

# Statistical analysis of driving under the influence of alcohol in Chongqing district in China

Yidong Li<sup>1</sup>, Jing Ding<sup>1</sup>, Yaoyu Du<sup>2</sup>, Wenwen Liu<sup>1</sup>, Chenbo Dong<sup>3</sup> and Zhong Zhang<sup>1\*</sup>

<sup>1</sup> Chongqing Institute of Forensic Science, Chongqing 400021, China;

<sup>2</sup> Department of Acupuncture and Moxibustion. Hospital of Traditional Chinese Medicine. BeiBei District. Chongqing 400700, China;

<sup>3</sup> Civil and Environmental Engineering, Rice University, Houston, TX, 77096, U.S.A.

\*Corresponding Author: E-mail: dongdongdong555@sina.com; Tel: +86-23-63751658.

**Abstract:** We analyzed 11846 driving violations blood alcohol content (BAC) cases (>0.05 mg/mL) under influence of alcohol (DUIA) from 2011 to 2012 in Chongqing. We also assessed the impact of the other factors including types of motor vehicle, gender influence on BAC. The results indicated that the traffic injuries by DUIA in Chongqing have been effectively prevented.

Published by [www.inter-use.com](http://www.inter-use.com). Available online April 25, 2015, Vol. 3 Issue 3 Page 41-44.

**Keywords:** Toxicology analyses, DUIA, BAC, Statistical analysis, Chongqing

## 1. Introduction

Forensic analytics is a very complicated analysis which needs to collect many information using different types of assays [1-3]. Alcohol is a regular examination and used in compulsory checking.

Chongqing is one of direct controlled municipalities in China with a population of 28.5 million (population density 278/km<sup>2</sup>) in 2010 and 3.55 million civil motor vehicles in 2011. Due to highly increased amount of vehicles as well as the change of people's lifestyle, a high prevalence of traffic offence was induced by the driving under influence of alcohol (DUIA) [4-6].

DUIA is a social issue, which should arouse the public and government concern on driving safety due to its induction of great financial loss and casualties. Several studies have been carried out to investigate blood alcohol content (BAC) of drivers in Wuhan, Shanghai [7-12]. However, these reports were not up to date and sample size is not large enough to reflect tendency change of "driving after drinking" since May, 2011 According to law on Road Traffic Safety (2011 amendment) in People's Republic of China. There are two provisions for examination of BAC of driver in China, 0.20 mg/mL and 0.80 mg/mL, respectively. A driver in a motor vehicle with a BAC between 0.20

mg/mL and 0.80 mg/mL commits a civil offense, and such behavior is defined as "driving after drinking". A driver in a motor vehicle with a BAC above 0.80 mg/mL commits a criminal offense, and such behavior is defined as "drunk driving".

In this study, we performed comprehensive statistical analysis on 11846 cases of BAC>0.05 mg/mL in the years of 2011 and 2012 in Chongqing, which may provide some information for monitoring DUIA in public as well as promoting Chinese government to undertake some appropriate prevention actions.

## 2. Materials and Methods

### 2.1 Study population

The study population consisted of 11846 drivers which were identified as DUIA by Chongqing Institute of Forensic Science, including 5025 cases in 2011, 6821 cases in 2012.

### 2.2 Ethanol analysis

The ethanol test was conducted according to GA/T 842-2009. The blood samples were collected from drivers who were suspected driving after drinking. Two sets of about 4 mL blood sample taken from the

suspects were placed in two 5 mL glass vacuum blood collection tubes containing trisodium citrate as anticoagulation (one tube as the testing sample, another tube as the backup sample).

Analysis of ethanol in 0.5 mL of the blood (from the testing sample) with 0.1 mL tert-butanol as the internal standard was performed by a headspace gas chromatography with a flame ionization detector. Each determination was done in duplicate, and data is expressed as mean value.

### 2.3 Data analysis

The database is created with Excel 2007. The cases of drivers with DUIA are classified by month, BAC components, arrest way, region distribution. The data were compared and analyzed.

## 3. Results and Discussion

### 3.1 DUIA month distribution and analysis

The drivers with DUIA month distribution are shown in Fig 1. From January 2011 to April 2011, the DUIA cases were just around 100. However, the DUIA cases increased dramatically since May, and it reached 718 in December. The possible reason may be as following: according to Amendment (VIII) to the Criminal Law of the People's Republic of China (executed in May, 2011) Article 133A “Whoever races a motor vehicle on a road with execrable circumstances or drives a motor vehicle on a road while intoxicated shall be sentenced to criminal detention and a fine”, the DUIA become a major criminal offense instead of a civil offense. Patrol police groups in different areas of Chongqing carried out campaigns to this issue. It was found that DUIA occurred frequently in Chongqing.

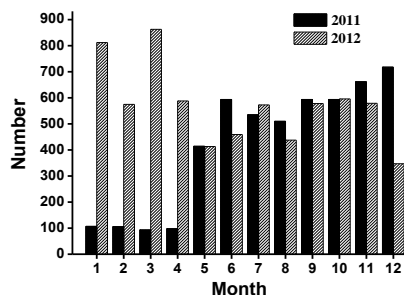


Fig.1. The drivers with DUIA month distribution of Chongqing City in 2011 and in 2012

In the first quarter of 2012 during the vacation, DUIA cases continue increasing to above 800, in February cases decreased which could be attributed to less days in February compared with other months. After the first quarter, the DUIA cases maintained 450-600, and in December these cases reduced below 400, which indicate that excitement of law, publicity and climate play important role in reduction of DUIA behavior.

### 3.2 BAC distribution and comparison analysis

The statistical analysis results of BAC are presented on Fig 2, which indicate that for almost all the suspected “drunk drivers”, their ethanol test were positive. In years between 2011 and 2012, the cases with BAC below 0.20 mg/mL and cases with BAC between 0.20 and 0.79 mg/mL were quite similar. However, for the cases with BAC above 0.80 mg/mL, they increased significantly from 3878 cases in 2011 to 5757 cases in 2012. Strengthen law enforcement and publicity led to the increased report “drunk driving” cases. Additionally, the increased numbers of motor vehicles in Chongqing, urban motorization degree as well as economic activities increasing by year could also result in increased “drunk driving” cases. Further, the increased “drunk driving” cases may also correlate with retest of fast alcometer.

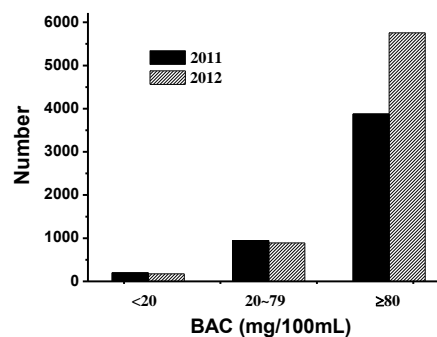


Fig.2. The BAC composition distribution of drivers with DUIA

For all the BAC positive cases, the average BAC in 2011 was 1.24 mg/mL, which was 1.55 times of BAC standard (BAC above 0.80 mg/mL) for “drunk driving”. Additionally, the average BAC in 2012 was 1.374 mg/mL, which was 1.72 times of BAC standard (BAC above 0.80 mg/mL) for “drunk driving”. The highest BAC values are 4.712 mg/mL and 5.387 mg/mL for 2012 and 2011, respectively. These two cases are found in suspected “drunk driving” drivers, which disagree with previous reports that lethal dose of BAC was 4

mg/mL, demonstrating that the alcohol resistance ability of individual and species could be significant different.

3.3 Arrest way compression and analysis

Fig 3 describes the arrest way distribution for DUIA. Arrested drives with DUIA in 2011 were 44.3%. Specially, the drivers arrested due to accidents were 54.3%, drivers arrested others (disorderly, dispute) were 1.3%. In 2012, the percentage of drivers with DUIA arrested increased to 55.8%, among these, the drivers arrested due of accidents were 42.7%, drivers arrested with other conditions (disorderly, dispute) were 1.5%. The reduced percentage of drivers arrested due to accidents could be attributed to strengthen law enforcement.

Fatal traffic accidents are main cause of global accident death. Previous report indicated that although the DUIA cases increased in 2012, the accidents are almost the same. In addition, the death in accidents decreased from 847 in 2011 to 782 in 2012, illustrating that strengthen law enforcement could effectively inhibit fatal road traffic injuries. Further, based on specific traffic condition in Chongqing (i.e. mountain road, complex terrain), the government could enhance road construction, improve road condition, raise public traffic safety awareness.

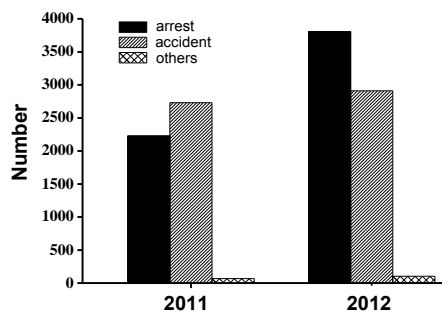


Fig.3. The arrest way distribution of drivers with DUIA

3.4 Comparison and analysis of BAC in urban district and suburban district

Chongqing is composed of 42 districts, including 10 urban districts, Yuzhong, Nanan, Jiangbei, Shapingbei, Yubei, Beibei, Banan, Dadukou, Gaoxin, Newnorth, and other suburban districts. It could be observed that “drunk driving” cases increased in 2012 compared with the previous year, in both urban district and suburban

district, especially for urban districts (Table 1). However, the cases with BAC below 0.20 mg/mL and cases with BAC between 0.20 and 0.79 mg/mL were quite similar. Ethanol components in suspected DUIA drivers are different. In 2011, “driving after drinking” cases are higher in suburban districts compared with those in urban districts, and “drunk drinking” cases in urban and suburban districts are similar. In 2012, both “driving after drinking” and “drunk drinking” cases in suburban districts are lesser than urban districts. Although Chongqing has 820 square kilometers of land, most areas are suburban districts, populations are focused in urban districts, and thus more DUIA are recorded on urban districts. Besides, in urban districts, more patrol police groups are involved for monitoring “driving after drinking” and “drunk drinking”, and they are stricter to civil or criminal offense behavior. The roads in urban districts are more concentrated than suburban districts, which make the DUIA behavior is easier to be monitored. Additionally, cases with BAC below 0.20 mg/mL in suburban districts are much higher than in urban districts. Although they are not civil offense, there are still DUIA and the potential risk may induce disasters. The government should enhance publicity and education in suburban districts, raise public safety driving awareness, make more people realize that “drunk drinking” is a criminal offense for which should be avoided.

Table 1. Comparison and analysis of BAC values of drivers with DUIA in urban district and suburban district

BAC (mg/100 mL)	Urban district		Suburban district	
	2011	2012	2011	2012
<20	67	61	132	113
20-79	410	457	538	433
≥80	1940	3306	1938	2451
Total	2417	3824	2608	2997

4. Conclusions

In this study, we compared and analyzed suspected “drunk drivers”, behavior of Chongqing in the year 2011 and 2012. Our analysis results indicated that when “drunk driving” is identified as a criminal offense, cases of DUIA in Chongqing increased initially, then reached plateau and finally decreased. Additionally, in 2012, the “drunk driving” cases increased compared with the case in 2011 of Chongqing, especially for urban districts. However the cases of DUIA did not change much in these two years. Further, due to strengthen law

enforcement, in 2012, the percentage of drivers with DUIA arrested due to violation of law increased, while the percentage of drivers with DUIA arrested due to accidents decreased, corresponding with deceased accidental death, suggesting that the traffic injuries could be effectively controlled and prevented. In summary, we compared and analyzed DUIA cases in Chongqing from 2011 to 2012. Analysis of other factors including types of motor vehicle, gender influence on BAC, as well as correlation between BAC and offences revealed the distribution and leading factors for the increasing of DUIA driving offence in Chongqing City.

## References

- [1] Zhu Q, Liu M, Han WQ, Li PL, Wang ZC, Li NJ. Over expression of HIF Prolyl-Hydroxylase-2 transgene in the renal medulla induced a salt-sensitive hypertension. *J Cell Mol Med.* 2012; 16:2701-2707.
- [2] Guo H, Zhang P, Wang JW, Zheng J. Determination of amitraz and its metabolites in whole blood using solid-phase extraction and liquid chromatography–tandem mass spectrometry. *J Chromatogr B.* 2014; 951: 89–95.
- [3] Yu ZQ, Kabashima T, Tang CH, Shibata T, Kitazato K, Kobayashi N, Lee MK, Kai M. Selective and facile assay of human immunodeficiency virus protease activity by a novel fluorogenic reaction. *Anal Biochem.* 2010; 397, 197-201.
- [4] Reasons for the 2005 road-traffic accidents in China. Year book of China transportation & communications. Beijing. Press by China Trans & Communi. 2006; 629-631.
- [5] Duan LL, Wu CM, Deng X. Road traffic injuries in China: 2006-2008. *Chin. J. Pub. Health and Prev. Med.* 2010; 21:3 10-13.
- [6] Zhang W, Zhao J, Yu J. The determination on the effects of alcohol and other relative factors for drivers killed in road-traffic crashes in Shenyang. *Chin J Foren Sci Med.* 2007; 22(2):37-123.
- [7] Chen C, Zhuo XY, Shen BH. A statistics of alcoholic driving in Pudong district of Shanghai. *Chin J Foren Sci.* 2010; 1:37-39.
- [8] Wan ZY, Yang CP. The BAC analysis of alcoholic driving arrested in traffic accidents during 2005 and 2011. *Chin J Pub Health and Prev Med.* 2013; 24(2):108-109.
- [9] Jones AW, Holmgren P. Comparison of blood-ethanol concentration in deaths attributed to acute alcohol poisoning and chronic alcoholism. *J Foren Sci.* 2003; 48:874–879.
- [10] Klaassen CD. Casarett and Doull's toxicology the basic science of poisons sixth edition. Kansas. Press by McGraw–Hill. 2001; 893- 894.
- [11] WHO. Road Safety is no Accident. A brochure for World Health Day 7 April 2004. <http://www.who.int/world/health/day>.
- [12] Sun XC, Li WB, Li QJ, Li SQ, Zhang M, Xian XH, Qi J, Chen WN, Liu M. Spantide inhibits up-regulation of NOS in the pericentral canal region of the spinal cord in the rat formalin test. *Chinese Journal of Pathophysiology.* 2005; 21:2422-2426.