

## Diary

### 17 – 21 September 2018

25th ITS World Congress  
Copenhagen, Denmark  
<https://itsworldcongress.com/>

### 19 – 22 September 2018

15<sup>th</sup> Romanian National Congress of Roads and Bridges  
Lasi, Romania  
<http://www.apdp.ro/en/>

### 26 – 29 September 2018

Global NCAP World Congress  
Delhi, India  
<http://www.globalncap.org/global-ncap-host-first-world-congress-delhi-september-2018/>

### 3 – 5 October 2018

Australasian Road Safety Conference  
Sydney, Australia  
<http://australasianroadsafetyconference.com.au/>

### 8 – 12 October 2018

Walk21  
Bogotá, Colombia  
<https://www.walk21.com/>

### 15 – 17 October 2018

6<sup>th</sup> International conference on driver distraction and inattention  
Gothenburg, Sweden  
<http://ddi2018.org/>

### 29 – 30 October 2018

20<sup>th</sup> International Conference on Road Traffic Safety and Public Transport Vehicles  
Paris, France  
<https://www.waset.org/conference/2018/10/paris/ICRTSPTV/home>

### 5 – 7 November 2018

Safety 2018 World Conference  
Bangkok, Thailand  
<http://www.worldsafety2018.org/>

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# Peer Reviewed Papers

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## Original Road Safety Research

### Recording of alcohol in official crash statistics: underreporting and procedures to improve statistics

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### Key Findings

- Official statistics on alcohol-related road casualties are often misleading due to underreporting.
- Improvements are needed to reach more accurate and reliable statistics on drink driving and this study makes recommendations to achieve this.
- Harmonized definitions are the necessary basis for improvements.
- All countries that use only police statistics should find methods to correct underreporting of alcohol-related crashes and casualties.

## Abstract

Worldwide 1.25 million people die in road crashes every year and it is widely recognized that drink driving is an important risk-increasing factor. Official statistics of alcohol-related crashes are likely to underestimate alcohol-related crashes and casualties, because official statistics are affected by underreporting. This study aims to obtain a good insight into the definitions, legislations and reporting procedures of alcohol-related road casualties to reach an accurate estimate of the drink driving problem and recommendations on how to improve the reliability and comparability of official statistics. A total of 45 countries, represented by road safety experts, responded to an online questionnaire. The questionnaire consisted of questions divided into four main categories: drink driving legislation, definitions of alcohol-related road casualties, recording methods, quality of official statistics and experts' best estimates. A weighted average of 21.8% alcohol-related road deaths is found in official statistics in the group of 45 countries and this proportion remains constant between 2000 and 2010. There are first signals that the proportion in 2015 is lower than in the period 2000-2010. If the proportion of 21.8% applies worldwide and is based on 1.25 million road fatalities per year, the annual number of alcohol-related road deaths will be around 273 000. However, this number is an underestimate of the real problem because strong indications of underreporting of alcohol-related crashes in official crash statistics are found. Most countries (89%) still base their official data upon only one single data source and in most cases (87.5%) these are the police records for which this study found evident shortcomings. Furthermore, countries use different definitions which makes international comparison difficult.

## Keywords

Alcohol, drink driving, casualties, statistics, underreporting

## Introduction

The World Health Organization (2015) reports that worldwide there are 1.25 million road deaths occur per year and WHO concludes that this number has not change much since 2007. One important road safety issue is drink driving and it is well documented that drink driving increases risks (Keall et al. 2004; Blomberg et al. 2005; Hels et al. 2011). National official percentages of alcohol-related road fatalities vary widely between 2% and 38% of all road traffic fatalities (WHO, 2013; WHO, 2015). Many studies suggest that the official numbers of alcohol-related road casualties are probably not reliable due to the problem of general underreporting of road crashes (Derrick and Mak, 2007; ETSC, 2010; IRTAD, 2011), and, more specifically, due to underreporting of alcohol-related road casualties (Assum and Sørensen, 2010; COWI et al., 2014). In the present study we describe how countries arrive at their national drink driving statistics and how some countries focus on methods to counter the problem of underreporting to improve the official numbers on alcohol-related road casualties so as to present a realistic estimate of alcohol-related crashes.

## Underreporting

Underreporting of alcohol-related road crash casualties in official crash statistics is a widespread phenomenon and has several causes. First of all, not all countries systematically test blood alcohol concentration (BAC) of all road users involved in road crashes and in some countries legislation does not allow post mortem testing. Sometimes police officers decide not to make an alcohol test from piety to those left behind. Furthermore, data collection is sometimes associated with a lot of (paper)work, is seen as just an administrative burden and is therefore not carried out (IRTAD, 2011). In addition, recordings of alcohol test-results sometimes get lost in the process of registration (Derrick and Mak, 2007) and police officers at the scene of

the road crash have a tendency to underestimate high BAC (Gundy and Verschuur, 1986) and may therefore decide not to test for alcohol. Finally, it can not be excluded in some countries that political or religious reasons prevent a proper registration of alcohol-related crashes.

To overcome the problem of underreporting of alcohol-related road crashes in the police registration, countries use other sources such as hospital data on road crash casualties to supplement the police data (IRTAD, 2011). For a better understanding of both the injury severity and the total number of alcohol-related road casualties, the use of hospital data in addition to police data is very important and contributes to better international comparisons (IRTAD, 2011).

In addition to the data on alcohol-related crashes surrogate sources can be used for better estimates of real numbers of alcohol-related fatalities and injuries. For example, a previous study on the effects of different scenario's on alcohol interlock programmes in the European Union (COWI et al., 2014) concludes that an estimated 20-28% (25% average) of all road fatalities in Europe were related to alcohol use, whereas the official statistics for the same group of countries suggest an average of 12.9%.

## Defining an Alcohol-Related Crash

Another problem concerns the definitions of alcohol-related road casualties used in the registration methods and their differences between countries. These differences complicate meaningful international comparison of official data on alcohol-related road crash casualties. In order to harmonize the recording of alcohol-related fatalities, the European SafetyNet project (2008) recommended the following definition for an alcohol-related fatality: "Any death occurring within 30 days as a result of a fatal road crash in

which any active participant was found with a blood alcohol concentration level above the legal limit". The choice of 30 days is based on the international definition of a road crash fatality (UNECE, 2009; IRTAD, 2012; WHO, 2013). However, the definition does not account for pedestrians and cyclists as active participant above the legal limit, since most countries have no legal limit on BAC for these groups. Therefore the absence of these road users in the definition of an alcohol-related fatality also contributes to the underestimation of drink driving fatalities in road traffic.

## Methods

As described above, the problem of underreporting in alcohol-related crash statistics and the difficulties of making meaningful international comparisons on drink-driving data are well-known issues. In order to arrive at reliable and accurate numbers on alcohol-related road casualties worldwide the main contributors to underreporting have to be unmasked first. Therefore, the main objectives of this study were to identify critical elements that cause underreporting and, secondly, to identify existing methods that could be used to counter underreporting and improve the reliability and the comparability of the official crash statistics on drink driving. This was done by distributing an online questionnaire among a large number of countries that included questions on their recording methods, data sources, definitions and current legislations.

## Respondents

This study was part of the work programme of the International Traffic Safety Data and Analysis Group (IRTAD, 2018). With the help of the secretariats of the IRTAD Group and the Ibero American Road Safety Observatory (OISEVI) respondents from 54 countries were selected. From these 54 representatives a total of 45 countries filled out the questionnaire. Most respondents were representatives of the IRTAD group (see Table 1). IRTAD is a group of road safety specialists with a focus on collecting and analysing road safety data. IRTAD has more than 70 members from almost 40 different countries. IRTAD works under the umbrella of the International Transport Forum ITF. ITF is politically autonomous and is administratively integrated with the OECD in Paris.

**Table 1. Responses of countries by organisation membership in percentages**

	Response		No response		Total
<b>IRTAD (34)</b>	34	100%	0	0%	63%
<b>OISEVI (16)</b>	8	50%	8	50%	30%
<b>ICAP (4)</b>	3	75%	1	25%	7%
<b>Total</b>	45	83.3%	9	16.7%	100%

OISEVI could be considered as a daughter of IRTAD. OISEVI is, like IRTAD, a network of road safety experts (in Latin America) and a database. Twenty countries are

member of OISEVI (19 from Latin America plus Spain). IRTAD hosts the OISEVI database. ICAP (International Center for Alcohol Policies) is an organisation set up by the beer, wine and spirit producers. I ran several programmes to reduce drinking and driving. The organisation has changed its name in IARD (International Alliance for Responsible Drinking).

The country representatives are all road traffic (safety) experts: 38% of which work for national research institutes, a quarter for the national road safety authority and approximately 20% work for the Ministry of Transport. The majority of respondents are researchers or statisticians (44%) and managers or directors (36%).

## Procedure

The country representatives were asked to participate in this study by an invitation letter which contained a web link to the online questionnaire. The initial questionnaire was pre-tested with the help of five road safety experts from the IRTAD network who did not participate in the final questionnaire. Based on their remarks some questions were added and some were reformulated. The first group of respondents that were approached are IRTAD members whose responses were collected between March and June 2014. The second group of respondents are members of OISEVI and are from Spanish speaking countries in Latin America. Therefore the questionnaire was translated into Spanish. These respondents were approached in mid-April 2014. A third group of respondents consisted of representatives from six countries participating in a project of the International Center for Alcohol Policies (ICAP). Two of these countries, Colombia and Mexico, are also members of the OISEVI group. In fall 2014 and autumn 2015 some countries were once more approached via e-mail for some additional follow-up questions regarding their responses and to enquire about additional methods used to improve drink driving data. In February 2017, those respondents who reported on their countries' national statistics in the initial questionnaire were sent a request to share their official statistics on alcohol-related casualties for the year 2015.

## Questionnaire

The online questionnaire was developed and distributed by using an online questionnaire application LimeSurvey (v2.05). The questionnaire (see Annex B in IRTAD, 2018) included four main topics:

- General background information on the respondent
- Legislation on BAC, definitions of alcoholrelated road casualties, and official casualty data.
  - Definitions used as a basis for the official data on alcohol-related road fatalities and serious road injuries.
  - Definitions of road fatalities and serious road injuries attributable to drink driving.
  - Unit of measurement for the legal BAC limit.
  - Existence of differentiated legal limits for the

- general driving population and other driver groups such as novice or professional drivers.
- Changes in national legislation regarding drinking and driving in the period 2000 to 2010.
- Official statistics on the number of road fatalities and serious road injuries related to alcohol in 2000, 2005 and 2010, thus covering a time period of ten years. It was a predetermined choice not to ask for official data on more recent years since often these numbers are not yet (completely) available.
- Method of recording alcohol-related crashes by police and medical institutions
  - Procedures used to produce police reports on road crashes.
  - Conditions and protocol for carrying out alcohol tests on the scene of the crash.
  - Conditions and protocol for carrying out alcohol tests at hospitals.
  - Availability of standard tests.
  - Process for registering results of alcohol tests.
  - Linkage procedure to link hospital and police data.
- Quality of the data and the respondent's expert estimate on alcohol-related road casualties
  - Existence of procedures to link and combine police data and hospital data on serious road injuries to correct for underreporting.
  - Conditions for post-mortem testing.
  - Expert's best estimate of the proportion of road traffic deaths and serious road injuries attributable to drink driving.
  - Expert's comments on differences between the reported official data and their personal best estimate.
  - Drug-related fatalities and injuries with a distinction between illicit and prescribed drugs.

The questionnaire mainly consists of closed questions, mostly with more than one possible answer. The researchers checked responses (with information from other sources) and corrected, if needed, together with the respondents. Data imputation for missing data was not needed.

## Results

### Legislation

Nearly all representatives (96%) reported to have a legal alcohol limit in their country. These legal limits vary between 0.0 g/l and 0.8 g/l for the general driving population. Countries use different units of measurement for BAC in their legislation on drink driving. Of the 45 respondents, 22 (49%) reported to have a lower legal limit

for young or novice drivers, 23 (51%) reported to have a lower legal limit for professional drivers and of the 45 representatives, 19 (42%) reported to have lower legal limits for both young or novice drivers and professional drivers. However, countries use different definitions for a professional driver and for a young/novice driver. Regarding the legal BAC limit, we found a trend towards stricter legislation on drink driving. Twelve of the 45 countries (27%) lowered their legal BAC limits for the general driving population and 11 countries (24%) introduced or lowered BAC limits for the young novice drivers and the professional drivers.

### Definitions

Another finding was that different definitions of alcohol-related road fatalities and serious road injuries were reported by the 45 respondents. The majority of the countries (62.2%) define an alcohol-related fatality as "any death occurring within 30 days as a result of a fatal road crash in which any active participant was found with a blood alcohol level above the legal limit." The United States is the only country that does not use 'any active participant above the legal limit' in their definition, but only includes drivers (of motorized vehicles) and motorcyclists. This country does not have legal limits on alcohol for pedestrians and cyclists and the SafetyNet definition would therefore not apply for these groups. A minority of the countries (26.7%) use other definitions which in most cases do not include a time period and 11.1% do not have any definition on alcohol-related road fatalities at all.

There is no generally accepted definition of alcohol-related serious road injuries. This study distinguishes between a so-called complete and an incomplete definition. The complete definition includes both a definition on serious road injuries and on whether or not the crash is alcohol-related. 24.4% of the countries are found to use this 'complete definition', but these definitions still vary considerably. 11.1% have an 'incomplete definition' because they do not specify the severity of an injury (severe or slight) and the majority (64.5% countries) do not have any definition at all.

### Official Statistics

Data was collected for 2000, 2005 and 2010. Of 45 countries 37 (82%) were able to provide official information on alcohol-related road fatalities (Figure 1) and 25 (56%) for alcohol-related serious injuries (Figure 2). Looking at the development over the years 2000-2010, 16 countries have an increased proportion of alcohol-related fatalities (see Figure 1). In 2010, the proportion of alcohol-related fatalities ranged from approximately 5% to 35% and in 10 countries more than 30% of road fatalities were alcohol-related. In general, the proportion of alcohol-related fatalities in official statistics has remained stable over the years. The weighted average in 2000 was 21.95% and in 2010 this remained on the same level with a weighted average of 21.8%. If we project this proportion on the annual number of 1.25 million road fatalities worldwide, the number of alcohol-related deaths is around 273 000 worldwide.

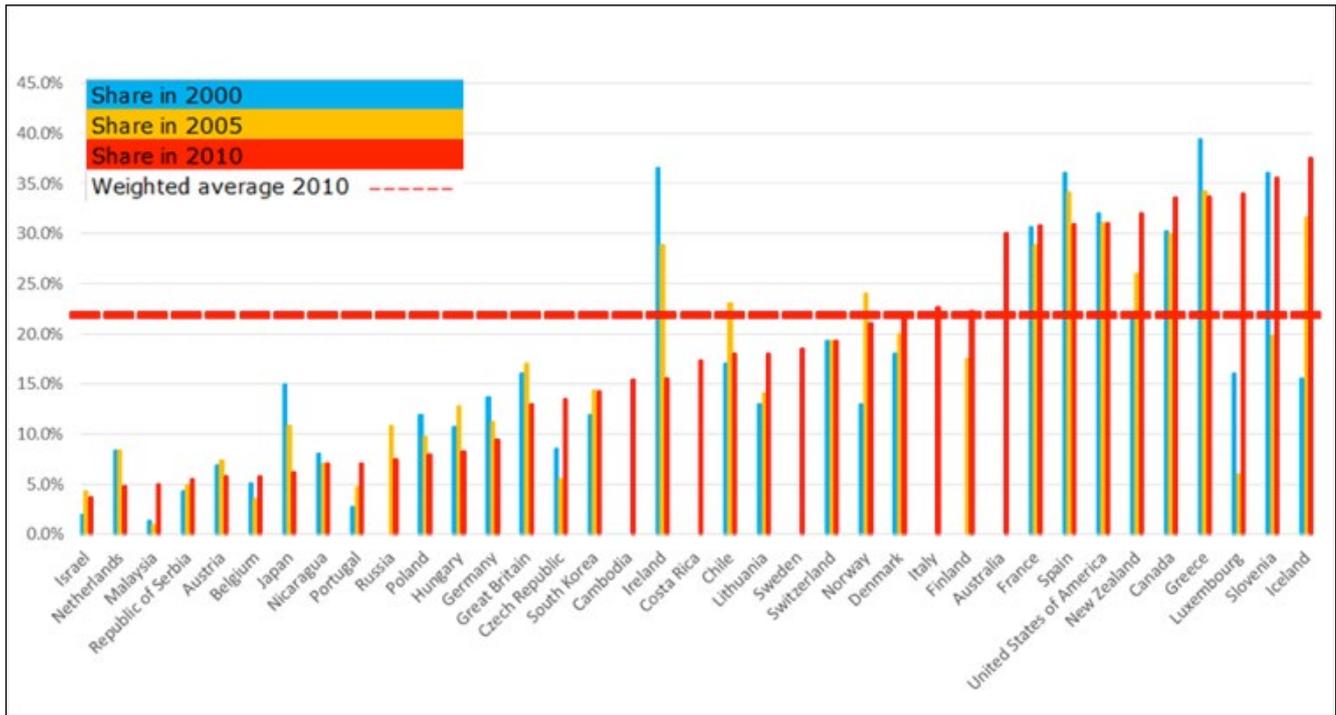


Figure 1. Proportion of alcohol-related road fatalities in 2000, 2005 and 2010 from official statistics

As expected the proportion of alcohol-related serious injuries is lower than the proportion of alcohol-related fatalities because of the higher risk of being involved in a fatal crash due to drink driving. The average proportion (mean) remained quite stable between 2000 (12.3%) and 2010 (11.3%). The highest proportion of alcohol-related serious road injuries for 2010 are found in New Zealand (23%) and Greece (23%) and the lowest proportion is reported in Japan (1.6%), see Figure 2.

Because legal alcohol limits differ between countries, alcohol-related casualties (defined as above a legal limit) will be derived using different ‘base lines’ (for example in UK alcohol-related casualties starts from a legal limit of 0.8 g/l and in Hungary from 0.0 g/l). This complicates international comparisons. Furthermore, many countries apply specific (lower) limits for professional drivers and for young/novice drivers.

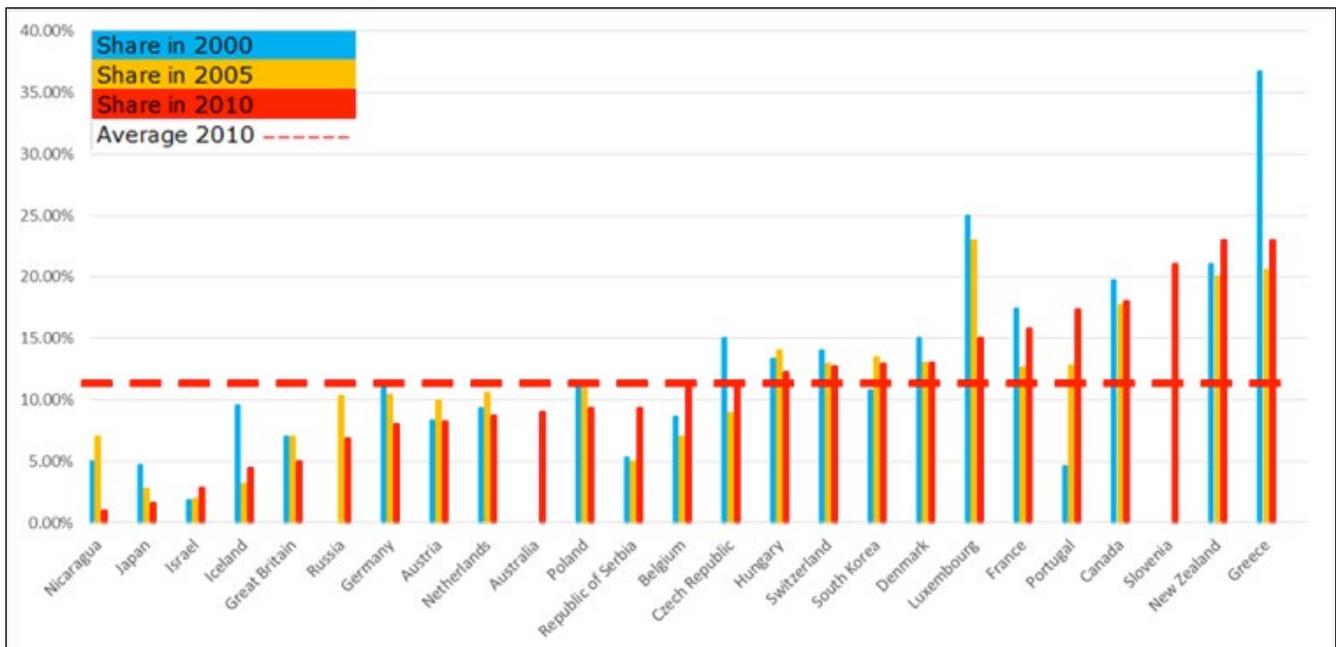


Figure 2. Share of alcohol-related serious road injuries in 2000, 2005 and 2010 from official statistics

Early 2017 another request was made to the respondents from 45 countries asking about alcohol-related casualties in 2015. The new information they provided was not fully comparable with info from earlier years (2000, 2005 and 2010), but it suggests a lower proportion of fatally injured casualties than in the earlier years, but no change for serious injuries.

## Data Collection Methods and Sources

The vast majority of countries use police records as their primary data source for statistics of alcohol-related fatalities (80%) and serious road injuries (87.5%). Only six countries make use of another data source in addition to the police records such as hospital data, insurance data and forensic records. However, only in three of these six (Russia, the United States and Sweden) two types of data (police and other) are reported.

An important reason for the police force to carry out an alcohol test is their suspicion of alcohol consumption above a legal limit among the road users involved in a crash. On the other hand, lack of suspicion is the main reason for the police not to carry out an alcohol test. In more than one-third (38%) of the countries alcohol tests are not performed at a later point in time if testing at the scene of the crash is not possible. If tests are carried out later, in most cases this is done in a medical institution. However, in only four countries (Argentina, Cambodia, Russia and Serbia) the official data is based on hospital data in addition to police records. Another method to limit underreporting is post-mortem testing. In 32 countries (71%) legislation allows post-mortem tests on alcohol consumption, but in 10 of these countries post mortem tests are not always carried out because of various reasons (permission of the relatives is needed, test is performed only upon request of the prosecutor, and family concerns).

## Experts' Best Estimate

In addition to the official data on alcohol-related serious road injuries and fatalities the respondents were asked for their own (experts') best estimate on the proportion of alcohol-related fatalities in their country. Eighteen of the 45 country respondents (40%) indicate that the official data on alcohol-related road casualties is the best estimate. Great Britain, The Netherlands, Serbia, Russia and Switzerland make a best estimate which is higher than the official data of their country. Two respondents (4.4%) make a personal best estimate that is actually lower than the official figure on alcohol-related road casualties (Chile and Nicaragua). Unfortunately, the largest proportion of respondents (44%) either do not have official data or a best estimate, therefore making a comparison between the two impossible. More respondents provide best estimates on fatalities than on serious injuries, which is in line with the general availability of data.

## Methods for Adjusting the Official Number of Alcohol-Related Road Casualties for Underreporting

Only a very limited number of countries (for example Canada, France, the Netherlands, UK, USA) are aware of the problem of underreporting of alcohol-related crashes and have developed methodologies to adjust official numbers (IRTAD, 2017). These methods differ for road fatalities and serious road injuries, and the methodologies are country-specific so they also differ between these five countries. With regard to the improvement of the estimate on alcohol-related road fatalities, methods range from strict quality control procedures for recording by the police (France; ONISR, 2012), the use of witness statements and police officers' indication on alcohol use at the scene, imputation techniques (The United States; Klein, 1986; Rubin, Schafer & Subramanian, 1998 and the United Kingdom; DfT, 1989), or using the development for alcohol use among serious road injuries to estimate the number of alcohol-related road fatalities (The Netherlands; Houwing et al., 2014).

Methods applied to estimate the number of serious road injuries vary between the use of in-depth studies in hospitals (Isalberti et al., 2011), combining the trend of alcohol use in traffic with information on risks of serious injury for various BAC levels (The Netherlands; Houwing et al., 2014), using the trend for fatal injuries to estimate the number of alcohol-related serious road injuries (The United Kingdom; DfT, 1989) and using a surrogate measure such as including serious injuries in single-vehicle crashes that occurred at night (Traffic Injury Research Foundation of Canada, 2010).

## Discussion

The WHO (2013) found a wide range of proportions of alcohol-related road fatalities among countries (between 2% and 38%), which is confirmed in this study with proportions of officially reported alcohol-related fatalities ranging from 5% to 35%.

Based on official statistics of countries that responded to our survey, more than 20% of all fatalities (weighted average 21.8%) are alcohol-related. This proportion remains constant over the years 2000-2010. We conclude that this official number is a serious underestimate because official statistics suffer from underreporting of alcohol-related crashes and casualties. Moreover, this proportion does not include pedestrian and cyclist fatalities and serious injuries in alcohol-related crashes. Therefore, if we assume that the estimate of 25% on alcohol-related road fatalities as estimated for Europe (COWI et al. 2014) is a good estimate for all countries worldwide and we use 1.25 million annual road fatalities worldwide as a basis, the alcohol-related road toll can be put at around 313 000 deaths every year. The official data of the countries surveyed for this study show that a weighted average of 21.8% among road deaths. Accepting the 21.8% from this study as a reasonable estimate for all countries in the world, the alcohol-related deaths among fatally injured road users can be put at around 273 000 people every year.

But these numbers are an underestimate of the real numbers. In accordance with previous work (COWI et al. 2014; IRTAD 2011; Assum and Sørensen 2010; ETSC 2010; Derriks and Mak 2007) we identify underreporting as a major problem in determining the correct number of alcohol-related road casualties. The majority of the countries surveyed base their official data upon the police recordings only, for which this study found evident shortcomings. Furthermore, different countries use different legislations on BAC and various definitions of what constitutes a road crash casualty. These deficiencies in data collection and the finding that post-mortem tests are often not performed, negatively influence the accuracy and reliability of the official data regarding alcohol-related road casualties, thus leading to underestimated figures. Therefore, relying on official statistics will often be misleading. To enable more accurate analyses improvements are needed and recommended.

## Recommendations

To identify and limit underreporting of alcohol-related crashes it is recommended that the police force carry out systematic and 100% alcohol testing of all road users actively involved in all serious road crashes (fatal crashes and crashes with serious injuries). Furthermore, we recommend conducting additional investigation to assess underreporting and, when necessary, to apply correction factors to estimate “real numbers”. If this is not a realistic option, it is recommended to estimate the number of alcohol-related road fatalities by using additional statistical analysis methods.

To make official country statistics comparable, definitions of alcohol-related road casualties should be harmonized. It is recommended to define an alcohol-related road fatality as “any death occurring within 30 days as a result of a fatal road crash in which any active participant was found with a blood alcohol level above the legal limit”. A person seriously injured in an alcohol-related crash should have injury of the severity level of 3+ (IRTAD, 2011) on the Maximum Abbreviated Injury Scale (MAIS3+), so that it would be defined as “any serious injury at MAIS3+ that occurred as a result of a road crash in which any active participant was found with a blood alcohol level above the legal limit”. If countries are unable to apply these recommended definitions, they are invited to develop algorithms to allow for a conversion. We recommend applying adequate conversion factors (or algorithms) in case of different BAC legal limits that would allow meaningful international comparisons.

In order to make sure the recommended definitions apply for all road users involved in alcohol-related road crashes, (i.e. ‘any active participant with a blood alcohol level above the legal limit’) countries need to introduce legal limits on alcohol for pedestrians and cyclists. If they fail to do so, these vulnerable road user groups will not be recorded as an alcohol-related road casualty because there is no legal limit. This lack of legal limits for these user groups contributes to the issue of underreporting. It is therefore recommended that future research investigates if legal limits for pedestrians and cyclists are practicable, for example in terms of

enforcement. Future work should also study which legal limits on BAC should be applied for these groups. The other option is of course to modify the definition of alcohol-related road crashes.

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## References

- Assum T, Sørensen M. Safety Performance Indicator for alcohol in road accidents—International comparison, validity and data quality. *Accid Anal Prev.* 2010;42(2): 595-603.
- Blomberg RD, Peck RC, Moskowitz H, Burns M, Fiorentino D. *Crash risk of alcohol involved driving: A case - control study.* Stamford, Connecticut, Dunlap and Associates, Inc;2005.
- COWI, SWOV, ADV consultancy & research. Study on the prevention of drink driving by the use of alcohol interlock devices. Rotterdam, Ecorys; 2014.
- Department for Transport. *Road Accidents Great Britain (RAGB).* London, UK Department for Transport; 1989.
- Derriks H, Mak P. Underreporting of Road Traffic Casualties. Organisation for Economic Cooperation and Development. Paris: IRTAD International Transport Forum; 2007.
- ETSC. Road safety target in sight: making up for lost time; 4th road safety PIN report. Brussels, ETSC; 2010.
- French Road Safety Observatory ONISR. Road safety in France; 2012 annual report. Paris, French Road Safety Observatory (ONISR); 2012.
- Gundy CM, Verschuur WLG. Police enforcement of drinking and driving laws: A field study of police decisions for requiring a roadside breath test. In: *Proceedings 10th International Conference on Alcohol, Drugs and Traffic Safety (ICADTS).* 10<sup>th</sup> ed. Amsterdam, NH. Elsevier Science Publishers B.V. (Biomedical Division); 1986: 417-420.
- Hels T, Bernhoft IM, Lyckegaard A, Houwing S, Hagenzieker M, Legrand SA, Isalberti C, Van der Linden T, Verstraete A. Risk of injury by driving with alcohol and other drugs DRUID Driving under the Influence of Drugs, Alcohol and Medicines, D2.3.5; 2011.