Determinants of drink-driving and association between drink-driving and road traffic fatalities in Ghana

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ABSTRACT

Aim

The objective is to establish determinants of drink-driving and its association with traffic crashes in Ghana.

Methods

A multivariable logistic regression was used to establish significant determinants of drink-driving and a bivariate logistic regression to establish the association between drink–driving and road traffic crashes in Ghana.

Results

In total, 2,736 motorists were randomly stopped for breath testing of whom 8.7% tested positive for alcohol. Among the total participants, 5.5% exceeded the legal BAC limit of 0.08%. Formal education is associated with a reduced likelihood of drink-driving compared with drivers without formal education. The propensity to drink-drive is 1.8 times higher among illiterate drivers compared with drivers with basic education. Young adult drivers also recorded elevated likelihoods for driving under alcohol impairment compared with adult drivers. The odds of drink-driving among truck drivers is OR=1.81, (95% CI=1.16 to 2.82) and two wheeler riders is OR=1.41, (95% CI=0.47 to 4.28) compared with car drivers. Contrary to general perception, commercial car drivers have a significant reduced likelihood of 41%, OR=0.59, (95% CI=0.38 to 0.92) compared with the private car driver. Bivariate analysis conducted showed a significant association between the proportion of drivers exceeding the legal BAC limit and road traffic fatalities, $p<0.001$. The model predicts a 1% increase in the proportion of drivers exceeding the legal BAC to be associated with a 4% increase in road traffic fatalities, 95% CI= 3% to 5% and vice versa.

Conclusion

A positive and significant association between roadside alcohol prevalence and road traffic fatality has been established. Scaling up roadside breath test, determining standard drink and disseminating to the populace and formulating policies targeting the youth such as increasing minimum legal drinking age and reduced legal BAC limit for the youth and novice drivers might improve drink-driving related crashes in Ghana.

INTRODUCTION

Road traffic crashes (RTCs) are important global public health pandemic claiming about 1.3 million lives and injuring up to 70 million people annually(WHO, 2009, 2011). Current WHO statistics available show that a vast majority (80%) of the world's cars is owned by some 15% of the world's population located in North America, Japan, Australia and Western Europe, nevertheless, the burden of RTCs are disproportionately felt by less developing countries with lower vehicle per population because more than 85% of road traffic fatalities and 90% of disability adjusted lost years from road traffic injuries occur in developing countries(Peden et al., 2004).

Alcohol use is part of Ghanaian culture. Prior to the arrival of Western culture, Ghana was predominantly secular and alcohol was used by all communities for religious, medical and dietary purposes. Rites of passages like naming ceremony, initiation into adulthood and funerals were preceded by pouring of libation with alcohol. Thus in Ghana, alcohol is drunk in both moments of joy and grief. Alcoholic drinks on the Ghanaian market can be broadly categorized into two; recorded and unrecorded. Recorded alcoholic drinks are those that are legally sold and quality controlled. Production and consumption records are easily obtainable on these drinks. Unrecorded drinks on the other hand are either illegally sold or has no definitive standards such as alcohol content by volume, manufacture and expiry dates etc. (Lachenmeier, Taylor, & Rehm, 2011). Generally, the unrecorded drinks are produced in small local breweries and distilleries and are cheaper than the recorded drinks manufactured in modern breweries and distilleries. Many people tend to patronize the unrecorded drinks because of their cheap prices and as a way of promoting local Ghanaian industries and culture. Traditional raw material for alcoholic drinks production are cereal grains produced in the northern savanna part of Ghana whilst palm trees and sugar cane are grown in southern part (the forest belt) which are sometimes used in producing alcohol. Un-distilled drinks from raffia and oil palm are called palm wine whilst drinks obtained from grains; mainly (millet and maize) are called *pito*. The alcoholic content by volume of some local drinks such as *akpeteshie* and their derivatives can be as high as 70% (Akyeampong, 1996). N.B (*Akpeteshie* is a local gin obtained from distilling palm wine or sugar pulp). Consuming of over 600 ml of this local gin at a sitting could be fatal (Akyeampong, 1996; Asare Buadu, 2013). Consequently, prior to independence, production, sale and consumption of *akpeteshie* was proscribed in Ghana due to the apparent deleterious effects associated with its consumption (Akyeampong, 1996).

In recent times, locally produced gins are combined with roots, herbs and tree backs to produce concoctions collectively characterized in Ghanaian parlance as "*bitters*". "*Bitters*" are believed to be appetizers, aphrodisiacs and posses medicinal properties. Nicknames of the local gins and their derivative *bitters* such as "Kill me Quick", "Take me and Fly" and "V.C 10" suggest the potency and how quickly the drinks can make one drunk after consumption(Akyeampong, 1996). Unlike in the western world where people normally drink alcohol whilst taken their meals, Ghanaians have developed the culture of drinking alcohol before taking their meals. The practice of drinking alcohol into an empty stomach is a specter of getting intoxicated with small amount of alcohol. We are unsure about the extent alcohol use is affecting drivers' crash rate in Ghana. Nevertheless in countries where road safety research is in advanced stages, impaired driving, particularly, drink-driving has been identified as a major risk factor of road traffic crash frequencies and severity (Global Road Safety Partnership, 2007; Longo, Hunter, Lokan, White, & White, 2000; Wells & Macdonalds, 1999; WHO, 2009). Most countries which have prioritized alcohol research seem to have found a concurrent decline in drink-driving and its related road traffic injuries and fatalities. According to Chang et al., (2012), in the United States, alcohol related fatalities have significantly declined from 60% in 1982 to 40% in 2006 due to the effectiveness of countermeasures premised on deterrent laws. On the contrary, in some developing countries, no discernible pattern of alcohol-related research protocols has been established. The paucity of alcohol-related research in some developing countries particular in Africa has been reported by (Mock, Asiamah, & Amegashie, 2001; Mock, Asiamah, & Amegasie, 1998; Obot, 2000). Evidence of drug and alcohol impairments are only sought when crashes involve public figures (Owusu Achiaw & Donkor, 2007). There is however evidence suggesting frequent use of alcohol and other drug among adolescents in Ghana (Adu-Mireku, 2003; Doku, Koivusilta, & Rimpela, 2012), thus, suggesting the potential involvement of alcohol in traffic crashes. The extent to which alcohol use is translating into road traffic crashes is yet to be studied in greater detail in Ghana and Africa. This situation does not augur well for road safety in Ghana given the high rate that alcohol misuse can be implicated in road traffic crashes. The National Road Safety Commission (NRSC) of Ghana has set a target in the National Road Safety Strategy 2011-2015 (NRSS-III) aimed at reducing road traffic fatalities on a year-to-year basis to achieve a total of less than 1000 fatalities by the year 2015. In order to meet this target, there is the need to prioritize alcohol impairment research to establish key determinants of drink-driving and its relationship with traffic crashes and design interventions targeting these risk factors thereof. The objective of the study is to establish the determinants of roadside drink-driving prevalence and its association with road traffic injury severity in Ghana.

METHODOLOGY

The cross-sectional study design was used for the alcohol data collection. There was no prospective or retrospective follow-up of participant drivers on their drinking history. No identifiable information regarding the drivers' name, telephone and car numbers was collected. Nevertheless, some drivers who were sampled on one road or city were later surveyed on other locations. This was possible because there was a provision in the questionnaire asking whether drivers have been tested for alcohol over the past 12 months. In most cases, those who did test positive in the first instance tested negative in subsequent breathalyzer tests. This might be as a result of the message given after each participant had gone through the test that the police are going to be equipped with the breathalyzers after the preliminary nationwide survey, and will prosecute potential drunk-drivers.

Sampling technique Systematic random sampling was used in selecting candidate drivers in which every fifth vehicle was stopped for breath test and interview. In few cases, some fifth cars were allowed to pass when successive samples had been repetitively of one mode of vehicle in which case purposive sampling was used instead to cater for other modes which would have been otherwise underrepresented in the regular sampling frame. The time lapse in this sampling method allowed for the breathalyzer's recovery after been used on a previous participant thus reducing the amount of waiting time spent on participating drivers.

Sampled drivers were generally pulled-off the roadway in order to allow uninterrupted traffic flow at the study sites. A participation rate of 99.5% was achieved. A vast majority of the drivers were seeing the breathalyzers for the first time and were eager to test their BAC with the instrument given the background that they were not liable to prosecution even if they tested positive or exceeded the legal limit. Drivers were curious to know if they took alcohol the previous day, week or month for example, the machine could detect it. The 0.05% drivers who refused participation cited delay or fear of spread of communicable disease to them in spite of adequate introduction on the *modus operandi* of the breathalyzer test procedure and the importance of the test. Short questionnaires were also administered on the field to capture essential socio-demographic and driving characteristics deemed potential determinants of drink-driving on the field.

Participation

Participation in the research was voluntary and the research team employed approved international ethical procedures in the study to protect research participants from being prosecuted. The survey engaged police assistance in stopping and administering the Breath Alcohol Concentration (BrAC) test. The police were informed from the onset that drunken drivers would not be liable to prosecution since this study is purely for research and does not constitute their routine drink-driving enforcement duties. However, when a driver was excessively drunk, e.g., having BAC of 0.1% or above, the police advised such drivers to park their vehicles and rest till they regained their sobriety or an alternative driver was called upon to take over driving from the drunken driver (Mock, et al., 2001). Allowing over drunk drivers to continue driving will be unethical since this will put the drunk driver and other road users at risk of collision. A mouthpiece once administered to a driver was disposed off to prevent any mouth-to-mouth spread of contagious diseases.

The breathalyzer equipment (Alco-Sensor V-ASV)

Alcohol-Sensor V (ASV) was used for the study. This is an advanced portable, handheld, micro-processor driven breadth alcohol testing instrument manufactured by Intoximeters, Inc, U.S.A. This equipment has been approved by the National Highway Traffic Safety Administration (NHTSA) of the United States Department of Transportation (U.S. DOT) for evidential breath alcohol testing in the United States. Alco-Sensor V is the state-of-the-art breath alcohol testing equipment with high evidential grade accuracy. By evidential, we mean breath alcohol measured with the equipment (ASV) can be used for prosecution purposes at the law court.

The equipment has three detachable components used for three different tasks enumerated below;

Passive Cup: is used for screening participant (subjects) to determine whether the individual has detectable alcohol in their breath or not.

Mouthpieces: are disposable accessories used for measuring the breath alcohol of a subject who has previously been measured positive in a passive screening test.

Drink Sniffer Attachment: is used to determine whether a given liquid has alcohol in it or not. The drink sniffer attachment was not used in gathering data in this research.

Overview of running breathalyzer tests on a subject

A two-step stage was used in administering the breathalyzer test to participating drivers. The Alco-Sensor V (ASV) is designed to have an interactive user interface. Two testing modes were used for the breath alcohol test namely; passive and breath alcohol tests.

Passive test: This test was meant to screen drivers to determine their sobriety status. The breathalyzer indicates either positive or negative results. When an individual is tested positive, a second test, namely breath alcohol test is then carried out on the person.

Breath Alcohol Test: Breath alcohol Test was conducted on drivers who had already tested positive during the preliminary screening test to further determine whether their alcohol levels were lower or higher than the legal BAC limit of 0.08%. Disposable mouthpieces were used at this stage in order to prevent the potential mouth-to-mouth spread of any communicable diseases from one participant to another.

Study sites

Five major cities namely Accra, Kumasi, Sekondi-Takoradi, Tamale and Ho were the urban locations where the roadside breath tests occurred. Breath test also took place on the principal inter-urban highways. The roads selected fall under three categories namely; the National Roads, Inter-regional Roads and Regional roads. These road categories are the most travelled roads in the country and fairly representative of Ghana's road network. Arranged in descending order of traffic volume is the National, Inter-regional and Regional Highways. Existing road blocks, police check points, and toll booths were used as the study sites. In Ghana, permanent police check points are located about 100 km apart on all trunk roads. Depending on the number of accesses to the main road, temporary check points are erected at night to beef up security. These sites are well known to motorists and drivers normally slow down to undergo either routine traffic examinations by the police or pay their road toll charges which are manually operated.

At each location, three people apiece in a three-hour shift were assigned to be in charge of each direction of traffic flow. A team responsible for each direction constituted a policeman whose duty was to wave in selected drivers, an interviewer who administers questionnaires and a breathalyzer holder who measures breath samples of selected motorists with alco-meters. Few motorists filled in the questionnaires themselves whilst the vast majority was filled in by designated personnel from the research team. The police who assisted in the data collection were exclusively for the research as there were other police personnel officially assigned at most of the locations to see to the routine police checks. Since some of these routes could be very long- up to a 1000 kilometers long- road segments were divided into independent sections. For example, the Aflao-Elubo highway, (N1) is about 550 kilometers long and was sub-divided into four independent categories namely: Aflao-Accra, Accra-Cape Coast, Cape Coast-Takoradi and Takoradi-Elubo sections. Some other locations were Accra-Nkwakaw, Nkawkaw-Kumasi, Bunso-Koforidua, Yamoransa-Assin Fosu, Assin Fosu-Anwia Nkwanta, Tema-Akosombo, Ho-Anyirawase, Discove-Tarkwa, Tarkwa-Ayamfuri, Kumasi-Sunyani and Kumasi-Mampong-Atebubu. The rest were Kumasi-Techiman, and Techiman-Tamale. The random breath test studies were strategically located about mid-way of each section requiring about an hour's travel by car, the average time one standard drink will disappear from a consumer's blood.

Study period

The roadside breath test took place between November 2011 and March, 2012. The yuletide period between 23rd December, 2011 and 15th January, 2012 was however excluded because of the attendant excessive high drinking behaviour. Crash data for 2010, (most recent available data) was analyzed as surrogate crash data for settlements and road sections for which BrACs data were collected for the bivariate model. At each location, breath test occurred between 6:00 am and 10:00 pm usually not longer than 4 hours per urban location and 8 hours at inter-urban locations. The Inspector General of police from whom permission for police support was sort advised that the survey should be carried out between these hours of day (6:00 am and 10:00 pm) because most highway robberies and shooting crimes in Ghana occur deep in the night and the police could not vouch for the security of research team outside the recommended hours.

Conversion of BrAC to BAC

The Breath Alcohol Concentration measurements on the field with the alco-sensor V were converted into their equivalent Blood Alcohol Concentrations (BAC) using the converting factor of 1:2,300 (breath to blood ratio) (Cowan, Burris, Hughes, & Cunningham, 2010; Haffner, Graw, Dettling, Schmitt, & Schuff, 2003). Research has established that the level of blood alcohol concentration (BAC in milligrams alcohol per 100 ml blood) is 2,300 times higher than the level of breath alcohol concentration (BrAc in micrograms per 100 ml breath). The unit used in expressing BrAc (microgram) is smaller than the unit used in expressing BAC (1 milligram=1000 microgram). Therefore the conversion can be expressed as BAC=2.3xBrAC and by re-arrangement, BrAc=BAC/2.3 (University of Dundee, 2011). The BrAc to BAC conversion was necessary to enhance the understanding of the average reading populace particularly in Ghana.

Statistical analysis and crash data source

The data obtained were first stratified by different degrees of alcohol concentrations i.e. (and important determinants of drink-driving including age categories, educational background and marital status; day of week, vehicle types and journey types. The phase I analysis predominantly uses descriptive statistics to determine the magnitude of drink-driving among Ghanaian drivers and a multivariate logistic regression was used to establish significant predictors of drink-driving. The second phase of the analysis on the other hand, is based on a bivariate logistic regression to determine the impact of drink-driving on road traffic crash severity.

The crash dataset used was obtained from the Building & Road Research Institute's accident databank stored in a software called Micro-computer Accident Analysis Package (MAAP) developed by Transport Research Laboratory (TRL) of the UK. Personnel from the BRRI visit all the police stations in the country to extract accident records from police files unto a standard accident form also developed by TRL. Each form contains 78 fields which describe the crash scenario and victims involved in detail. Some of the attributes of the crash data include day and time of accidents, crash severity, number of persons and types of vehicles involved, and whether road users involved were under the influence of drug or alcohol. Eventhough the crash form provides portions for police to report on alcohol and drug use of road users, alcohol and drug information are always missing in the police records. This is why the use of surrogate estimate of drink-driving was considered. Data on the form are manually entered into the MAAP and can be queried to produce cross-tabulations to suit the research purpose.

Limitation of dataset: The dataset is one year behind time. Some levels of under-reporting regarding less severe accidents are inherent in the dataset (Salifu & Ackaah, 2009). Some drivers do not want to embroil themselves in court litigations after the traffic crash especially when the collision resulted in damaged only or minor injury. They prefer to settle their cases without involving the police or court. Such data are not captured in the dataset.

RESULTS

In total, 2,736 drivers were randomly stopped and their BrAC measured with the breathalyzer; Alco-sensor V. BrAc figures were converted to BAC using the principle of Henry's law based on the established partition ratio between the blood and breath alcohol concentration ratio of 2,300:1 in the UK (Cowan, et al., 2010; Haffner, et al., 2003; University of Dundee, 2011).

Among those drivers whose BrAC were tested, 8.7% had detectable alcohol in their breaths whilst 5.5% exceeded the legal alcohol BAC limit of 0.08% in the country.

Thus the pattern shows that, among drivers who tested positive for BAC, drivers were more likely to exceed the legal limit than to be below it. A stratified analysis shows that 64% of the drivers who tested positive for alcohol recorded BAC exceeding the legal BAC limit of 0.08%, 19% had BAC ranging between 0.05% and 0.08% whilst the remainder 17% had ingested alcohol ranging between 0.001% and 0.051%. For the category of drivers who were alcohol positive, the mean BAC was 0.136 (95% CI: 0.122 to 0.152). This implies that the tendency for drunken-drivers to exceed the legal BAC limit in Ghana is very high.

The male: female ratio for drivers sampled in the randomized roadside blood alcohol concentration test was 98%:2% respectively showing low female participation in driving in the country. It is worthy to note that among the 2% females who were captured in the survey, none of them had detectable alcohol in their breaths. It is plausible to postulate that the share of female in drink-driving might be negligible among women compared to men in Ghana at the moment. This may go a long way to explain the alarming disparity of the male: female distribution in the driver casualty ratio in Ghana with the predominance of males.

Drivers' knowledge of drink-driving law in Ghana

Of the drivers who were questioned, 97% answered in affirmative regarding their knowledge of the drink-driving law in the country whilst the remaining 3% said they do not know any legal drink-driving law in the country. Nevertheless, when drivers who said they knew the drink-driving regulation in the country were further asked to provide the legal alcohol limit of the country in figures or any volume of alcohol when drank by an average person will reach the limit, drivers could neither give definitive alcohol limit nor any quantity of a given drink when drank can reach the legal limits. Only less than 1% of drivers could hazard a numerical legal alcohol limit although majority of the answers were not accurate.

Police and drink-driving enforcement

Though the police are responsible for enforcing drink-driving law in the country, they are seemed to be ill-equipped to do meaningful enforcement as a vast majority (98%) of all the police stations visited did not have breathalyzers that were in good conditions and could be used immediately to test drivers for drink-driving. They depended so much on the hospitals for blood tests to determine the sobriety of a suspect. Drivers become suspects when they smell alcohol to a police officer. Consequently, when drivers were asked whether they have been tested on the road for alcohol over the past year or since they started driving, 96% said they have never been tested over the past year or all over the period they have been driving whilst 4% have ever been tested some of whom were tested during this research at a different location or on a different day.

Determinants of drink-driving among Ghanaian drivers

A multivariable logistic regression analyses in which drivers BAC levels was stratified into binary levels; (a) BAC above legal limit and (b) otherwise to determine which covariates are associated with drink-driving was carried out and the results displayed in Table 1. In the logistic regression, the variable vehicle type was categorized into five levels namely; bus, bicycle/motor cycles, cars (including taxis) and trucks. Other covariates and their respective levels were (1) drivers' educational level i.e. none, basic education, secondary school certificate qualification, and tertiary or higher qualification (2) drivers' age stratified into 18-29 year olds, 30-39 year olds, 40-49 year olds, 50-59 year olds and 60 or more years; (3) driver category i.e. private or commercial vehicle category; and (4) day of the week.

Driving trucks was significantly associated with impaired driving, p=0.009. The odds of being found drunk on the roadway is two times higher among truck drivers compared with car drivers, OR=1.8; (95% CI: 1.16 to 2.82). There was no significant differences between the likelihood of being drunk among two-wheeler riders (cyclists and motorcyclists), p=0.535 and bus drivers p=0.406 when compared with car drivers. Having a formal education is seen to be a significant predictor of lower propensity for drink-driving. Drivers without any formal education were associated with an elevated likelihood of drink-driving, p=0.012. Compared with drivers who has basic education, the odds of being drunk among drivers without any formal education was OR=1.8: (95% CI: 1.14 to 2.98). There appears to be a consistent similarity regarding the association among drivers with formal education and drink-driving. The odds of being found drunk among secondary school graduate and tertiary level graduate drivers were not significantly different p=0.692 and p=0.447 respectively compared with drivers with basic education.

As illustrated in Table 1, age of drivers was a significant predictor of drink-driving in Ghana. By comparing the youngest drivers' age groups, i.e. the (18-29) and 30-39 year-olds with the 40-49 year-olds yielded significantly higher likelihood of drink-driving OR=1.6 and OR=2.0 respectively. The 50-59 year-olds were also at 3.2 chance of drink-driving compared with the 40-49 year olds, p<0.001. The likelihood for the aged to drink-drive was not however significantly different from the referent age group the (40-49 year-olds) p=0.817.

INSERT TABLE 1 ABOUT HERE

According to Table 1, with the exception of Wednesday, there appears to be a general reduced likelihood to drink-drive on most days of the week compared with Saturday. The logistic regression model predicts a significantly reduced propensity of being drunk among drivers whose BrACs were measured on Thursdays p<0.001 and Fridays p=0.008 when compared with Saturdays drivers. The apparent reduction of the likelihood of being drunk was not however statistically significant for Sunday p=0.244 and Monday p=0.154 when compared with the referent day (Saturday). Also, the apparent higher odds for being observed as an intoxicated driver on the roadway on Wednesday was not statistically different from Saturday p=0.158.

Finally, commercial car drivers had 41% lower rate of drink-driving compared with private car drivers p=0.021.

Relationship between drink-driving and road traffic crashes

Crash data for 2010 was analyzed for settlements and road sections for which randomize breath test data were collected. In total, 5,896 independent road traffic crashes occurred in the study areas out of which 956(16.2%) were fatal, 1,253(21.3%) were serious injuries requiring at least a 24-hour hospitalization, 1,983(33.6%) were minor injuries which required only out-patient treatment whilst 1,704(28.9%) resulted in property damage only crashes. In the bivariate logistic regression analysis, the damage only crashes were omitted from the data set. Dichotomous dependent variable- accident severity- (fatal versus non-fatal) was created and used in the bivariate model whilst the proportion of drivers exceeding the legal BAC was left as a continuous covariate.

INSERT TABLE 2 ABOUT HERE

As illustrated in Table 2, there was a significant relationship between the proportion of drivers exceeding the legal BAC and road traffic fatalities p<0.001. On the whole, a 1% increase in the proportion of drivers exceeding the legal BAC is associated with a corresponding 4% increase in road traffic fatality, 95% CI=3% to 5%. This implies that, a reduction in the proportion of drivers exceeding the legal alcohol limit by 1% or 2% might respectively lead to a 4% or an 8% reduction of road traffic fatality in Ghana.

DISCUSSION

The roadside prevalence of driving whilst intoxicated above the legal limit in Ghana is 5.5%. Drink-driving above a legal limit of 0.08% of this magnitude is very high because in countries where similar roadside breathalyzer studies have been conducted showed prevalence rates between 2.9% and 3.7% of drink-driving in the US (Chou et al., 2005; Chou et al., 2008) and 2% in Thailand (Ingsathit et al., 2009). The roadside prevalent rate of 3 to 4% in the US resulted in about 40% of alcohol related fatality in that country. The magnitude of the impact of drink-driving traffic crashes in Ghana could be potentially higher given that only limited nighttime data could be collected due to security reasons. Mock et al., (2001) reported an impaired driving rate of 7% in Ghana which is statistically not different from the current prevalence rate. The main reason why drink-driving prevalent rate has remained higher over time in Ghana is due to weak enforcement. Countries which have registered significant declines in drink-driving have achieved this through consistent enforcement of the drink-driving traffic law. The success of the enforcement is premised on deterrence theory which fundamental attributes are certainty of apprehension, swiftness and severity of punishment (Freeman & Watson, 2006, 2009; Watling & Freeman, 2011; Watling, Palk, Freeman, & Davey, 2010). It was determined in the study that over 95% of drivers have never been tested for alcohol on the roadway during their lifetime driving suggesting low level of enforcement. Our study predicts a potential reduction of 4% in traffic fatality associated with a 1% decline in the proportion of drink-driving on the roadway. Thus, to achieve declines in drink-driving related traffic crashes and fatalities, it is recommended to increase random breath testing on the roadways.

Again, given the lower level of enforcement in Ghana, an 8.7% detection of drivers who tested positive appears to be somewhat lower than expected. Nevertheless, we do not have enough information to confirm whether a twenty-four hour data collection would have created a different picture regarding drink-driving prevalence.

The order of drivers who tested positive reveals the tendency of heavy drinking. Three possible explanations might account for this distribution. Due to the low level of drink-driving enforcement, there is little fear of apprehension for driving under the influence of alcohol. Secondly, many people drink alcohol before their meals in this country. This is captured in a popular saying in *Twi* (one of the widely spoken dialects in Ghana) "*yɛ bu didi*". These drinks are normally local liquors or concoctions of herbs and local alcohol collectively called "bitters" in the Ghanaian parlance. Apart from being appetizers, "bitters" are believed to possess aphrodisiac qualities. These local liquors are unrecorded drinks with very high alcohol concentrations. Consumption of about 650 ml of these local liquors at one sitting have resulted in death of consumers(Akyeampong, 1996; Asare Buadu, 2013). Drinking of liquors with higher alcoholic content into empty stomachs might result in rapid absorption into the blood stream and engender rapid drunkenness. This is why an overwhelming 64% of drivers who tested positive of alcohol exceeded the legal alcohol limit. Again, unlike the developed countries, Ghana has not defined standard drinks on the bottles of alcoholic beverages and drivers who have the urge to drink and drive anyway do not know the number of standard drinks that will reach the legal BAC and for that matter permissible for drivers. For instance, when drivers who tested positive were asked about the number of drinks they had consumed on their drinking sprees in Ghana, they answered by saying they drank two calabashes of palm wine or two pots of *pito* or three bottles of beer. These units of measure are too arbitrary and therefore unscientific to be relied upon for determining the amount of alcohol an individual has consumed. Conversely, in the industrialized countries, people count the amount of alcohol they have consumed in terms of standard drinks. It is therefore recommended that Ghana should define what a standard drink is in their context and enforce that standard drink labels are embossed on each kind of drink on the market.

Formal education is associated with a significantly lower likelihood of drink-driving compared with drivers without any formal education. The likelihood of observing a drunken driver is 1.8 times higher among drivers with no formal education compared drivers with basic education. The incidence of drink-driving was however not statistically distinguishable from one formal educational level from another. It appears drivers with formal education qualification have a better understanding and appreciation of the impairing effects of alcohol and the concomitant higher accident tendencies of drunken drivers thus engendering their higher sobriety levels compared with drivers without formal education (Abikoye, 2012). It is recommended that drivers should be given periodic education on the legal BAC limit and the harmful effects of drink-driving in the media.

Among the vehicle types observed, only bus drivers recorded lower likelihood of drink-driving compared with car drivers. Two wheeler riders and truck drivers had elevated drink-driving rates relative to car drivers. This might be one of the reasons accounting for truck drivers' over involvement in road traffic crashes and fatalities. Contrary to the general perception that commercial drivers have higher propensity to drink and drive in Ghana, private car drivers are the worst offenders in impair driving. It was evident in our results that the youngest age categories of drivers, the 18 – 29 and the 30-39 year olds, have elevated propensity of drink-driving compared with the 40 – 49 year olds. In corroboration with findings from the advanced countries, episodic drinking is associated with the youth and has resulted in their over involvement in alcohol related crashes (Clarke, Ward, & Truman, 2005). The advanced countries have therefore outlined strategies aimed at combating high rates of drink-driving in general and for the young drivers in particular. One of such policies is increasing the minimum legal drinking age (MLDA) for drinking alcohol in the country until age 21 or above. Research have found the MLDA to be a successful programme in reducing young drivers' alcohol related accident rates significantly (Hingson, Heeren, Levenson, Jamanka, & Voas, 2002; McCartt, Hellinga, & Kirley, 2010; Tomas Dols et al., 2010; Wrechsler, Lee, Nelson, & Lee, 2003; Zarajsek & Shope, 2006). This policy has been proven to have a positive effect on drink-driving and its related traffic crashes in two dimensions. Firstly, according to (Begg & Langley, 2001) many young people mature from their youthful impulsivity after age 26 and if by this time they have never tasted alcohol, may end up not drinking alcohol at all throughout their life time. Secondly, the turbulent adolescent behaviour might pass before the drinking law permits them to taste alcohol. Crossing over adolescence and young adulthood without drinking alcohol will ultimately prevent potential alcohol related traffic crashes among this age group.

Conclusion

A significant association between roadside alcohol prevalence and road traffic fatalities has been established. In order to reduce drink-driving prevalence and its attendant road traffic crashes, it is recommended that the country should scale-up randomized roadside breath testing programme, define standard drink and disseminate this to the populace through intensive media education, increase the minimum legal drinking age to 21 years, and reduce legal BAC limit for the youth to 0.05% in respect of the current legal limit of 0.08%. The prevailing legal BAC of 0.08% is on the higher side, therefore as a longtime measure, the country should consider reviewing this level downwards due to the apparent impairment at the 0.08% level.

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LIST OF TABLES

Table 1: Predictors of drink-driving in Ghana

	Logit	Odds	P - value	95% CI OR
Vehicle Type				
Bus	-0.192	0.825	0.406	0.52 to1.30
Two wheelers	0.350	1.419	0.535	0.47 to 4.28
Cars	-	1	-	-
Truck	0.593	1.810	0.009	1.16 to 2.82
Educational Level				
None	0.612	1.845	0.012	1.14 to 2.98
Basic	-	1	-	-
Secondary	0.080	1.083	0.692	0.73 to 1.61
Tertiary	-0.231	0.793	0.447	0.44 to 1.44
Age				
18 - 29	0.465	1.591	0.024	1.06 to 2.38
30 - 39	0.681	1.977	0.002	1.28 to 3.04
40 - 49	-	1	-	-
50 - 59	1.170	3.222	0.000	1.93 to 5.39
60 - 72	0.148	1.159	0.817	0.33 to 4.05
Day of Week				
Saturday	-	1	-	-
Sunday	-0.314	0.730	0.244	0.43 to 1.24
Monday	-0.444	0.642	0.154	0.35 to 1.18
Tuesday	-0.727	0.483	0.065	0.22 to 1.05
Wednesday	0.318	1.375	0.158	0.88 to 2.14
Thursday	-0.803	0.448	0.000	0.29 to 0.70
Friday	-0.536	0.585	0.008	0.39 to 0.87
Driver Category				
Private	-	1	-	-
Commercial	-0.527	0.590	0.021	0.38 to 0.92
Constant	-2.234		0.000	

Table 2: Association between drink-driving and road traffic injuries

Accident Severity	Logit	Odds Ratio	P - value	95% CI of logit
Percentage of Drivers exceeding legal BAC Level	0.0369	1.038	0.000	0.026 - 0.048
Constant	-2.064			-2.211 to - 1.916