

## Original Paper

# A Study of Blood Alcohol Levels Among Drunk Drivers in Mauritius and Literature Review

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### ABSTRACT

This study was conducted to assess the trends of drunk driving offences in Mauritius, and the relationship with motor vehicle accidents. It is well known that driving under the influence of alcohol increases the risk of motor vehicle accidents. Data obtained from police road safety unit (1999–2001) and forensic science laboratory (1992–2000) were analyzed. More than 85% of drunk drivers had BAC above 0.08%. In 2003, the permissible blood alcohol concentration (BAC) limit had been lowered from 0.08 to 0.05. This article provides a summary of the evidence regarding the benefits of reducing the blood alcohol concentration (BAC) for driving. Although moderate alcohol intake (20 grams ethanol; two standard drinks or less) may not violate BAC laws, it still carries significant risk of motor-vehicle accidents.

**Key Words:** Drunk driving; Blood alcohol concentration (BAC); Motor vehicle accidents

### Introduction

Various kinds of alcoholic beverages are consumed by many people all over the world. The World Health Organization (WHO) estimates that about 2 billion people consume alcoholic drinks, which can have immediate and long-term consequences on health and social life, leading to 1.8 million deaths a year, which represents 3.2% of all deaths worldwide.<sup>1</sup> However, inadvertent or deliberate injuries resulting from abuse of alcohol alone, account for about one-third of the 1.8 million deaths. It is well recognized that irresponsible drinking patterns along

with certain behaviours, such as vehicular driving, may lead to a range of harmful outcomes.<sup>2</sup> Depending on the amount of alcohol consumed, and the pattern of drinking, alcohol consumption can lead to drunkenness and alcohol dependence. Driving under the influence of alcohol is one of the most important factors increasing the risk of severe motor vehicle accidents. Many countries agree on the need to establish regulations that prohibit impaired driving. The setting of maximum allowable BAC levels by law enforcement agencies is one of the important tools for preventing motor vehicle accidents. The offence of driving with a BAC above legal limit is known as “*driving under the influence*”, “*driving while intoxicated*”, or “*drunken driving*”.

The issue of drinking and driving first attracted attention in the late 19th and early 20th centuries, as population and automobile ownership increased.<sup>3,4</sup> Early laws drafted against drunk-driving reflected the nature of transport at that time, comprising carriages, horses and cattle, and steam engines. They were later amended to include motor vehicles as these became more common.<sup>5</sup>

This study was undertaken to observe the quantity of alcohol consumption among drunken drivers, and compare the data with similar studies in other countries, and to assess the relationship of blood alcohol concentration (BAC) with motor vehicle accidents.

**Blood concentration limits around the world:** *Blood alcohol concentration or Blood alcohol content (BAC)*

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is the concentration of alcohol in blood measured as a percentage by mass, or mass per volume, or a combination. For example, a BAC of 0.5% means 5 grams of alcohol per 1000 grams of an individual's blood, or 0.5 grams of alcohol per 100 millilitres of blood. The earliest signs of alcohol intoxication can generally be detected on physical examination at BAC as low as 0.03, when driving skills begin to deteriorate. Unless a person has developed high tolerance, a BAC of 0.20 represents very serious intoxication, and 0.35 represents potentially fatal poisoning.

The important effects of alcohol in relation to BAC are as follows<sup>6</sup>:

- 0.03–0.05: Impairment of driving and similar skills.
- 0.05–0.10: Reduced inhibition, talkativeness, laughter and slight sensory disturbance.
- 0.10–0.15: Incoordination, unsteadiness and slurred speech.
- 0.15–0.20: Obvious drunkenness, nausea and ataxia.
- 0.20–0.30: Vomiting, loss of equilibrium, marked disturbances in vision and stupor.
- 0.30–0.35: Increasing dissociation, danger of aspirating vomit, stupor and probably coma.
- Over 0.35: Coma and possible death.

For purposes of law enforcement, BAC is used to define intoxication, and provides a rough measure of impairment. Most countries disallow operation of motor vehicles and heavy machinery above permissible limit of BAC. The alcohol level at which a person is considered to be legally impaired varies in different countries.<sup>7</sup> **Table 1** lists legal blood alcohol concentration limits of some countries.

The fixation of these limits is based upon clinical research showing impairment of driving-related abilities at certain BAC levels. The number of drinks consumed is a very poor measure of intoxication, because of variations in physiology, and individual tolerance to alcohol. It is generally accepted that the consumption of two standard drinks (containing a total of 20 grams) of alcohol will increase the average individual's BAC by about 0.05%, but it varies according to body weight, gender and body fat percentage. When the BAC reaches a level of 0.15%, the person is usually considered to be under the influence of alcohol, but no dogmatic opinion can be furnished on this finding alone because of adaptation to chronic alcohol use. Norway was the first country in the world to introduce an act in 1936, which prohibited drunken driving.<sup>8</sup>

**Problems relating to drunken driving:** Drinking and driving is a major problem all over the world, even in Islamic countries where alcohol is officially banned. It is well known that driving under the influence of alcohol increases the risk of motor-vehicle accidents. Several studies have shown that the severity of injury following the road traffic accidents increases as blood alcohol concentration increases.<sup>9,10</sup> Shih et al correlated alcohol intoxication with severity of injury, morbidity, and mortality in drivers involved in motor vehicle accidents in a prospective cohort study in Taiwan.<sup>11</sup> The intoxicated drivers (BAC more than 0.05%) had a significantly higher injury severity score (ISS) and lower Glasgow Coma Score, indicating that alcohol is one of the significant predictors for morbidity. A study conducted in British Columbia (BC) in the year 2002 showed that the risk of

**Table 1** Worldwide Blood Alcohol Concentration (BAC) permissible limits

BAC (%)	Countries
0.08	Canada, Malta, Mexico, New Zealand, Singapore, United Kingdom, United States
0.05	Argentina, Australia, Austria, Belgium, Bulgaria, Croatia, Denmark, Finland, France, Germany, Greece, Iceland, Israel, Italy, Luxembourg, Macedonia, Mauritius, Netherlands, Peru, Portugal, Serbia, Slovenia, Spain, South Africa, Switzerland, Thailand, Turkey
0.04	Lithuania
0.03	Georgia, India, Japan, Moldova, Turkmenistan, Uruguay
0.02	Estonia, Hungary, Norway, Poland, Russia, Sweden
0.00 (zero tolerance)	Bangladesh, Brazil, Croatia, Czech Republic, Hungary, Malaysia, Romania, Saudi Arabia, Slovakia, UAE

fatal collision, the risk of injury collision, and also importantly, the risk of vehicle damage severity was increased for those drinking and driving as compared with those driving sober.<sup>12</sup> In Italy, higher BAC ( $\geq 0.05\%$ ) was associated with specific characteristics of crash, as well as increased risk of higher trauma severity as compared to BAC less than 0.05%.<sup>13</sup> In 2005, approximately 39% of all traffic fatalities in the United States were alcohol related.<sup>14</sup> Haffner et al reviewed a total of 625 accidents caused by drivers who were under the influence of alcohol in Germany, and compared the effect of alcohol intoxication on the driving performance with regard to both the quantity and quality, and found that the maximum number of accidents was in the group with BAC more than 0.20%.<sup>15</sup>

### Materials and Methods

The methodology used for this study comprised literature review and data obtained from the *Traffic Management and Road Safety Unit (TMRSU)*. The samples of this study include 3120 cases of drunk drivers exceeding the legal limit during roadside breathalyzer tests in the years from 1999 to 2001, and 4935 cases of drivers whose blood samples were received by the forensic science laboratory for estimation of blood alcohol concentration (BAC) during the period 1992 to 2000. These data were analyzed to understand the trends of such cases in Mauritius, and compared with similar studies conducted in other parts of the world.

### Results and Discussion

Analysis of data obtained from *Police Road Safety Unit*<sup>16</sup> shows about 2.4-fold increase in the number of drunk-drivers exceeding the legal limit during roadside breathalyzer tests in 2001 as compared to 1999 (**Table 2**).

Distribution of cases as per BAC level showed that majority of drivers (more than 85%) had BAC above permissible limit, i.e., 0.08% (**Table 3**).

**Table 2** Year-wise distribution of drunk-driver cases

Year	Number of Cases
1999	647
2000	966
2001	1507
Total	3120

**Table 3** Distribution of cases at different Blood Alcohol Concentration (BAC), 1992–2000

BAC (%)	Number of Cases	Percentage
0.00–0.05	341	6.90
0.05–0.08	378	7.65
0.08–0.10	204	4.13
0.10–0.20	2081	42.13
0.20–0.30	1633	33.06
Over 0.30	298	6.03
Total	4935	100

Drunk driving is still a serious global problem, even though various designated programs have been implemented to curb the menace. A study of 50 years of accumulated evidence showed a direct relationship between increasing blood alcohol concentration (BAC) in drivers and increasing risk of a motor vehicle crash.<sup>17</sup> Alcohol impairs driving skills by its effects on the central nervous system, acting like a general anaesthetic. A study by Borkenstein et al indicated that drivers with BAC of 0.05 to 0.09 per cent were twice as likely to crash as drivers with a zero BAC, and drivers with BAC from 0.10 to 0.14 per cent were ten times as likely to have a fatal crash.<sup>18</sup> Fell and Voas studied the effectiveness of reducing blood alcohol concentration (BAC) limits for driving.<sup>19</sup> In fact, many studies indicate that lowering of permissible blood alcohol concentration (BAC) limit from 0.10 to 0.08, 0.08 to 0.05, and lowering the BAC limit among adolescents to 0.02 or less reduces alcohol related fatalities. In the United States, lowering the BAC limit from 0.10 to 0.08 has resulted in 5–16% reductions in alcohol-related crashes, fatalities, and injuries.<sup>18</sup> In Japan, lowering the legal BAC limit from 0.05 to 0.03 led to fewer alcohol-related crashes, deaths and injuries.<sup>20</sup>

In Mauritius, which is located in the Indian Ocean with an area of 1865 sq km, prior to the year 2003, drivers were legally permitted to drive if their BAC was less than 0.08. An analysis of 9 years data (1992–2000) obtained from the forensic science laboratory showed that more than 85% of drivers had BAC level above the legal limit. In 2003, the **Road Traffic Act** was amended, which lowered the permissible blood alcohol concentration (BAC) for drivers from 0.08 to 0.05, introduced breath alcohol testing using modern roadside as well as evidential breathalyzers, and made provision for tougher fines coupled with imprisonment for drunk driving offences.<sup>21</sup> Breath test is generally used only as a preliminary test for the purpose of getting an idea as to whether the propor-

tion of alcohol in a person's breath or blood is likely to exceed the prescribed limit. The prescribed limit of breath alcohol content (BrAC) is 23 micrograms per 100 millilitres. To carry out this test, the subject will have to blow into the disposable plastic mouth-piece fitted to the *Lion Intoxilyzer 8000*. When the result is above 23 micrograms, the subject will be required to provide a specimen of blood or urine for a laboratory test.

The role of the doctor in drunk driving offences varies according to the law in place in a particular country. In countries where there is no statutory limit for blood or breath, a doctor will have to carry out clinical testing of the driver to decide whether his ability to control the vehicle is impaired, while if a statutory limit is defined by law, blood samples must be taken by a doctor by venepuncture for laboratory analysis.

**Limitations of this study:** Since there is no official data available on alcohol related crashes in Mauritius, this study could not determine the effectiveness of reducing blood alcohol concentration (BAC) among vehicle drivers.

### Conclusion

This critical review supports the concept of lowering permissible BAC limits for driving to minimal levels, in order to reduce alcohol-related motor vehicle accidents. The lay public should be educated that although moderate alcohol intake (20 grams ethanol, two standard drinks or less) may not violate BAC laws, it still carries a significant risk of motor-vehicle accidents. Further studies are required to observe the effectiveness of reducing blood alcohol concentration (BAC) among drivers in relation to motor vehicle accidents and the severity of injury. Current BAC laws in some countries need re-evaluation.

### REFERENCES

1. World Health Organization. International guide for monitoring alcohol consumption and related harm. 2002. Geneva: WHO.
2. Grant M, Litvak J. Drinking Patterns and Their Consequences. 1998. Washington, DC: Taylor & Francis.
3. Jones AW. Physiological aspects of breath alcohol measurement. *Alcohol Drugs Driving* 1990; 6(2): 1–25.
4. Moskowitz H, Burns M, Fiorentino D, Smiley A, Zador P. Driver Characteristics and Impairment at Various BACs. 2000. Washington, DC: National Highway Traffic Safety Administration.
5. International Center For Alcohol. Blood alcohol concentration limits worldwide. 2000. [http://www.icap.org/portals/0/download/all\\_pdfs/ICAP\\_Reports\\_English/report11.pdf](http://www.icap.org/portals/0/download/all_pdfs/ICAP_Reports_English/report11.pdf).
6. Knight B. Alcohol. In: Simpson's Forensic Medicine. 11<sup>th</sup> edn, 1991. Arnold: 176–179.
7. Wikipedia. Blood alcohol content. [http://en.wikipedia.org/wiki/Blood\\_alcohol\\_content](http://en.wikipedia.org/wiki/Blood_alcohol_content).
8. Khiabani HZ, Christophersen AS, Morland J. Routines upon suspicion of driving under influence. *Tidsskr Nor Laegeforen* 2007; 127(5): 618–619.
9. Wyss D, Rivier L, Gujer HR, Paccaud F, Magnenat P, Yersin B. Characteristics of 167 consecutive traffic accident victims with special reference to alcohol intoxication: A prospective emergency room study. *Soz Praventivmed* 1990; 35(3): 108–116.
10. Haffner HT, Erath D, Graw M. Changes in the spectrum of alcohol-induced traffic accidents in relation to blood alcohol level. *Blutalkohol* 1996; 33(2): 78–83.
11. Shih HC, Hu SC, Yang CC, Ko TJ, Wu JK, Lee CH. Alcohol intoxication increases morbidity in drivers involved in motor vehicle accidents. *Am J Emerg Med* 2003; 21(2): 91–94.
12. Desapriya E, Pike I, Raina P. Severity of alcohol-related motor vehicle crashes in British Columbia: Case control study. *Int J Injury Control Safety Promotion* 2006; 13(2): 89–94.
13. Fabbri A, Marchesini G, Morselli-Labate AM, Rossi F, Cicognani A, Dente M, et al. Positive blood alcohol concentration and road accidents. A prospective study in an Italian emergency department. *Emerg Med J* 2002; 19(3): 210–214.
14. Centers for Disease Control and Prevention (CDC). Alcohol and other drug use among victims of motor vehicle crashes - West Virginia, 2004–2005. *MMWR Morb Mortal Wkly Rep* 2006; 55(48): 1293–1296.
15. Haffner HT, Erath D, Graw M. Changes in the spectrum of alcohol-induced traffic accidents in relation to blood alcohol level. *Blutalkohol* 1996; 33(2): 78–83.
16. Road Accident Mauritius. Traffic Management and Road Safety Unit (TMRSU). <http://www.gov.mu/portal/goc/mpi/file/ram.pdf>.
17. Council on Scientific Affairs. Alcohol and the driver. *JAMA* 1996; 255(4): 522–527.
18. Desapriya EB, Iwase N, Brussoni M, Shimizu S, Belayneh TN. International policies on alcohol impaired driving: Are legal blood alcohol concentration (BAC) limits in motorized countries compatible with the scientific evidence? *Nihon Arukoru Yakubutsu Igakkai Zasshi* 2003; 38(2): 83–102.

19. Fell JC, Voas RB. The effectiveness of reducing illegal blood alcohol concentration (BAC) limits for driving: Evidence for lowering the limit to 0.05 BAC. *J Safety Res* 2006; 37(3): 233–243.
20. Desapriya EB, Shimizu S, Pike I, Smith D. Impact of lowering the legal BAC limit to 0.03 on teenage drinking and driving related crashes in Japan. *Nihon Arukoru Yakubutsu Igakkai Zasshi* 2006; 41(6): 513–527.
21. Road Traffic (Amendment) Act 2003. Traffic Management and Road Safety Unit, Republic of Mauritius. [www.gov.mu/portal/sites/legaldb/files/ncsa.pdf](http://www.gov.mu/portal/sites/legaldb/files/ncsa.pdf).