2016, which is about five times higher than the annual average reported by the National Gendarmerie and represents about 30.1 deaths per 100,000 inhabitants (WHO 2018). Thus, RTC injuries and deaths are high in Cameroon compared to other causes of death, such



Figure 1. Map of Cameroon showing the highways stretches included in the roadside survey (blue color) as well as the location of the three major cities (based on United Nations map).

as tuberculosis with 25 deaths per 100,000 inhabitants, and poisoning combined with suicides, which together represent 15.6 deaths per 100,000 inhabitants (MINSANTE 2019).

The legal blood alcohol concentration (BAC) limit in Cameroon is 0.08%. The penalties include fines (FCFA 25,000; about 46 USD), vehicle immobilization, and possible driver license suspension. There are little reliable data on the prevalence of alcohol use among Cameroon drivers in random road traffic, and the impact of alcohol on RTC deaths is also unknown. A 2016 study of professional drivers in random road traffic in Cameroon found that about 10% tested positive for alcohol and 2.8% of them had BACs of more than 0.04% (Sobngwi-Tambekou et al. 2016). A survey, conducted with participants among the general public and with traffic police, on knowledge and experiences about drinking and driving, found that 12% of the rural and 5.9% of the urban population in Cameroon had been involved in RTCs where the driver had been drinking (Minang 2014). Survey respondents also reported that the vast majority of people in Cameroon did not know the laws or penalties for DUI, and the majority thought that the police did not enforce drinking and driving laws. Further, law enforcement (police or gendarmerie) survey respondents indicated that drunk drivers were rarely punished. Finally, about 40% of law enforcement did not know the legal limit for DUI of alcohol, indicating awareness and enforcement of the DUI law is weak in Cameroon.

In cities and villages, most motor vehicles in the streets are used for public transport. In addition to buses, mini-buses, and licensed taxis, transportation is performed by motorcycle taxis and so-called clandestine vehicles or “clandos,” which are unlicensed taxi cars, vans or pickup trucks (Ahanda 1984; Olvera et al. 2012). Streets may be overcrowded with motorcycle taxis and “clandos” at times, and the risk for crash involvement is high (see online supplemental material Photos P1 and P2).

The primary aim of this study was to determine the prevalence of alcohol among three groups of motor vehicle drivers in Cameroon: random drivers on highways, drivers at public transportation car stations in the capital of Yaoundé, and drivers at fuel stations in the large city of Douala, which is dominated by motorcycle taxis. A second aim was to determine the associations between DUI of alcohol and socio-demographic factors.

Methods

Setting

The Republic of Cameroon is located in the western part of central Africa and had an estimated population of about 26 million inhabitants in 2020. The majority of RTCs in Cameroon occur in the southwestern part of the country, where the three largest cities are located: Yaoundé (the political capital), Douala (the commercial and economic capital), and Bafoussam. This geographical area is crossed by four national highways of great economic importance: 1) N2 links Yaoundé with Region South and further on to the neighboring countries of Gabon and Equatorial Guinea; 2) N3 links Yaoundé with Douala, which is the main entry for goods into the country via the port and also serves as the freight transport to neighboring countries; 3) N4 links Yaoundé with Region West to Bafoussam; and, 4) N10 links Yaoundé with Region East through Bertoua to the Central African Republic and Chad. The triangle between the three cities Yaoundé, Douala and Bafoussam has been called the “Triangle of Death” due to the large number of fatal RTCs. Road policing in those regions is performed by Road Traffic Group No. 1 of the National Gendarmerie (see Figure 1).

Study design and participants

Three cross-sectional DUI studies were performed: one along the four main highways noted above, one in the capital Yaoundé, and one in Douala.

The recruitment of drivers was performed between May and September of 2020 during time intervals with expected high incidence of DUI; similar time intervals were used in the American Roadside Survey (Kelley-Baker et al. 2016). On highways, gendarmerie agents stopped commercial and noncommercial vehicles at random from the stream of traffic for routine checking, and then sent the vehicle to the research team for invitation into the research study. In Yaoundé and Douala, drivers were recruited at fuel and car stations during selected time intervals without support from

police or gendarmerie. The total number of eligible vehicles was counted to determine the proportion of traffic passing by each location, in order to calculate the participation rate.

During recruitment, drivers were informed that participation was voluntary and that the aim of the study was to investigate the use of alcohol among drivers in order to measure and reduce RTCs. Participants were assured anonymity and provided oral informed consent (in order to avoid registering their names).

Data collection

Group 1: Drivers on highways

Driver enrollment was conducted under the supervision of Road Traffic Group No. 1 of the National Gendarmerie at national highways N2 (Yaoundé – Mbalmayo axis), N3 (Yaoundé – Douala axis), N4 (Yaoundé – Bafoussam axis), and N10 (Yaoundé – Ayos axis) (see Figure 1) in connection with their regular weekend road traffic controls. Drivers were randomly recruited during six times periods in five weekends: Fridays 9 a.m. to 12 p.m. (noon), Fridays 10 p.m. to 12 a.m. (midnight), Saturdays 1 a.m. to 3 a.m., Saturdays 9 a.m. to 11 a.m., Saturdays 10 p.m. to 12 a.m., and Sundays 9 a.m. to 12 p.m.

Group 2: Drivers in Yaoundé metropolis

Drivers were recruited at main car stations (Mokolo and Mvog-mbi). These included mainly motorcycle taxi riders and “clando” drivers. They were recruited during three times periods in two weekends: Fridays 10 p.m. to 12 a.m., Saturdays 9 a.m. to 11 a.m. and Sundays 9 a.m. to 12 p.m. Police or gendarmerie was not involved at the data collection sites.

Group 3: Drivers in Douala metropolis

Drivers at main fuel stations within town (Tradex Ndokoti, Total Deido, Total Deux Eglises and Total Makepe) were invited to participate. These included mostly motorcycle taxi riders. They were recruited during three times periods: Fridays 10 p.m. to 12 a.m., Saturdays 9 a.m. to 11 a.m. and Sundays 9 a.m. to 12 p.m. Police or gendarmerie was not involved at the data collection sites.

Alcohol testing and questionnaire

Breath Alcohol Concentration (BrAC) was determined using an AL 6000 Breathalyzer (AlcoDigital Ltd., West Chilton, UK). The blood alcohol concentration (BAC) was estimated using a blood to breath ratio of 2100:1. Drivers who tested positive for alcohol (BAC > 0.01%) were tested twice. Drivers whose results were above the legal limit (BAC > 0.08%) were asked not to drive their car for two hours or more; their car keys were kept and given back to them when their BAC fell below the legal limit. A questionnaire was used to collect data on drivers' age, gender, education level, religion, residency, professional or nonprofessional driver, vehicle type, time interval, and data collection site.

Data analysis

Data analysis was performed using SPSS version 21.0 (IBM Corporation, Corporation, Armonk, NY). Descriptive statistics of respondent characteristics are presented as frequencies. Bivariate (crude) and multivariable logistic regression analysis were used to determine associations between covariates that may be associated with alcohol use (age, education, religion, residency, professional or nonprofessional driver, vehicle type, and time interval). Associations are presented as odds ratios (ORs) with 95% confidence intervals (95% CI) as well as *p*-values.

Ethical approval

The study was approved by the National Ethical Committee for Research for Human Health, Cameroon with the National Ethical Clearance No 2018/07/1080/CE/CNERSH/SP.

Results

In total, 2,402 drivers and motorcycle riders were asked to participate to the study; 1,701 (70.8%) of them consented to participate. Among these, 1,424 participants were encountered on highways and 1,175 (82.5%) of them consented; whereas 978 drivers were contacted in towns and only 526 (53.8%) of them consented to participate. All the non-included/consented participants also refused to complete the questionnaire.

Characteristics of the participants are presented in the supplemental material (see Table S1). Note, only 1.4% were female. Drivers aged 30-39 years constituted the largest age group on the highways and in Yaoundé, whereas the most prevalent driver age group in Douala was 18-29 years. The average age among motorcycle riders was lower (33 years) than for other driver groups (40 years). More than 70% of the drivers who were recruited along highways and in Yaoundé had secondary or tertiary education, compared to about 50% in the Douala driver group (likely caused by a

Table 1. Proportions of drivers with BACs >0.08% among different groups.

	Highways % (n)	Yaoundé town % (n)	Douala town % (n)
Religion			
Christians	4.0 (35)	31.6 (85)	6.3 (10)
Muslims	2.0 (4)	18.9 (7)	0.0 (0)
Other	8.0 (7)	34.6 (9)	50.0 (1)
Driver			
Professional	2.7 (22) ^a	32.5 (100) ^b	5.7 (11) ^c
Nonprofessional	6.6 (24)	4.2 (1)	0.0 (0)
Time			
Nighttime (10 p.m.-3 a.m.)	4.3 (31) ^d	32.9 (71) ^e	3.2 (4) ^e
Morning (9-12 a.m.)	3.3 (15) ^f	25.9 (30) ^g	10.3 (7) ^g

^aMostly drivers of trucks (36%), buses (34%), and clandestine taxi car drivers (11%).

^bMostly motorcycle taxi riders (47%) and clandestine taxi car drivers (42%).

^cOnly motorcycle taxi riders.

^dFridays and Saturdays.

^eFridays.

^fFridays, Saturdays and Sundays.

^gSaturday and Sundays.

Table 2. Logistic regression analysis for drivers recruited along highways with BAC >0.08% as dependent variable. Crude odds ratios (OR) and adjusted odds ratios (aOR) are presented with 95% confidence intervals (95% CI) and p-values.

Independent variable	Crude OR (95% CI)	p	aOR ^a (95% CI)	p
Professional driver	0.4 (0.2-0.7)	0.002	0.3 (0.09-0.8)	0.018
Vehicle (ref: cars/vans)	1			
Motorcycles	7.4 (1.4-40.0)	0.021	14.6 (2.1-103.5)	0.007
Trucks	0.8 (0.4-1.7)	0.832	1.7 (0.6-5.3)	0.356
Buses and licensed taxi cars	0.4 (0.2-1.0)	0.053	1.0 (0.3-3.7)	0.976
Clandestine taxi cars	0			
Time (ref: Sunday 9 a.m.-12 p.m.)	1			
Friday 9 a.m.-12 p.m.	9.0 (1.5-55.1)	0.017	6.6 (1.1-40.7)	0.043
Friday 10 p.m.-12 a.m.	7.7 (1.4-42.9)	0.019	7.3 (1.3-41.1)	0.024
Saturday 1-3 a.m.	9.7 (2.1-44.8)	0.004	9.4 (2.0-44.3)	0.005
Saturday 9-11 a.m.	5.4 (1.2-25.0)	0.03	4.1 (0.9-19.2)	0.069
Saturday 10 p.m.-12 a.m.	17.0 (3.9-74.4)	<0.001	15.1 (3.4-67.2)	<0.001

^aThe odds ratio was adjusted for the covariates listed in the table. Covariates that were not statistically significant (age, education, religion, and residency) were not included. See Table S3 in online supplemental material for details.

Table 3. Logistic regression analysis for drivers at car stations in Yaoundé with BAC >0.08% as dependent variable.

Independent variable ^a	Crude OR (95% CI)	p	aOR ^a (95% CI)	p
Religion (ref: Christian)	1			
Muslim	0.5 (0.2-1.2)	0.120	0.4 (0.1-0.9)	0.038
Other	1.1 (0.5-2.7)	0.753	0.9 (0.3-2.3)	0.787
Professional driver	11.1 (1.5-83.0)	0.019	13.1 (1.7-102.9)	0.014
Vehicle (ref: cars/vans)	1			
Motorcycles	5.8 (1.3-25.2)	0.020	8.7 (1.9-39.6)	0.005
Trucks ^b	—		—	
Buses and licensed taxi cars	6.3 (0.7-57.9)	0.107	5.1 (0.5-49.3)	0.155
Clandestine taxi cars	6.4 (1.4-28.2)	0.014	6.2 (1.4-27.9)	0.017
Time (ref: Sunday 9 a.m.-12 p.m.)	1			
Friday 10 p.m.-12 a.m.	0.5 (0.3-0.9)	0.018	0.5 (0.3-0.9)	0.016
Saturday 9-11 a.m.	0.5 (0.3-0.9)	0.015	0.4 (0.2-0.7)	0.003

^aThe odds ratio was adjusted for the covariates listed in the table. Covariates that were not statistically significant (age, education, and residency) were not included. See Table S4 in online supplemental material for details.

^bNo truck driver was included.

larger proportion of young drivers). Three quarters of the participants were Christians, and 16% were Muslims.

Almost all participants in Douala (99.5%) and Yaoundé (92.8%), and the majority (69.0%) of those on the highways were professional drivers. Almost all the drivers encountered in Douala were motorcycle taxi riders and about half of the participants in Yaoundé were motorcycle taxi riders and 39% were drivers of “clandos.” About half of the participants recruited along highways were truck, bus, or taxi drivers, about 40% were car and van drivers, and 8% were “clandos.”

The highest prevalence of alcohol use was observed among the recruited drivers in Yaoundé, where 70.2% tested positive for alcohol, and 30.4% had BAC >0.08%. Among drivers recruited in Douala, 7.7% tested positive, and 5.7% had BACs >0.08%. On highways, 15.6% tested positive for alcohol and 3.9% had BACs > 0.08%. Among professional drivers on highways, the proportions were slightly lower, with 13.8% who tested positive for alcohol and 2.7% having BACs >0.08%. Proportions of drivers with BACs above the legal limit among the main groups of drivers are presented in Table 1. More details are presented in supplemental material (see Table S2).

None of the female drivers had BACs > 0.08%. The highest proportion with BACs > 0.08% was found in the age group 40-49 years in all driver groups, followed by drivers aged 30-39 years old. The proportion that tested positive for alcohol was highest among those with tertiary education.

The proportion testing positive for alcohol was lowest among Muslims (4.0%), higher among Christians (10.7%), but highest among those with other religions (14.7%). The time intervals with highest proportion of drivers with high BAC were Saturday nights on the highways and Sunday mornings in the cities. More details on the alcohol findings are presented in supplemental material (see Table S2).

Logistic regression analysis was performed to determine the adjusted odds ratios for driving with a BAC above the legal limit. Analysis of data for highway drivers (Table 2) found the following characteristics were significantly associated with having a BAC >0.08%: being nonprofessional driver, driving a motorcycle taxi, and driving at night. For drivers recruited in Yaoundé (Table 3), multivariable regression analysis also found that religion was a significant covariate: Muslims had lower odds for driving with high BACs. In addition, clandestine taxi car drivers (“clandos”) and motorcycle taxi riders had higher odds for driving with high BACs compared to other drivers, and many of the drivers on Saturday mornings had been drinking. For drivers recruited in Douala, none of the covariates were statistically significantly associated with high BACs, neither in the crude or in multivariable analysis.

Discussion

This study sought to examine the prevalence of alcohol use among drivers in Cameroon. Most significantly, this study

found that driving with a BAC above the legal limit was especially common among clandestine taxi car drivers and motorcycle taxi riders in Yaoundé, where about 30% had BACs above the legal limit. This was significantly higher than the group of mainly motorcycle taxi riders in Douala, where about 6% had BACs above the legal limit, and drivers along highways, where 4% had BACs above the legal limit.

It is important to highlight that alcohol positive results may be underestimated. In random roadside surveys, the driver recruitment process must be based on a random sampling mechanism that allocates equal probabilities for selection of drinking drivers and non-drinking drivers (Vanlaar 2005). Recruitment of voluntary drivers in drinking and driving surveys is difficult, because driving under the influence of alcohol is punishable by law. Therefore it may be that some motor vehicle drivers who had been drinking refused to participate in the study, thus underestimating results on highways and surveys in Yaoundé and Douala.

In general, the highest participation rate is observed when participation is compulsory, but the presence of police may also affect the participation rate. In this study, the participation rate was higher on highways (82.5%) than in the two towns (53.8%), probably because data collection teams were not accompanied by police or gendarmerie agents in the towns. Also, in the American Roadside Survey, they noted fewer vehicles stopped to participate at sites where the police were not involved (Kelley-Baker et al. 2016). In European roadside surveys of alcohol and drug use among drivers, where participation also was voluntary, participation rates varied from 48% to 99% across different countries, even though the police were present during the recruitment of drivers (Houwing et al. 2011). Thus, the participation rate is affected by other factors as well.

This study had few female participants. Similar studies in other sub-Saharan countries also found that few females were driving (Odero and Zwi 1997; Mock et al. 2001; Ogazi and Edison 2012; Sobngwi-Tambekou et al. 2016). Moreover, younger men seemed to be more involved in motorcycle riding than older men, who were mostly car drivers.

Drivers in Yaoundé were recruited at sites where the “clandos” and motorcycle taxi riders were waiting for passengers. The research team observed that many of them were drinking alcohol while they waited for customers. The prevalence of BACs above the legal was very high among these drivers; therefore, passengers in these cars are also at increased risk for alcohol related RTC injuries.

The prevalence of alcohol along the highways in Cameroon was similar to findings in studies in other sub-Saharan countries. Odero and Zwi found in a roadside survey in urban Kenya that 19.9% of participants had a positive breath test for alcohol and 4% had BACs $>0.08\%$ (Odero and Zwi 1997). Mock et al. (2001) found that in 1997 21% of drivers in Ghana had a detectable BAC and 7.3% had BACs $\geq 0.08\%$. Damsere-Derry et al. (2016) conducted a similar study in northern Ghana in 2013 and found that 9.7% tested positive for alcohol, 6% had BACs $>0.08\%$. A high prevalence of alcohol was reported in a Nigerian study

of commercial drivers and motorcyclists performed in 2014. Oginni et al. (2018) observed that 51.1% of the drivers had BACs $>0.01\%$ and 7.9% had BACs $>0.05\%$. The similarities among these sub-Saharan countries could be due to similar cultures, socio-economic levels, and policies.

The lowest prevalence of DUI have been reported in high-income countries. In Europe, the prevalence of BACs $>0.01\%$ ranged from 0.4% (Norway) to 9.6% (Italy) in 2007–2009; the average prevalence of BACs $>0.05\%$ in a selection of European countries was 1.49% (Houwing et al. 2011). In the 2013–2014 American Roadside Survey, drivers were recruited during the same time intervals as the current study. Among Friday and Saturday nighttime drivers, 8.3% tested positive for alcohol and 1.5% had BACs $>0.08\%$ (Ramirez et al. 2016). Thus, during those time periods, driving with a BAC $>0.08\%$ was more common in Cameroon than in the US.

In our study, the highest prevalence of BACs above the legal limit was found among drivers aged 40–49 years, followed by drivers aged 30–39 years old. Similar results were observed in Ghana (30–49 years old) (Mock et al. 2001) and 30–59 years (Damsere-Derry et al. 2016). The proportion that tested positive for alcohol was highest among those with tertiary education, contrary to observations done in Ghana (Mock et al. 2001; Damsere-Derry et al. 2016), where the prevalence of alcohol use was higher among illiterate adults compared to literate drivers.

To our knowledge, only one study on alcohol use among drivers in Cameroon has been published before this study. Sobngwi-Tambekou et al. (2016) studied alcohol use among professional drivers along the Douala-Yaoundé highway in 2014. In total, 1.4% had BACs $>0.08\%$. In that study, drivers were recruited over a 10-day period, 24 h per day. Our study included only select time periods during weekends, time periods when the prevalence of DUI is thought to be higher than on weekdays (Houwing et al. 2011). Thus, in our study, a comparatively higher proportion of the professional drivers (2.7%) had BACs $>0.08\%$.

Logistic regression analysis showed that age and education were not significantly associated with having a BAC $>0.08\%$ in multivariable models. Being a Muslim was inversely associated with alcohol use, as expected. Being a nonprofessional driver, motorcycle taxi rider, or clandestine car driver were significantly associated with having a high BAC. Odero and Zwi's survey in urban Kenya in 1997 also found that professional drivers had lower odds of having a BAC $> 0.08\%$; educated individuals with skilled careers tended to engage in drinking and driving to a greater extent than professional drivers. And, in comparison to operators of public service vehicles, people driving personal cars were more than twice as likely to have been drinking (Odero and Zwi 1997). Surprisingly, in the current study the prevalence of drinking was higher among drivers recruited at car stations in Yaoundé during Sunday morning compared to those recruited Friday night and Saturday morning. It is likely that this might have been a result of heavy drinking the night before in many cases. This drinking pattern was different from drivers on highways.

The prevalence of DUI has decreased in high-income countries over the last decades. Damsere-Derry et al. (2016) concluded that this decline was mainly due to the increased use of high visibility enforcement, such as sobriety check points and random breath testing, as well as increased sanctions/punishments for violators. As noted previously, according the survey conducted in Cameroon by Minang (2014), both the general public and law enforcement were unaware of the law and penalties concerning drinking and driving. Many do not even know the legal drinking and driving limit. Consequently, general impaired driving education and awareness, as well as strengthening DUI legislation with high visibility law enforcement, may increase road safety in Cameroon.

Data availability statement

We do not have permission to share non-aggregated research data.

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Roadside surveys of drinking and driving in Cameroon

Supplemental Material



Photo P1. Motorcycle taxi riders in a street of Yaoundé (Photo: Yannick Oyono).



Photo P2. “Clandos” car in a car station in Yaoundé (Photo: Yannick Oyono).

Table S1. Characteristics of enrolled driver groups

	Highways	Yaoundé town	Douala town
	% (n)	% (n)	% (n)
Gender			
Males	99.1 (1164)	96.4 (320)	100.0 (194)
Females	0.9 (11)	3.6 (12)	0.0 (0)
Age (years)			
18-29	10.0 (118)	16.6 (55)	46.4 (90)
30-39	39.6 (465)	47.0 (156)	39.7 (77)
40-49	32.0 (376)	28.0 (93)	8.2 (16)
50+	18.4 (216)	8.4 (28)	5.7 (11)
Education			
No formal	4.1 (48)	6.0 (20)	11.3 (22)
Primary	24.0 (282)	19.3 (64)	39.2 (76)
Secondary	51.7 (608)	56.0 (186)	43.3 (84)
Tertiary	19.5 (229)	15.4 (51)	5.2 (10)
Other	0.7 (8)	3.3 (11)	1.0 (2)
Religion			
Christians	75.2 (884)	81.0 (269)	82.0 (159)
Muslims	17.3 (203)	11.1 (37)	17.0 (33)
Other	7.5 (88)	7.8 (26)	1.0 (2)
Residency			
Yaoundé	43.7 (514)	99.1 (329)	0
Douala	27.9 (328)	0	100.0 (194)
Other	28.3 (333)	0.9 (3)	0
Driver			
Professional	69.0 (811)	92.8 (308)	99.5 (193)
Non-professional	31.0 (364)	7.2 (24)	0.5 (1)
Vehicle type			
Cars/vans	39.6 (465)	8.1 (27)	0.5 (1)
Motorcycles	0.6 (7)	50.6 (168)	99.5 (193)
Trucks	25.5 (300)	0.3 (1)	0
Buses and licensed taxis	26.0 (306)	1.8 (6)	0
Clandestine taxi cars	8.3 (97)	39.2 (130)	0
Time			
Friday 09-12	5.0 (59)	0	0
Friday 22-24	7.7 (91)	34.9 (116)	35.1 (68)
Saturday 01-03	15.6 (183)	0	0
Saturday 09-11	27.1 (319)	33.4 (111)	33.5 (65)
Saturday 22-24	15.7 (185)	0	0
Sunday 09-12	28.8 (338)	31.6 (105)	31.4 (61)
Blood alcohol conc.			
<0.01%	84.4 (992)	29.8 (99)	92.3 (179)
0.01-0.050%	10.0 (118)	30.1 (100)	0.5 (1)
0.051-0.080	1.6 (19)	9.6 (32)	1.5 (3)
>0.08%	3.9 (46)	30.4 (101)	5.7 (11)

Table S2. Proportions of drivers with BAC >0.08% among specified characteristics groups

	Highways	Yaoundé town	Douala town
	% (n)	% (n)	% (n)
Gender			
Males	3.9 (46)	31.6 (101)	5.7 (11)
Females	0.0 (0)	0.0 (0)	–
Age (years)			
18-29	3.4 (4)	18.2 (10)	5.6 (5)
30-39	4.3 (20)	32.1 (50)	3.9 (3)
40-49	4.5 (17)	40.9 (38)	18.8 (3)
50+	2.3 (5)	10.7 (3)	0.0 (0)
Education			
No formal	0.0 (0)	40.0 (8)	0.0 (0)
Primary	3.9 (11)	20.3 (13)	6.6 (5)
Secondary	3.9 (24)	30.6 (57)	3.6 (3)
Tertiary	4.8 (11)	39.2 (20)	30.0 (3)
Other	0.0 (0)	27.3 (2)	0.0 (0)
Religion			
Christians	4.0 (35)	31.6 (85)	6.3 (10)
Muslims	2.0 (4)	18.9 (7)	0.0 (0)
Other	8.0 (7)	34.6 (9)	50.0 (1)
Residency			
Yaoundé	5.6 (29)	29.8 (98)	–
Douala	3.0 (10)	0.0 (0)	5.7 (11)
Other	2.1 (7)	100.0 (3)	–
Driver			
Professional	2.7 (22)	32.5 (100)	5.7 (11)
Non-professional	6.6 (24)	4.2 (1)	0.0 (0)
Vehicle type			
Cars/vans	5.2 (24)	7.4 (2)	0.0 (0)
Motorcycles	28.6 (2)	31.5 (53)	5.7 (11)
Trucks	4.3 (13)	0.0 (0)	–
Buses and licensed taxis	2.3 (7)	33.3 (2)	–
Clandestine taxi cars	0.0 (0)	33.8 (44)	–
Time			
Friday 09-12	5.1 (3)	–	–
Friday 22-24	4.4 (4)	25.9 (30)	5.9 (4)
Saturday 01-03	5.5 (10)	–	–
Saturday 09-11	3.1 (10)	25.2 (28)	1.5 (1)
Saturday 22-24	9.2 (17)	–	–
Sunday 09-12	0.6 (2)	41.0 (43)	9.8 (6)

Table S3. Highway group: Logistic regression analysis with BAC >0.08% as dependent variable. Crude odds ratios (OR) and adjusted odds ratios (aOR) are presented with 95% confidence intervals (95% CI) and p-values

Independent variable	Crude OR (95% CI)	p	Model 1	p	Model 2	p
			aOR (95% CI)		aOR (95% CI)	
Age (ref: 50+ years)	1					
Age 18-29 years	1. (0.4-5.6)	0.564	1.4 (0.4-5.9)	0.607		
Age 30-39 years	1.9 (0.7-5.1)	0.207	1.5 (0.5-4.2)	0.472		
Age 40-49 years	2.0 (0.7-5.5)	0.18	1.5 (0.5-4.3)	0.439		
Education (ref: tertiary)	1					
Primary	0.8 (0.3-1.9)	0.618	1.1 (0.4-3.0)	0.856		
Secondary	0.8 (0.4-1.7)	0.582	1.4 (0.6-3.2)	0.451		
None or other	0					
Religion (ref: Christian)						
Muslim	0.5 (0.2-1.4)	0.178	0.7 (0.2-2.0)	0.464		
Other	2.1 (0.9-4.9)	0.085	2.3 (0.9-5.7)	0.072		
Residency (ref: Yaoundé)	1					
Douala	0.5 (0.3-1.1)	0.086	0.6 (0.3-1.3)	0.198		
Other	0.4 (0.2-0.8)	0.017	0.5 (0.2-1.2)	0.118		
Professional driver	0.4 (0.2-0.7)	0.002	0.3 (0.09-0.8)	0.019	0.3 (0.09-0.8)	0.018
Vehicle (ref: car/van/etc)	1					
Motorcycles	7.4 (1.4-40.0)	0.021	14.6 (1.9-113.5)	0.01	14.6 (2.1-103.5)	0.007
Trucks	0.8 (0.4-1.7)	0.832	1.7 (0.5-5.6)	0.381	1.7 (0.6-5.3)	0.356
Buses and licensed taxis	0.4 (0.2-1.0)	0.053	1.2 (0.3-4.5)	0.794	1.0 (0.3-3.7)	0.976
Clandestine taxi cars	0					
Time (ref: Sunday 09-12)	1					
Friday 09-12	9.0 (1.5-55.1)	0.017	5.6 (0.9-35.5)	0.068	6.6 (1.1-40.7)	0.043
Friday 22-24	7.7 (1.4-42.9)	0.019	6.0 (1.0-34.6)	0.044	7.3 (1.3-41.1)	0.024
Saturday 01-03	9.7 (2.1-44.8)	0.004	9.7 (2.0-46.3)	0.005	9.4 (2.0-44.3)	0.005
Saturday 09-11	5.4 (1.2-25.0)	0.03	4.1 (0.9-19.1)	0.075	4.1 (0.9-19.2)	0.069
Saturday 22-24	17.0 (3.9-74.4)	<0.001	14.3 (3.2-65.2)	0.001	15.1 (3.4-67.2)	<0.001

Model 1 included all covariates, and Model 2 only statistically significant covariates from Model 1.

Table S4. Yaoundé group: Logistic regression analysis with BAC >0.08% as dependent variable

Independent variable ^a	Crude OR (95% CI)	p	Model 1	p	Model 2	p
			aOR (95% CI)		aOR (95% CI)	
Age (ref: 50+ years)	1					
Age 18-29 years	1.9 (0.5-7.4)	0.381	0.7 (0.2-3.5)	0.704		
Age 30-39 years	3.9 (1.1-13.6)	0.031	1.8 (0.5-7.2)	0.385		
Age 40-49 years	5.8 (1.6-20.4)	0.007	2.9 (0.7-11.7)	0.126		
Education (ref: tertiary)	1					
Primary	0.4 (0.2-0.9)	0.028	0.7 (0.3-1.9)	0.466		
Secondary	0.7 (0.4-1.3)	0.428	1.1 (0.5-2.3)	0.873		
Other	0.6 (0.1-2.5)	0.461	0.8 (0.2-3.8)	0.745		
None	1.0 (0.4-3.0)	0.951	1.4 (0.2-8.1)	0.716		
Religion (ref: Christian)						
Muslim	0.5 (0.2-1.2)	0.120	0.3 (0.1-0.9)	0.038	0.4 (0.1-0.9)	0.038
Other	1.1 (0.5-2.7)	0.753	0.5 (0.1-2.6)	0.439	0.9 (0.3-2.3)	0.787
Professional driver	11.1 (1.5-83.0)	0.019	9.7 (1.2-81.8)	0.036	13.1 (1.7-102.9)	0.014
Vehicle (ref: car/van/etc)	1					
Motorcycles	5.8 (1.3-25.2)	0.020	11.1 (2.3-53.0)	0.003	8.7 (1.9-39.6)	0.005
Trucks	-		-		-	
Buses and licensed taxis	6.3 (0.7-57.9)	0.107	6.9 (0.7-71.4)	0.107	5.1 (0.5-49.3)	0.155
Clandestine taxi cars	6.4 (1.4-28.2)	0.014	5.9 (1.3-26.6)	0.022	6.2 (1.4-27.9)	0.017
Time (ref: Sunday 09-12)	1					
Friday 22-24	0.5 (0.3-0.9)	0.018	0.6 (0.3-1.1)	0.116	0.5 (0.3-0.9)	0.016
Saturday 09-11	0.5 (0.3-0.9)	0.015	0.4 (0.2-0.8)	0.010	0.4 (0.2-0.7)	0.003

^aResidence was not included as covariate because only one driver lived outside Yaoundé. Model 1 included all covariates, and Model 2 only statistically significant covariates from Model 1.

Table S5. Douala group: Logistic regression analysis with BAC >0.08% as dependent variable

Independent variable ^a	Crude OR (95% CI)	p	Model 1	p
			aOR (95% CI)	
Age (ref: 40+ years)	1			
Age 18-29 years	0.5 (0.1-2.1)	0.325	0.4 (0.04-3.6)	0.399
Age 30-39 years	0.3 (0.06-1.7)	0.185	0.3 (0.05-1.7)	0.178
Education (ref: Sec/tert)	1			
Primary	1.0 (0.3-3.5)	0.959	2.0 (0.3-15.6)	0.499
None/other	-		-	
Religion (ref: Christian)	1			
Muslim/other	0.4 (0.05-.5)	0.439	0.5 (0.0-4.2)	0.496
Time (ref: Sunday 09-12)	1			
Friday 22-24	0.6 (0.2-2.1)	0.407	0.5 (0.1-2.0)	0.332
Saturday 09-11	0.1 (0.2-1.2)	0.076	0.1 (0.01-1.1)	0.056

^aResidence was not included as covariate because no driver lived outside Douala. Vehicle type and being professional driver were not included as all participants except one were motorcycle taxi riders and professional. Model 1 included all covariates.