# EPIDEMIOLOGY: DRINKING DRIVERS; DRINKING PEDESTRIANS; ALCOHOL IN RURAL CRASHES

# Results of the Belgian Drink Driving Roadside Survey

W. Vanlaar

Behaviour and Policy Department, Belgian Road Safety Institute (IBSR)

**Keywords**
Drink Driving, roadside survey

**Abstract**
In September, October, and November 2000, the Belgian Road Safety Institute (IBSR) organised, for the second time, a roadside survey to estimate the proportion of drink drivers in Belgium and their profile. The objective is to repeat this roadside survey every two years, so that it becomes possible to discern a trend and to offer guidance to all players in the field of traffic safety in their decisions regarding the problem of drink driving. In co-operation with police forces, about 10,000 drivers were randomly stopped nation-wide and were asked to take an alcohol breath test. In addition, a short questionnaire was completed. The proportion of drink drivers was calculated and a logit analysis provided insight into the profile of the drink driver. The results indicate that 8.4% of all drivers were on or above the legal limit (breath alcohol concentration (BrAC) of 0.22 milligrams alcohol per litre of exhaled air (mg/l)). The vast majority (6.7%) had BrAC levels above 0.35 mg/l, while only a small part was below 0.35mg/l (1.7%). The logit analysis indicated that, relatively spoken, the Belgian drink driver with a BrAC of at least 0.22mg/l but less than 0.35mg/l is female, older than 55 and driving with passengers and that the Belgian drink driver with a BrAC of at least 0.35mg/l is male, aged between 26 and 54 years, and drives without passengers. However, in absolute numbers, the Belgian drink driver with a BrAC of at least 0.22mg/l but less than 0.35mg/l is male, is aged between 26 and 54 years and drives with passengers and the Belgian drink driver with a BrAC of at least 0.35mg/l is male, is aged between 26 and 54 years and drives with passengers. Finally, it was found that 69.2% of the drink drivers came from bars or restaurants, and that 30.8% came from their homes, family or friends. Notwithstanding the improvement of the methods based on the experience of the first roadside survey of 1998, some remarks must be borne in mind when interpreting these results. Still, the results indicate that drink driving is without any doubt a problematical issue in Belgium. Therefore we advocate an integrated approach towards the problem of drink driving, with attention for the problem groups as indicated by relative numbers as well as for the problem groups as indicated by absolute numbers.

## Introduction

In 1998 (1; 2) and in 2000, the Belgian Road Safety Institute carried out a roadside survey to determine the amount of drink drivers and their profile. The objective is to repeat this roadside survey every two years, so that it becomes possible to discern a trend and to offer guidance to all players in the field of traffic safety in their decisions regarding the problem of drink driving.

According to the official statistics of the year 2000 (3), 8.5% (4,168) of all injury accidents were alcohol-related, whereas 10.2% (949) of all accidents with dead and seriously injured persons, was alcohol-related. 7.7% (787) of all car drivers who got involved in an accident with at least 1 dead or seriously injured road user, were under the influence of alcohol. In 2000, there were 97 deaths (within 30 days) in alcohol-related accidents, 1,090 seriously injured persons and 5,047 lightly injured persons. As in the official statistics not all accidents are taken into consideration and as the persons concerned cannot always perform the alcohol test (for instance because they were taken over to the hospital), the accident figures are always an underestimation of the real dimensions of the problem. The Belgian Toxicology and Trauma Study estimated that 28% of the persons who entered the emergency room after an injury accident, had blood alcohol levels above the legal limit. During weekend nights, this percentage increases up to 50% (4). There exists a positive correlation between the consumption per capita and drink driving (5). In 1999, for Belgium, the consumption per capita accounted to 8.7 litres of pure alcohol. On world scale, Belgium occupies the fourteenth place (6). According to official sources, in 1998, the state police carried out 183,568 alcohol tests (7). International research proves that this number is too low in order to influence the drivers' behaviour (1). In 1999, this amount went down to 163,373 (8), and in 2001, due to the reorganisation of Belgian police forces, to 32,430. Data about the number of settlements, deprivations of the right to drive, condemnations, etc. are rare. In 1993, 164,470 mentions of condemnation were registered, of which 116,169 have to do with traffic. Of this group, 16,686 sentences have been pronounced on account of drunkenness or intoxication by alcohol (9).

**Methodology**

Just like in 1998, we have carried out a roadside survey in collaboration with the – former – state police and the municipal police. In September, October and November 2000, during the night from Saturday to Sunday, from 22 pm to 4 am, drivers of personal cars (except for minibuses and vans) who were on the public road, were controlled.

On the standard registration form, the municipal and the state police wrote down the data per respondent, gathered by observation or asking questions.

We carried out a proportionally stratified two-stage cluster sample (10), the first stage consisting of a non-random choice of control locations and the second stage of the random stopping of drivers. The random stopping of drivers has been realized by stopping as much drivers as possible and by testing them all, without making a distinction based on physical criterions. The strata of this sample are the provinces. The planned number of research units per stratum was not reached. In order to make up for this disproportion, we used weighting coefficients (11). Agreements that had an important impact on the representativity of the data were made (for instance: to control during one hour at most and to intercept drivers who try to escape).

In the descriptive analysis, we describe the dimensions of the phenomenon of drink driving. To get insight into the profile of the person who drove under influence, we carried out a logit-analysis (12; 13). The variables gender (G), age (A) and the presence or absence of passengers (P) are the independent variables. The variable representing the result of the breath test (B) is the dependent variable (it was calculated with a Alcotest 7410 PAF 4 from Dräger). To prevent overfitting in the results of the logit analysis, we have taken a simple aselect sample of 1,500 research units out of the total dataset. Cells presenting a zero value in this dataset were replaced

by various delta values, so that we could check the stability of the results. For the selection of models (14, 15), we used different strategies (simultaneous test, partial and marginal association test with Sidak's adjustment formula for multiple testing (16), conditional test, Akaike's and Bayesian Information Criterion). After modelselection, we interpret the results with the help of the Kaufman and Schervish method (17). This method interprets the model both based on its multiplicative parameters (used for the calculation of semi-generalised and generalised odds ratios) and on the absolute figures (via a Deming-Stephan adjustment).

**Results**

Table 1 gives the results of the total sample of 10,112 drivers. If the missing values (109), the refusals (7) and the drivers who weren't able to do the test (13) are not taken into account, 91.6% of all drivers had a Breath Alcohol Concentration (BrAC) of less than 0.22mg/l, i.e. the legal limit. 8.4% of all drivers had a BrAC of at least 0.22mg/l. It is remarkable that most intoxicated drivers had drunk a lot: 6.7% of them had results of at least 0.35mg/l.

**Table 1: Results (frequency, percent and valid percent) of breath testing**

| | Frequency | Percent | Valid Percent |
|---|---|---|---|
| Refusal | 7 | 0.1 | / |
| Not able | 13 | 0.1 | / |
| BrAC<0.22mg/l | 9,142 | 90.4 | 91.6 |
| BrAC>=0.22mg/l | 174 | 1.7 | 1.7 |
| BrAC>=0.35mg/l | 667 | 6.6 | 6.7 |
| Missing | 109 | 1.1 | / |
| Total | 10,112 | 100 | 100 |

We have found a good fitting logit model (based on the saturated model with: df=27; Chi Square=26.6; p=0.49). Based on the multiplicative parameters of this model (in table 2), we calculated the semi-generalised and the generalised odds ratios, which permit to interpretet the model in terms of relative statements.

**Table 2: Semi Generalised and Generalised odds ratios of the logit model**

| Independent Variables | Dependent Variable (B) | | |
|---|---|---|---|
| | Semi Generalised odds ratio | | Generalised odds ratio |
| | BrAC<0.22mg/l | BrAC>=0.22mg/l | BrAC>=0.35mg/l |
| P | | | |
| No passengers | 0.493 | 0.451 | 2.122 |
| Passengers | 2.032 | 2.215 | 0.471 |
| A | | | |
| 16/25 | 2.308 | 1.102 | 0.627 |
| 26/39 | 0.736 | 0.730 | 1.364 |
| 40/54 | 0.566 | 0.513 | 1.855 |
| 55+ | 1.039 | 2.421 | 0.630 |
| G | | | |
| Male | 0.277 | 0.433 | 2.888 |
| Female | 3.606 | 2.315 | 0.346 |

Furthermore, we have to take into account the reality of the absolute figures. As certain groups of drivers participate more to traffic than other groups (for example males compared to females), the absolute figures do not always reflect the typical profiles, based on relative statements. Therefore we conducted a Deming-Stephan adjustment, which permits to interpret the model in terms of absolute figures (see table 3).

Relatively speaking, the group that has test results of at least 0.35mg/l consists of male drivers, aged from 26 up to 54 years, without passengers. The group with test results of at least 0.22mg/l, but less than 0.35mg/l consists of female drivers of at least 55 years, with passengers. The largest group that has test results of at least 0.35mg/l, however, consists of male drivers, aged from 26 up to 54 years, with passengers. The largest group with test results of at least 0.22mg/l but less than 0.35mg/l, consists of male drivers, between 26 and 54 years, with passengers.

Finally, we notice that most persons driving under the influence of alcohol came from hotels, restaurants or catering establishments (69.2%), but still, a lot of them came from their homes, friends, family, etc. (30.8%).

**Table 3: Absolute numbers of the logit model, calculated via a Deming-Stephan adjustment**

| Independent Variables | Dependent Variable (B) | | |
|---|---|---|---|
| P | BrAC<0.22mg/l | BrAC>=0.22mg/l | BrAC>=0.35mg/l |
| No passengers | 377 | 7 | 39 |
| Passengers | 884 | 17 | 45 |
| A | | | |
| 16/25 | 360 | 4 | 12 |
| 26/39 | 474 | 10 | 36 |
| 40/54 | 320 | 6 | 30 |
| 55+ | 107 | 4 | 6 |
| G | | | |
| Male | 940 | 20 | 77 |
| Female | 320 | 4 | 7 |

**Discussion**

Notwithstanding the improvement of the methods based on the experience of the first roadside survey of 1998, some remarks should be borne in mind when interpreting these results. These remarks mainly concern a number of methodological shortcomings, which are the result of the fact that the translation of theory into practice is not a straightforward task, particularly when working alongside police forces in the real world.

Police forces are legally obliged to work with testing devices of which the result is a category instead of an exact figure. So, from a statistical point of view, we lose information. Secondly, it was impossible to work according to a detailed, uniform time schedule. Only one agreement was made, namely to control drivers on Saturday nights between 22pm and 4am. Furthermore, we do not possess the necessary information to calculate the weighting coefficients according to the time period. Thirdly, the control places have been chosen in a selective way, which, strictly spoken, puts the representativity of the results at stake. This is the main reason why we didn't bother calculating confidence intervals for the proportion of drink drivers. Currently, we conduct

a similar research project that is limited to one province. The second and the third shortcoming of the nationwide roadside survey will be tackled. During the daytime, the evening and the night on weekdays and in the weekend, police forces will conduct a roadside survey. Weighting coefficients for each time period will be used. Locations will be selected randomly by means of a Geographic Information System (with Arcview-software). Since we will be working with a real probability sample, it will be worthwhile to calculate confidence intervals, taken account of the complex sampling design – a stratified two stage cluster sample – (with Stata-software) and to build a multilevel model, taken account of contextuality (with MlwiN-software).

The dimensions of the problem of drink driving in Belgium in 2000 (8.4%) do not significantly differ from the percentage of 1998 (8.9%) (2). There is a decline, but it is doubtful whether this decline is significant. Not only when making comparisons in time, but also when carrying out comparisons in space, one should display the necessary prudence. Different aspects can differ when collecting the data (choice of locations, choice of drivers, duration of a control at one particular place, etc.). Nevertheless, we will attempt to compare out results with the results of the Netherlands. In 2000, 2.2% of the Dutch drivers had test results of at least 0.22mg/l, but less than 0.35mg/l. 1.5% had test results of at least 0,35mg/l (18). An important conclusion is that the problem of drink driving has taken on considerable dimensions in Belgium. Moreover, the group of persons driving under the influence of alcohol mainly consists of heavy drinkers, whereas moderate drinkers form a minority. Belgian enforcement levels being rather low probably is one of the explanations for this bad performance. From our findings, we conclude that it is highly recommended to tackle this problem in an efficient way. A well-considered way of enforcement could be the solution. Therefore, the following elements should be present: firstly a sufficiently high objective chance to get caught, secondly a good balance between the objective and the subjective chance to get caught and thirdly, a swift, certain and adapted penalty.

We found an appropriate logit model that summarizes the collected data in a concise way. Based on the parameters that were taken into consideration in the model, we described the profile of drink drivers. Note that these statements are relative, i.e. a comparison of probabilities. Aside from the odds ratios, we would like to stress the importance of absolute figures. For instance, we found that, in spite of the greater probability that drink drivers drive without passengers, there is a greater amount of drink drivers with passengers. In practice, this means that sensibilisation campaigns should not only be aimed at “risk groups”, but also at “large groups”. This also applies to police enforcement. Together with the subjective perception of the drivers that they have a chance to escape from selective controls, this is an argument against these selective controls.

Finally we highlight that, as from 1999, Belgian police services have a legal instrument at their disposal for the detection of driving under the influence of illegal drugs. A well-considered policy for the allocation of manpower and means for the fight against drink driving on the one hand and for driving under the influence of illegal drugs on the other, is necessary (19).

**References**


1. Vanlaar W. Rijden onder invloed in België. Aanbevelingen ter ondersteuning van het effectief politietoezicht naar aanleiding van de aselecte alcoholcontrole, uitgevoerd in 1998. Belgisch Instituut voor de Verkeersveiligheid, Brussel 1999, discussion paper 99-05.

2. Vanlaar W. Drink driving in Belgium. In: s.e., 4th International Conference on "Global Safety", Bled, Slovenia, The Institute of Occupational Safety ZVD, 2000, pp 233-239.

3. Belgisch Instituut voor de Verkeersveiligheid (BIVV). Verkeersveiligheid. Jaarverslag 2000. Belgisch Insitituut voor de Verkeersveiligheid, Brussel (s.d.).

4. Belgian Society of Emergency and Disaster Medicine (BESEDIM), Toxicological Society of Belgium and Luxemburg (BLT), Belgian Road Safety Institute (BIVV/IBSR). Belgian Toxicology and Trauma Study. (s.e), (s.l.), (s.d.).

5. Mann RE, Anglin L. Alcohol Availability, Consumption, and the Alcohol-Crash Problem. In: Wilson RJ, Mann RE, editors, Drinking and Driving. Advances in Research and Prevention, The Guilford Press, New York, 1990, pp 216-225.

6. De Donder E. Alcohol, illegale drugs, medicatie en gokken. Recente ontwikkelingen in Vlaanderen 2000. VAD, Brussel, 2001.

7. Belgisch Instituut voor de Verkeersveiligheid (BIVV). Verkeersveiligheid. Jaarverslag 1998. Belgisch Instituut voor de Verkeersveiligheid, Brussel (s.d.).

8. Belgisch Instituut voor de Verkeersveiligheid (BIVV). Verkeersveiligheid. Jaarverslag 1999. Belgisch Instituut voor de Verkeersveiligheid, Brussel (s.d.).

9. Ministerie van Justitie, Dienst voor strafrechtelijk beleid. Jaarverslag 1995-96. Ministerie van Justitie, Brussel (s.d.).

10. Levy PS, Lemeshow S. Sampling of Populations. Methods and Applications. John Wiley & Sons, New York, 1999 (third edition).

11. Billiet JB. Methoden van Sociaal-Wetenschappelijk Onderzoek: Ontwerp en dataverzameling. Acco, Leuven, 1996.

12. Hagenaars JA. Categorical Longitudinal Data. Sage, Newbury Park, 1990.

13. Hagenaars JA. Loglinear Models with Latent Variables. Sage, Newbury Park, 1993 (Sage University Paper series on Quantitative Applications in the Social Science, series no. 07-094).

14. Agresti A. Categorical Data Analysis. John Wiley & Sons, New York, 1990.

15. Brown MB. Screening effects in multidimensional contingency tables. Appl Stat 1976; 25: 37-46.

16. Sidak Z. Rectangular confidence regions for the means of multivariate normal distributions. J Am Stat Assoc 1967; 62: 626-633.

17. Kaufman RL, Schervish PG. Using adjusted crosstabulation to interpret log-linear relationships. Am Sociol Rev 1986; 51: 717-733.

18. Adviesdienst Verkeer en Vervoer (AVV). Rijden onder invloed in Nederland; onderzoek 2000. Ministerie van Verkeer en Waterstaat, Directoraat-Generaal Rijkswaterstaat, Adviesdienst Verkeer en Vervoer, Rotterdam 2001.

19. Vanlaar W. Alcohol, Illegal Drugs and Driving in Belgium. In: s.e., Road Safety on Three Continents, Proceedings of the International Conference, Moscow, Russia, Swedish National Road and Transport Research Institute (VTI), 2001.

# The Incidence of Alcohol in Fatally Injured Adult Pedestrians in Great Britain

[1]R.J. Tunbridge and [1] M Keigan

[1]TRL Limited, Crowthorne, Berkshire, England, RG45 6AU.

**Keywords**
Alcohol, Blood, Pedestrian, Fatality

**Abstract**
The results of blood alcohol tests obtained from Coroners in England and Wales and Procurators Fiscal in Scotland between 1995 and 1999 have been analysed to examine the problem of drinking pedestrians who die in road accidents. Records linking blood alcohol concentrations to accident details obtained from the national road accident database (Stats19) were available for 1748 adult pedestrian fatalities (those aged 16 and over who died within 12 hours of a road accident) during this five-year period. The analysis explores a number of parameters of accident circumstance together with the age and sex of the fatally injured adult pedestrians and associations with different blood alcohol concentration levels. The results have been compared with the results of an earlier study in 1985-89. There has been an increase in the proportion of adult pedestrians fatalities found to be drinking prior to an accident in the decade. The number of pedestrians killed per year has reduced by about one half but the proportion who had consumed alcohol has increased from 40% to 48%.

## Introduction

Over 42,000 pedestrians were injured in road accidents in Great Britain in 1999 including 870 who were killed, which is approximately one quarter of all road users killed that year (1). Although this represents a substantial reduction compared with over 60,000 pedestrian casualties in 1989, when one third of fatalities were pedestrians (2), this is still a serious cause for concern. The vulnerability of the child and elderly pedestrian is well recognised and this is illustrated by the fact that out of 9825 pedestrians killed or seriously injured in 1999, 51% were either under 16 or at least 70 years old.

The remaining group of adult pedestrians aged 16-69, although making up only half of the total population of injured pedestrians, are more likely to have been drinking than their younger or older counterparts, and for this group the consumption of alcohol is associated with a considerably increased accident risk. A study of alcohol and pedestrians in 2000 (3) reported that the risk of fatal accident involvement for adult pedestrians starts to increase rapidly at blood alcohol concentrations (BAC) above 120mg/100ml. This is supported by studies that considered the role of alcohol in fatally injured pedestrian casualties outside Britain (4) and (5).

The risk of non-fatal injury is also considerably increased. A hospital-based TRL study of drinking behaviours of road accident casualties, in 1991, showed a high rate of previous drinking (6), 37% among pedestrians. This compares with the 2000 study cited above (3) where 40% of adult pedestrian casualties tested for alcohol had been drinking.

**Method**

Blood alcohol concentrations for road users aged 16 or more who died within 12 hours of being injured in an accident have been recorded at TRL since 1967 using returns made by Coroners in England and Wales, and by Procurators Fiscal in Scotland since 1978. BAC is not reported for about half the road accident fatalities for a number of reasons:

- the casualty died more than 12 hours after the accident, this accounts for about 20% of cases (7)
- a test was not carried out
- a blood transfusion had taken place
- TRL depends on the voluntary co-operation of the Coroners and Procurators Fiscal, and a few cases are not reported.

Additional data items supplied by the coroners are:

- date, time and location of the accident
- speed limit
- brief story of the accident circumstances
- age, sex and an outline of the deceased's occupation
- class of road user and vehicle type
- date and time of death
- date and time the blood sample was collected/reason for non-collection

These returns are matched to Stats19 casualty records using the date, time and location of the accident and the age and sex of the fatality, which enables additional variables such as road class to be examined.

The majority of the data in this paper relates to the aggregated dataset for the five-year period 1995-1999, of all pedestrian fatalities for whom the BAC is known; n=1748. There are references throughout this report to pedestrians who had *not* been drinking (BAC ≤9mg/100ml) and those who had been drinking (BAC ≥10mg/100ml). Also referenced is the legal limit for drivers, which is 80mg/100ml. Figures are also given in relation to 200mg/100ml, which is one of the selection criteria for High Risk (drink/driving) Offenders, and over 300mg/100ml, when an extreme amount of alcohol has been consumed and may be described as very heavy intoxication.

**Results**

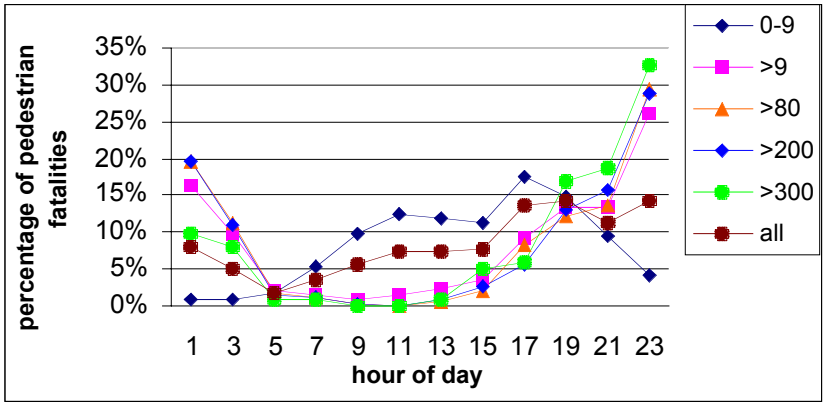
For the five year period 1995-99 the number of fatally injured adult (aged 16 and over) pedestrians was 4153 and of this total the BAC was known for 1748 (42%). In this paper, for reasons of space, the results presented are limited to an analysis of the time when the accident occurred by hour and the age and sex of the pedestrian. In 1989 the incidence of any alcohol (BAC in excess of 9mg/100ml) in fatal adult pedestrians was 40% (8) and this rose to 48% in 1999 (9). The figure for those pedestrians found to have a BAC in excess of the drink-drive limit (80mg/100ml) in 1989 was 31%; by 1999 this figure had increased to 39%. The comparable

proportions in 1999 for motor vehicle drivers (excluding 2 wheelers) were much lower: 33% with any alcohol (34% in 1989) and 21% over the drink-drive limit (22% in 1989).

**Hour of day**

Figure 1 shows the distribution of the sample of fatalities and of various subgroups by time of day and relates to the 1748 fatally injured pedestrians where BAC was known. Data are plotted at the mid-point of each two-hour period. Among those pedestrians who had not been drinking the proportion of accidents occurring between midnight and 0800 hours is very low, most accidents occurred in the late morning and early evening. Conversely, for those pedestrians who had been drinking relatively, few accidents occurred during the morning, but the incidence rose modestly during the afternoon and more sharply through the evening. They peak around 2300 hours, and then fall during the early hours to a minimum at 0500 hours. This pattern is followed at all BAC levels above 9mg/100ml, but is more marked for the higher levels.

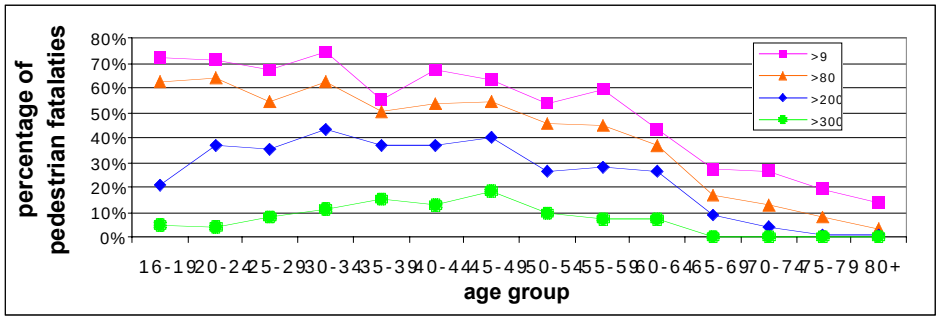
**Figure 1: Hourly variations in BAC among pedestrian fatalities**




**Age and sex**

The proportion of pedestrian fatalities in each age group with a BAC exceeding the given levels is shown in figure 2 and refers to the 1653 adult pedestrian fatalities whose age was known.

**Figure 2: The variation of BAC level by age group**



The proportion of pedestrians aged from 16 to 60 who had been drinking was above 50%, and notably over 40% were over the drink-drive limit. Furthermore, for those aged up to 35 over 70% had consumed some alcohol. The proportion of those that had been drinking and those over the drink-drive limit decreases steadily after age 60.

The maximum proportion pedestrians whose BAC level exceeded 2.5 times the drink-drive limit (200mg/100ml) occurred in the 30-34 age range (43%); the proportion falls to one-quarter by the mid-fifties age group and is below 5% by age 70. The proportion of adult pedestrians whose BAC exceeded 300mg/100ml was highest in those in their late thirties (18%).

Overall, the greatest proportion of pedestrian fatalities who had not been drinking were aged over 65, and the greatest proportion who had consumed a large amount of alcohol were aged 35-49.

Table 1 gives a summary of BAC levels by age group for male and adult pedestrian fatalities from the period 1985-89 and also for 1995-1999.

**Table 1: BAC level by age group for male and female fatally injured adult pedestrians**

| **1985-1989** | Male | | | | | | | | Female | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| BAC (mg/100ml) | 16-19 | 20-29 | 30-39 | 40-49 | 50-59 | 60-69 | 70+ | All | 16-19 | 20-29 | 30-39 | 40-49 | 50-59 | 60-69 | 70+ | all | ALL |
| 0-9 | 40.8% | 31.4% | 33.3% | 37.3% | 42.3% | 51.2% | 70.6% | 47.4% | 62.1% | 50.6% | 44.3% | 57.7% | 74.3% | 87.8% | 91.7% | 80.9% | 60.2% |
| 10-80 | 7.2% | 7.4% | 6.9% | 9.0% | 9.2% | 9.6% | 15.9% | 10.2% | 10.3% | **13.0**% | 4.9% | 9.9% | 7.6% | 5.6% | 5.5% | 6.7% | 8.8% |
| 81-200 | **33.6**% | 25.8% | 20.4% | 17.5% | 21.8% | 19.6% | 9.5% | 19.3% | 15.5% | **28.6**% | 24.6% | 11.3% | 5.7% | 4.6% | 2.4% | 7.1% | 14.6% |
| 201-300 | 17.1% | **27.1**% | 22.7% | 22.6% | 18.0% | 14.3% | 3.2% | 16.1% | 10.3% | 6.5% | 16.4% | **19.7**% | 6.7% | 2.0% | 0.3% | 4.1% | 11.5% |
| >300 | 1.3% | 8.4% | **16.7**% | 13.7% | 8.8% | 5.3% | 0.8% | 7.0% | 1.7% | 1.3% | **9.8**% | 1.4% | 5.7% | - | - | 1.3% | 4.8% |
| N | 100% 152 | 100% 299 | 100% 216 | 100% 212 | 100% 239 | 100% 322 | 100% 473 | 100% 1913 | 100% 58 | 100% 77 | 100% 61 | 100% 71 | 100% 105 | 100% 196 | 100% 616 | 100% 1184 | 3097 |
| **1995-1999** | Male | | | | | | | | Female | | | | | | | | |
| BAC | 16-19 | 20-29 | 30-39 | 40-49 | 50-59 | 60-69 | 70+ | All | 16-19 | 20-29 | 30-39 | 40-49 | 50-59 | 60-69 | 70+ | all | ALL |
| 0-9 | 22.5% | 25.1% | 29.3% | 30.2% | 39.3% | 52.5% | 71.3% | 40.8% | 50.0% | 51.9% | 61.1% | 51.2% | 61.5% | 80.5% | 89.6% | 75.7% | 51.8% |
| 10-80 | 10.1% | 10.4% | 8.0% | 11.4% | 10.3% | 7.4% | 14.6% | 10.7% | 9.1% | 7.7% | 11.1% | 12.2% | 12.8% | 9.8% | 9.2% | 9.8% | 10.4% |
| 81-200 | **44.9**% | 25.1% | 17.2% | 17.4% | 19.3% | 12.3% | 10.4% | 19.2% | **27.3**% | 19.2% | 13.9% | 7.3% | 12.8% | 4.9% | 1.2% | 6.9% | 15.3% |
| 201-300 | 18.0% | **32.7**% | **31.0**% | 24.2% | 20.7% | 21.3% | 3.8% | 21.2% | 9.1% | **17.3**% | 8.3% | **19.5**% | 10.3% | 4.9% | - | 5.7% | 16.3% |
| >300 | 4.5% | 6.6% | 14.4% | **16.8**% | 10.3% | 6.6% | - | 8.1% | 4.5% | 3.8% | 5.6% | **9.8**% | 2.6% | - | - | 1.9% | 6.1% |
| N | 100% 89 | 100% 211 | 100% 174 | 100% 149 | 100% 145 | 100% 122 | 100% 240 | 100% 1130 | 100% 22 | 100% 52 | 100% 36 | 100% 41 | 100% 39 | 100% 82 | 100% 251 | 100% 523 | 1653 |

The younger age groups show the greatest differences in alcohol consumption over the decade. The proportion of male pedestrian fatalities aged 16-19 who had been drinking has increased from 59% to 78% over the decade and for females has increased from 38% to 50%, both representing an increase of almost one-third over the period.

**Discussion**

It is clear that the adult group of pedestians includes a sustantial proportion who had been drinking. This is particularly true of those under 35. After age 60 the proportion of those drinking gradually declines.

For those drinking excessively, i.e. those whose BAC level exceeded 2.5 times the UK drink-drive limit (200mg/100ml) the peak age group was in the 30-34 age range. For those drinking at very high levels i.e. (those whose BAC exceeded 300mg/100ml) the peak age was for those in their late forties. These results show close agreement with those from the earlier study.

Since the earlier study in 1985-89 the overall number of fatally injured pedestrians has reduced by about one half but the proportion that had consumed any alcohol has increased from 40% to 48%. The proportion of males who had been drinking has increased from 53% to 60% and for females this increase has been from 19% to 24%.

The younger age groups show the greatest changes in alcohol consumption over the decade. The proportion of male pedestrian fatalities aged 16-19 who had been drinking has increased from 59% to 78% and for females from 38% to 50%, both these figures represent an increase of almost one-third.

The increase in the incidence of alcohol in those aged under 20 is a serious cause for concern. The Royal College of Physicians Report (10) shows that alcohol consumption among under-age drinkers (aged 11-15) more than doubled between 1990 and 1996. Furthermore, recent Home Office research (11) shows that drinking levels increase substantially after 16 with around 60% of both males and females reporting feeling very drunk in the last year. Further evidence of a problem with British teenagers comes from the ESPAD report (12) which covered interviews with 60,000 15-16 year olds in 30 countries; the UK was second behind Denmark for frequency in drinking.

This pattern of drinking continues with increasing age to include the "18-30 culture" and reflects changes in lifestyles since the 1980s. In particular it highlights apparent differences in drinking culture between those aged under and over 30 for both males and females. For males aged under 30 there has been an increase in the proportion who had been drinking, from 65% to 76%. For the men aged 30 and over there was a smaller increase in the proportion who had been drinking, from 49% to 53%.

There has been a slight increase in the proportion of fatally injured female pedestrians aged under 30 who had consumed alcohol (from 44% to 49%) since the earlier study. However, this increase is most marked in those with BAC between 201 and 300mg/100ml, which has increased from 8.1% in 1985-89 to 14.9% in 1995-99 and in those with a BAC exceeding 300mg/100ml (1.5% to 4.1%). These increases in alcohol consumption among younger women, particularly at the higher alcohol levels are again considerable cause for concern. They no doubt reflect the social changes cited earlier and are worthy of further research. For the fatally injured female pedestrians aged 30 and over changes in drinking patterns over the period appear to have been minor.

This study of fatally injured adult pedestrians covering the period 1995-99 has shown that although many trends and patterns have remained unchanged since the previous study, covering

1985-89, there have also been several changes of consequence. In particular, the overall proportion who had been drinking increased from 40% to 48%; increases in alcohol consumption were greatest in those under age 20, rising by one-third for both males and females. There was also a general increase in consumption for those under age 30, which is of particular concern for women, where the greatest rise was in those with BAC above 200mg/100ml. There was a significant reduction in pedestrians killed in urban accidents relative to rural accidents.

These changes are worthy of further specific research on drinking patterns and behaviour. It would be useful to investigate the fatal road accident files stored at TRL to shed further light on the circumstances of fatal pedestrian accidents involving alcohol.

**References**


1. Department of Transport , Local Government and the Regions (2000). Road Accidents Great Britain: 1999, The Casualty Report. London, The Stationery Office.

2. Everest JT (1992). The involvement of alcohol in fatal accidents to adult pedestrians. RR 343, TRL Crowthorne.

3. Clayton AB and Colgan MA (2001). Alcohol and pedestrians. Road Safety Research Report No. 20, DETR, London.

4. Holubowycz OT (1995). Age, sex and blood alcohol concentration of killed and injured pedestrians. Accident Analysis and Prevention, 27, 417-422.

5. Fontaine H and Gourlet Y (1997). Alcohol involvement in pedestrian accidents in France. In Mercier-Guyon, C(Ed) Proceedings of the 14th international conference on alcohol, drugs and traffic safety, Annecy, September 1997, 155-60.

6. Everest JT, Banks S, Hewer PA and Mineiro J (1991). Drinking behaviour and breath alcohol concentrations of road accident casualties. RR 311, TRL Crowthorne.

7. Transport Research Laboratory (2000). Time interval between road accident and death, 1997. TRL leaflet, LF2080, TRL, Crowthorne.

8. Transport and Road Research Laboratory (1991). Blood alcohol levels in fatalities in Great Britain,1989. TRRL leaflet, LF 2053, TRL, Crowthorne.

9. Transport Research Laboratory (2001). Blood alcohol levels in road accident fatalities for 1999 in Great Britain. TRL leaflet, LF 2084, TRL, Crowthorne.

10. Royal College of Physicians (2001). Alcohol - can the NHS afford it? Recommendations for a coherent alcohol strategy for hospitals. A report of a working party of the Royal College of Physicians, London.

11. Home Office (2000). Underage drinking: Findings from the 1998-99 Youth Lifestyles Survey. Home Office Research Findings No. 125. Research and Statistics Directorate, Home Office, London.

12. The 1999 ESPAD Report (2000), Alcohol and Other Drug Use Among Students in 30 European Countries. The Swedish Council for Information on Alcohol and Other Drugs (CAN), The Pompidou Group, Stockholm.

# In Depth Study of Rural Road Crashes in South Australia

M.R.J. Baldock, C.N. Kloeden and A.J. McLean

Road Accident Research Unit, University of Adelaide, Australia

**Keywords**
Alcohol, crash

**Abstract**
An in depth study of rural road crashes in South Australia was conducted from 1998 to 2000 and produced detailed information about a sample of 236 crashes. This information was analysed to assess the contributions of different factors, such as varieties of driver error and inadequacies in road infrastructure, to the causation of rural road crashes and the severity of consequent injuries. Crashes involving alcohol intoxicated drivers were more likely to be single vehicle crashes and to involve male and teenage drivers. Such crashes were usually the result of the driver losing control of the vehicle, particularly after the vehicle ran off the road and onto an unsealed shoulder. The injuries and fatalities resulting from these crashes were usually caused by the vehicles striking roadside hazards close to the side of the road. It is concluded that efforts to reduce the role of alcohol in rural road crashes are best directed at males, and great gains are likely through reduction of teenage drink driving. However, reductions in rural drink driving crashes are also very likely if shoulders are sealed, road edges are marked with lines and roadside hazards close to the road edge are eliminated or protected.

## Introduction

Very little research is conducted in the road safety field in which researchers attend the scenes of road crashes, especially those in rural areas, as soon as they occur, and investigate the nature of the crashes and their contributory antecedents in depth (eg 1,2). In depth research of this type is a useful tool for assessing accurately the factors most commonly involved in the causation of crashes and consequent injuries, and also for generating new hypotheses concerning possible countermeasures and their likelihood of success.

This study was conducted to look at road, vehicular and driver factors and their contribution to a large sample of rural road crashes. This paper, however, will focus only on the crashes in which alcohol intoxication of a driver contributed to the causation of the crash.

## Method

An in depth study of rural road crashes on South Australian roads was conducted by the Road Accident Research Unit with the data collection phase of the study running for two years from 1 March 1998 to 29 February 2000.

Vehicle crashes eligible for inclusion in the study were those to which an ambulance was called and which occurred on public roads outside the metropolitan area but within 100 km of Adelaide, the capital city of South Australia. Notification of crashes was obtained by monitoring ambulance radio frequencies and also by pager notification from the South Australian Ambulance Service.

Road Accident Research Unit staff members were available on call to attend crash scenes during the day seven days per week and on Thursday and Friday nights until midnight. These two nights and during the day on Saturday and Sunday were selected as on-call periods following an examination of the time of day and day of week distribution of calls for an ambulance to attend vehicle accidents in the study area during the previous year.

Some fatal cases were able to be investigated on the day following the crash if the scene had been marked up by the Police Major Crash investigators. This enabled the inclusion in the study of some crashes that occurred outside the on-call periods. However, that the fact that no team members were on call to attend crashes on Saturday nights or on any night between midnight and 9am biased our sample to some extent against inclusion of alcohol related crashes.

The information collected on each case included:

- photographs of the crash scene and vehicles involved
- video record of the crash scene and vehicles in selected cases
- examination of the road environment, including traffic control measures
- a site plan of the crash scene and vehicle movements in the crash
- examination and measurements of the vehicles involved
- interviews with crash participants, witnesses and police
- information on the official police report
- information from Coroner's reports
- injury data on the injured crash participants

Blood alcohol concentration information was collected for the study from two sources. First, attending police officers are instructed to conduct a breath alcohol test on all crash involved drivers. Secondly, the law requires that all persons aged over 14 who are treated at hospital as a result of injuries sustained in a road crash have a blood sample taken for BAC analysis. Both these sources of data were available for use in the study.

**Results**

The study consisted of the in depth investigation of 236 rural road crashes. Of these, 54 (23%) resulted in at least one fatality, and a further 76 (32%) in at least one crash participant being admitted to hospital. There was an over-representation of severe crashes in the sample, due in part to the ability to follow up fatal crashes occurring outside of the study on-call times.

Of the 236 crashes, there were 143 in which the BAC for each driver was known to be zero and 27 crashes in which one of the drivers recorded a positive BAC. Information concerning BACs for drivers in the remaining crashes was not able to be obtained for one of a number of reasons, the most common being that the drivers were neither injured severely enough to attend a hospital nor asked by the police to submit to a breath analysis.

Six of the 27 drivers with a positive reading recorded BACs below the South Australian legal limit of 0.05gm/L, but two of these drivers only held provisional licences and therefore were not allowed to have a positive alcohol reading at all. Of the remaining 21 drivers, nine recorded BACs between 0.05 and 0.15gm/L and 12 recorded BACs above 0.15gm/L. These results illustrate that the crash involved drivers with positive BACs tended to have very high levels of alcohol in their blood.

It is also likely that in two of the cases, alcohol played a very minor role in the crash causation, if at all. In one case, a driver with a BAC of 0.05gm/L was in a car that was struck by another vehicle that was out of control, and it is unlikely that he would have been able to avoid the collision even if he had no alcohol in his system. In another crash, a teenage female driver ran off the road after she attempted a dangerous, high speed overtaking manoeuvre on the wrong side of the road. The driver had a BAC of 0.012gm/L when her provisional licence required her to have a zero BAC. However, it is likely that her inexperience at driving at that speed (110-120km/h), the fact that she had had very little sleep the night before the crash, the possibility that her boyfriend in the passenger seat was encouraging her to drive dangerously, and her failure to wear appropriate footwear or her prescribed glasses, would, in sum, provide sufficient explanation, in terms of driver error, for the occurrence of the crash rather than the small amount of residual alcohol left in her system from the night before.

The remainder of the results section compares the crashes involving the 21 drivers with illegal BACs, in which alcohol intoxication was likely to have been a contributory factor to the causation of the crash, with those 143 crashes involving only drivers known to have no alcohol in their blood.

Table 1 provides details of the differences between alcohol and non-alcohol involved rural road crashes in terms of crash type. The figures for crashes in which BACs were unknown for one or more drivers are also shown for comparison purposes. The table shows that cases in which a driver had an illegal BAC were more likely than other crashes to be single vehicle run-off-the-road crashes. Given that crashes classed as "head on" in this study were similar to single vehicle crashes, in that they were precipitated by a driver losing control of his or her vehicle rather than by conflicts with other traffic, Table 1 shows that loss of vehicular control was the precipitating factor in over 95 per cent of crashes involving alcohol. This tendency for crashes involving alcohol to be single vehicle or head on crashes more often than non-alcohol crashes was statistically significant ($c^2_{(1)}=7.52$, $p<.01$).

**Table 1: Crash type according to alcohol involvement**

| Crash Type | Alcohol | Non Alcohol | Unknown | Total |
|---|---|---|---|---|
| Single Vehicle | 17 | 72 | 16 | 105 |
| Head On | 3 | 22 | 14 | 39 |
| Other Midblock | - | 12 | 14 | 26 |
| Intersection | 1 | 37 | 28 | 66 |
| Total | 21 | 143 | 72 | 236 |

The sex of the 21 alcohol affected drivers and the drivers in the crashes not involving alcohol is shown in Table 2. Males were in the majority for both alcohol and non-alcohol involved crashes, but the percentage of males in the former (90) was far greater than that in the latter (59), and the

difference was statistically significant ($c^2_{(1)}$=7.79, $p$<.01). Therefore, alcohol affected drivers involved in crashes in rural areas were far more likely to be male than drivers in crashes in which alcohol intoxication was not present.

**Table 2: Sex of the driver according to alcohol involvement**

| Sex | Alcohol | Non Alcohol | Unknown | Total |
|---|---|---|---|---|
| Male | 19 | 130 | 72 | 221 |
| Female | 2 | 89 | 45 | 136 |
| Total | 21 | 219 | 117 | 357 |

Table 3 provides details of the age of the alcohol affected drivers and the drivers in the crashes not involving alcohol. It is apparent that crashes involving alcohol impairment more commonly featured teenage drivers and less commonly featured drivers aged over 40 than crashes in which no drivers recorded illegal BACs. The lower likelihood of drivers over the age of 40 being involved in alcohol related rural crashes was statistically significant ($c^2_{(1)}$=4.84, $p$<.05).

**Table 3: Age of the driver according to alcohol involvement**

| Driver Age (Yrs) | Alcohol Involved | Non Alcohol Involved | Unknown | Total |
|---|---|---|---|---|
| 16-19 | 7 | 32 | 14 | 53 |
| 20-29 | 4 | 52 | 25 | 81 |
| 30-39 | 6 | 39 | 17 | 62 |
| 40-49 | 3 | 41 | 28 | 72 |
| 50+ | 1 | 55 | 32 | 88 |
| Total | 21 | 219 | 116 | 356 |

Investigation of roadway characteristics and alcohol related crashes revealed that one road feature common in the such crashes was an unsealed shoulder. Of the 20 alcohol related crashes precipitated by loss of vehicular control, there were 13 in which the vehicle moving onto an unsealed shoulder played a role in the causation of the crash. In 11 of these 13 crashes, the vehicle ran off to the road to the left (traffic keeps to the left in Australia). On five occasions this occurred on a straight section of road and on six occasions on the outside of a right curve. The lower coefficient of friction of the unsealed shoulder in each of these cases either contributed directly to a loss of control, or made it more difficult for the driver to steer the vehicle back onto the road successfully.

In six of the 13 crashes in which an unsealed shoulder contributed to the causation of the crash, there was also no edge lining to delineate the side of the road. The lack of clear visual cues indicating the position of the road edge would have increased the likelihood that the alcohol affected driver would allow a wheel to move onto the unsealed shoulder, resulting in loss of control. It is also notable that in five of these six occasions, when alcohol affected drivers ran off the road where there was a lack of edge lining, it was night time, when visibility of the road edge without road markings would have been compromised.

The 17 single vehicle crashes featuring an alcohol affected driver all involved the vehicle striking one or more roadside hazards. In nine of these 17 crashes, the main roadside hazard struck by the vehicle was a tree and in another five it was a utility pole. In two of the three head on collisions

involving an intoxicated driver, the most injurious impact was also with a roadside hazard following the collision with the other vehicle. The average distance between the road edge and the trees struck in alcohol related crashes was 3.8m, while the average distance to a utility pole was 3.9m. All of the poles and all but one of the trees were within 6m of the road edge.

**Discussion**

Rural road crashes involving alcohol tended to involve drivers with very high BACs, as has been found previously in South Australia (3). These crashes were also more likely to be single vehicle crashes and to involve young male drivers. This suggests that countermeasures aiming to change driver and/or drinking behaviour, whether they be educative or enforcement related, should be directed particularly at young males.

However, the results also suggest that there are road features that are equally as prominent in alcohol related rural crashes as the involvement of young male drivers.

First, unsealed shoulders were found commonly to have played a contributory role in crash causation. It is likely that alcohol intoxication in many cases would have been responsible, at least partly, for a driver veering off the road onto the shoulder. On roads where this shoulder was unsealed, the greatly reduced coefficient of friction of the shoulder compared to the road surface would have made it difficult for the driver to regain control of the vehicle. In some cases, the driver never managed to steer the vehicle back onto the road before striking an object by the roadside. In other cases, the driver steered back toward the road but the vehicle yawed across to the other side of the road where it either struck another vehicle or continued off onto the roadside.

Secondly, related to the problem of unsealed shoulders, alcohol intoxicated drivers often ran off the road at locations where there was no road edge lining, especially at night when visibility of the road edge would have been compromised. The beneficial effect of edge lining on the lateral position of a vehicle driven by an intoxicated driver has been demonstrated in past research (eg 4).

Thirdly, collisions with roadside hazards, particularly trees and utility poles, were very common in alcohol related crashes. The roadside hazards that were struck in these crashes were almost all less than six metres from the road edge, with the average distance being less than four metres.

On the basis of these findings, it can be concluded that successful methods of reducing alcohol related crashes in rural areas would include sealing of shoulders, line marking of road edges and clearance of roadside hazards within 10m of the side of the road. Due to these crashes commonly beginning with vehicles running off the road to the left on right curves, the implementation of these countermeasures should begin on the outside of right curves. These road treatments, as well as specifically reducing the likelihood of alcohol related crashes, would be of benefit to all drivers (5).

Finally, although drivers in alcohol related crashes have exhibited carelessness by the very act of driving while intoxicated, it is not acceptable that such drivers should pay for their mistakes with serious injuries or worse. Although countermeasures for alcohol related crashes that are aimed at changing the behaviour of drinking drivers are both worthwhile and necessary, it is important that these measures are complemented by those directed at the road infrastructure. One of the clearest

findings from the in depth study was that crashes are the result of a combination of factors related to both the drivers and the environment in which they are expected to drive.

**References**


1. Armour M, Carter RE, Cinquegrana C, Griffith JR. Study of Single Vehicle Rural Accidents (Volume 1): Accident Data Report. Road Traffic Authority: Victoria, 1989 Report No GR/89/4.

2. Ryan GA, Wright JN, Hinrichs RW, McLean AJ. An In Depth Study of Rural Road Crashes in South Australia. Federal Office of Road Safety, Canberra, Australia, 1988, Report No CR 78.

3. Holubowycz OT, Kloeden CN, McLean AJ. Age, sex and blood alcohol concentration of killed and injured drivers, riders and passengers. Accid Anal and Prev 1994; 26: 483-492.

4. Johnston IR. Going 'round the bend' with the drinking driver. In: Proceedings of the American Association for Automotive Medicine Conference, 1981, p177-188.

5. Ross HL. Confronting Drunk Driving: Social Policy for Saving Lives. Yale University, New Haven, 1992.

# The Role of Alcohol, Licit and Illicit Drugs in Traffic in Eastern Europe

T. Varga[1], M. Vali[2], R. Wachowiak[3], F. Longauer[4], M. Zorec-Karlovsek[5]

[1]Dept. of Forensic Medicine, University of Szeged, Hungary
H-6724, Szeged, Kossuth Lajos sgt. 40., P.O. Box 92
[2]Estonian Bureau of Forensic Medicine, Tallin, Estonia
[3]Dep. of Forensic Medicine, University of Poznan, Poland
[4]Dept. of Forensic Medicine, University of Kosice, Slovak Republic
[5]Dept. of Forensic Medicine, University of Ljubljana, Slovenia

**Abstract**
The role of alcohol, licit and illicit drugs in fatal traffic accidents were investigated in a multicenter, prospective study in five European countries during the period 01.01-31.12.2001. The alcoholic intoxication remained risk factor in all of the countries, the rate of intoxication was 43,1 % at the pedestians, 40,1 % at the drivers, 38,1 % at the motobike and 32,1 % at the bike drivers. The licit drug use is sporadical, illicit drug use was found to be relative common only in Slovenia.

**Introduction**
In the past decades the prescribed medicinal drugs and the abused licit and illicit drugs have been playing an increasing role among the risk factors of road traffic accidents. In the past years data coming from the territory of the USA indicate that their occurrence in fatal accidents have already exceeded the number of those affected by drunken driving. In Europe the situation is better but surveys also indicate that the number and proportion of licit and illicit drugs have been on the increase. The situation in Western Europe – the preliminary results of the ROSITA project – was reported about in the T-2000 conference in Stockholm.

In the absence of data the Central-Eastern European situation is not known. In most of the countries in the region there are no national statistics summarising the toxicological results, and the laboratory tests and their frequency are not unified.

In our project we carried out a prospective survey of 5 countries about the occurrence of alcohol and licit and illicit drugs in fatal traffic accidents. The institutions that participated in the project agreed to comply with the previously defined minimum conditions of the analytical tests.

**Material and Method**
The department of forensic medicine in Tallin, and the departments of forensic medicine at the universities of Szeged (Hungary), Kosice (Slovak Republic), Ljubljana (Slovenia) and Poznan

(Poland) were the participating institutions in the survey. The population of the surveyed regions are as follows:

| | |
|---|---|
| Tallin (EST) | 1,431,600 |
| Szeged (H) | 428.000 |
| Kosice (EK) | 998.000 |
| Ljubljana (SLO) | 1.927.000 |
| Poznan (P) | 830.000 |

The survey included all the individuals who suffered fatal traffic accidents between 01.01.2001-31.12.2001. Together with the sex and age, the scene and the time of the accident and the role the victim had played were assessed on the basis of the police reports. After the post mortem examinations there were toxicological tests in each case where death occurred either on the scene of the accident or in six hours after admittance to hospital. In case of longer survival the occasional presence of alcohol or drug was assessed on the basis of clinical data (17,8 %).

The tests of blood and urine alcohol concentration were carried out by headspace gas chromatographic method. Immunological (FPIA) methods were used to detect licit and illicit drugs in the urine in the preliminary tests. (Cut-off values: amphetamine, methamphetamine, TCA - 150 ng/l, THC-COOH 25 ng/l, opiates, methadone, cocain – 50 ng/l, benzodiazephines – 40 ng/ml, barbiturates - 60 ng/ml, phencyclidine – 25 ng/ml). In every case a thin-layer chromatographic test was also performed on urine and liver samples. In case of positive preliminary tests confirmation and quantitative determination was done by Gc-MS and HPLC-DAD. (In Estonia in the post-mortem examinations only the alcohol tests were performed routinely. The toxicological analysis was only occasional.)

**Results**

At the given time altogether 712 individuals were tested according to the following distribution:

| | **Survival time** | | **Total** | **Mortality** |
|---|---|---|---|---|
| | **0-6 h** | **> 6 h** | | **No / 100.000** |
| Tallin | 132 | 10 | 142 | 9,92 |
| Szeged | 43 | 18 | 61 | 14,95 |
| Kosice | 114 | 7 | 123 | 12,32 |
| Ljubljana | 207 | 80 | 287 | 14,89 |
| Poznan | 87 | 12 | 99 | 11,93 |

In analyses about the role played in the accident alcoholic impairment was the highest for pedestrians (43.1%) whereas it was the lowest for the passengers of vehicles (30.5%). Its occurrence was highest in Estonia (45.1%) and the lowest in Poland (25.3%). The average blood alcohol concentration (1.76 g/l) is the highest in the Polish sample (2.17%) and the lowest in the Slovenian sample (1.63%) (Table 1).

**Table 1: The absolute number of victims related to the intoxicated victims in the investigated countries**

| County | Pedestian | Driver | Passenger | Motobike | Bike | Total |
|---|---|---|---|---|---|---|
| Estonia | 54/26 | 40/18 | 39/16 | 2/0 | 8/4 | **242/64** |
| Hungary | 16/7 | 18/5 | 8/2 | 7/2 | 12/4 | **61/20** |
| Holland | 34/10 | 28/7 | 28/5 | 10/0 | 8/3 | **99/25** |
| Slovak Rep. | 51/22 | 32/13 | 29/12 | 3/2 | 8/0 | **123/49** |
| Slovenia | 42/20 | 114/50 | 65/15 | 50/20 | 20/7 | **287/112** |
| **Total** | **197/85** | **232/93** | **164/50** | **63/24** | **56/18** | **712/270** |

Most of the dead people (62.2%) were males, and the frequency of their alcoholic impairment (43.3%) and average blood alcohol concentration were higher than in case of women where the values were 10.9% and 1.45g/l (Table 2).

**Table 2: Distribution of the rate of alcohol intoxication and tha average blood alcohol concentration**

| | Male | | Female | |
|---|---|---|---|---|
| | **rate (%)** | **ΔBAC (g/l)** | **rate (%)** | **ΔBAC (g/l)** |
| Pedestian | 52,2 | 2,11 | 13,0 | 2,13 |
| Bike driver | 33,3 | 1,78 | 12,5 | 1,30 |
| Driver | 44,0 | 1,72 | 4,2 | 1,68 |
| Motobike dr. | 39,7 | 1,34 | 33,3 | 0,71 |
| Passenger | 35,4 | 1,73 | 11,4 | 0,78 |

The differences between the countries are not significant. The average frequency for males is between 33.8% (Poland) and 48.9% (Slovak Republic) and the blood alcohol concentration is between 1.68 g/l (Slovenia) and 2.20 g/l (Poland). Pedestrians are most frequently under the influence of alcohol in Hungary (63.6%) and the most rarely in Poland (39.1%). Drivers are most frequently under the influence of alcohol in Slovenia (49.5%) and the most rarely in Hungary (33.3%). The average frequency for female victims is between 6.4% (Poland) and 15.4% (Slovenia), and the blood alcohol concentration is between 0.85 g/l (Hungary) and 2.73% (Slovak Republic).

As to the age, the drunkenness of drivers under 20 is relatively rare (26.3%) and the average blood alcohol concentration is also low (1.13 g/l). The highest frequency (47%) is between 31 and 40 years of age. The highest average blood alcohol concentration (2.14 g/l) is between 51 and 60 years of age (Figures 1-2).

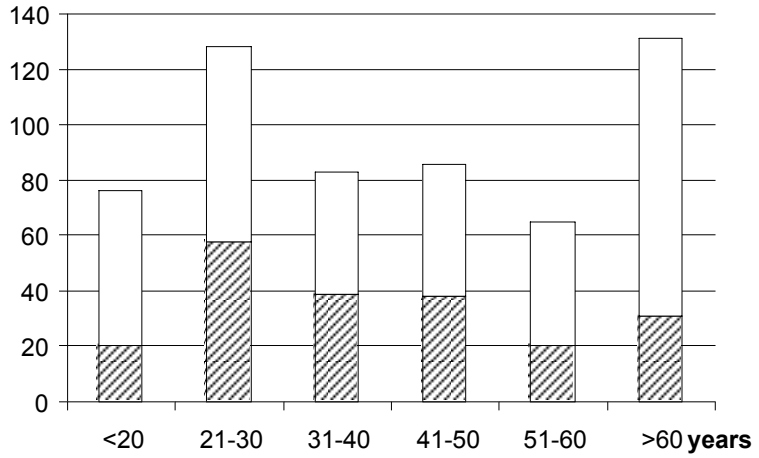



**Figure 1: The absolute number of victims and intoxicated victims according to age**

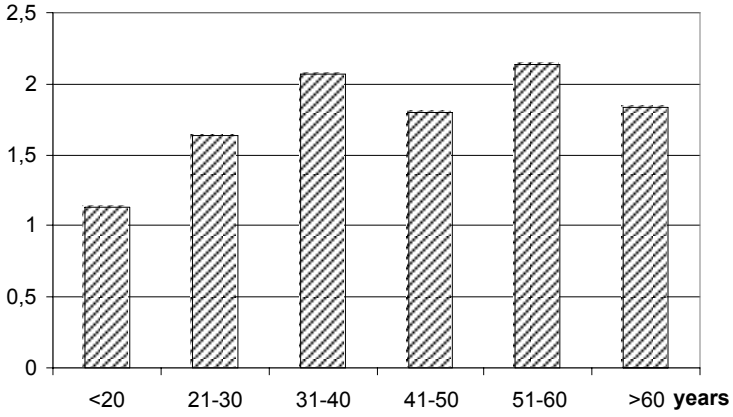



**Figure 2: Average blood alcohol concentration according to age**

The smaller part of fatal traffic accidents happened in cities (42.5%) where the proportion of drunkenness is lower (32.9% in cities, 38.6% on the outskirts). However, there is no considerable difference in the average blood alcohol concentration (Table 3). There is no significant difference in the distribution between the countries either.

**Table 3: The rate of accidents and the intoxication according to the site of accident**

| | Cities | | Outskirts | |
|---|---|---|---|---|
| | rate of accidents | rate of intoxication | rate of accidents | rate of intoxication |
| Pedestian | 65,5 % | 38,7 % | 43,5% | 46,9% |
| Bike driver | 48,9% | 13,0% | 52,1% | 44,0% |
| Driver | 31,8% | 31,1% | 38,2% | 42,7% |
| Motobike dr. | 39,9% | 45,5% | 61,0% | 35,1% |
| Passenger | 31,0% | 25,6% | 69,0% | 39,1% |

Most of the accidents (63.9%) happened during the day (6 a.m. – 20 p.m.) and drunkenness is also considerably lower (25.4% during the day and 54.6% during the night). There is no difference between the average values of drunkenness. (Table 4)

**Table 4: The rate and the average blood alcohol concentration according to the time of the accident**

| | Nighttime (20-06) | | Daytime (06-20) | |
|---|---|---|---|---|
| | rate (%) | ΔBAC (g/l) | rate (%) | ΔBAC (g/l) |
| Pedestian | 69,8 | 2,14 | 29,0 | 1,99 |
| Bike driver | 50,0 | 1,79 | 26,3 | 1,73 |
| Driver | 58,4 | 1,64 | 26,1 | 1,90 |
| Motobike dr. | 65,0 | 1,66 | 26,8 | 0,91 |
| Passenger | 36,4 | 1,59 | 20,3 | 1,49 |

There are major differences between the drunkenness of drivers in the various countries. During the day it is the Polish value (13.0%) that differs from the average, whereas during the night it is the Slovak value (47.1%). In Hungary 25% of the drivers who deceased at night were intoxicated, and the value in Slovakia is 33.3%, in Poland it is 80%, in Slovenia it is 67.3%.

The values of licit and illicit drug use in Estonia cannot be evaluated. In Hungary in the blood of a driver medicinal benzodiazphine could be detected and in the urine of a passenger alcohol and mentaphetamine could be traced. In Slovakia only in case of pedestrians and passengers was it possible to detect analgeticum in blood in 2 cases and THC-COOH in urine in 1 case. In Poland in the blood of 2 drivers and 1 pedestrian benzodiazepin was detected in therapeutic concentration without the presence of alcohol. In Slovenia in 22 cases also the presence of drugs or their metabolites were detected in blood and/or urine: benzodiazepines (10) /midazolam (6), oxazepam (2), diazepam (1), bromazepam (1)/, morphine (6), THC (5), tramadol (4), methadone (2), citalopram (1), ketamine (1)/.

Detailed study of drug positive cases cleared up that in 9 cases the presence of midazolam, tramadol, ketamine and morphine was the consequence of medical treatment. In 6 cases only the

presence of drugs in urine were detected: THC-COOH (4), THC-COOH and oxazepam (1), oxazepam (1). In 7 cases (4.1%) driving under the influence of drugs and drugs and alcohol was confirmed: 2 (tramadol), 1 (methadone, morphine, codeine), 1 (methadone, ethanol), 1 (morphine, ethanol), 1 (diazepam, ethanol), 1 (citalopram, bromazepam).

**Discussion**

Data about drunken driving are only available in Hungary. The value of 1.03% observed here is a lot more favourable than the values observed elsewhere with the exception of the Scandinavian countries. The occurrence of drunkenness is however higher in every examined field in case of all the fatally injured drivers as compared to the data published in Western Europe despite the fact that drunken driving is against the law in each country except for Slovenia. The higher frequency values cannot be explained with less skilfulness and the underdeveloped road infrastructure because publications from the territories of the USA also coincide with these data. The drinking habits and the lack of obedience to the laws are more likely to explain the coincidence. The considerable regional differences can also be deducted from these factors. Drunken driving is a typical male behaviour and the sexual distribution regarding the regional differences can mainly be connected to the degree of motorization (female drunken driving could only be detected in Slovenia).

Distribution by age corresponds to other publications. Low occurrence among teenagers can be explained by the drinking habits and the provisional driving licence that has been introduced in some countries (Hungary). The highest frequency and blood alcohol concentration could be found in the generations mostly affected by chronic alcoholism but it also corresponds to the international trends. The same refers to the average blood alcohol concentration of 1.5% - 2.5%. This latter one alone also indicates that most of the drunken victims were regular drinkers.

High frequency among pedestrians has to be emphasised, which is mainly manifested in accidents at night in the outskirts. In this respect there are considerable regional differences: the Slovenian-Hungarian-Slovak values considerably exceed the data of Estonia and Poland. There apart from the differences in the drinking habits the different settlement structure may play a significant role.

The licit and illicit use of drugs in the examined regions is only considerable in Slovenia but the frequency of occurrence is also below the values published in Western Europe and the USA. Although the use of drugs has also been exponentially increasing in the last decade in the Central and Eastern European countries, it does not cause dangerous situations in most of these countries, which could be evaluated.

**References**

1. de Gier J.J.: Review of investigations of prevalence of illicit drugs in road Traffic in different European countries. In: Road traffic and drugs. Council of Europe Publishing. Strasbourg. 1999. pp. 13-62.

2. Verstraete, A.G.: Roadside testing assesment (ROSITA): a European uniun project on roadside drug testing. In: T'00 Alcohol, Drugs, and Traffic Safety. Stockholm. 2000. pp. 265.

3. Kroj, G., Friedel, B.: Alcohol related road accidents in Federal Republic of Germany. In: T'97 Alcohol, Drugs, and Traffic Safety. Annecy. 1997. pp.1211-1217.

4. Varga, T., Szendrényi E., Jeszenszki, E.: Fatal pedestian accidents in South-east Hungary. In: T'00 Alcohol, Drugs, and Traffic Safety. Stockholm. 2000. pp. 319.

# The Establishment of a Methodology to Measure the Effects of Alcohol on Pedestrian Road Crossing Behaviour

Lenné, M., Oxley, J., Corben, B., Potter, J.

Accident Research Centre

**Abstract**
Background/Introduction: A recent inquiry by the Parliamentary Road Safety Committee of Victoria into the Incidence and Prevention of Pedestrian Accidents, identified alcohol-impaired pedestrians as an at-risk group for involvement in a crash. As a result, research was commissioned to identify a measure of pedestrian intoxication.

**Objectives**
To establish a methodology for measuring the effects of alcohol on key pedestrian behaviours in the laboratory.

**Methods**
The effects of alcohol on the decision-making processes involved when crossing the road in front of approaching vehicles, and particularly the ability to select safe gaps in the traffic, are examined. The effect of alcohol on functional performance is also measured, and correlated with the ability to make appropriate crossing decisions. This task has been used previously to examine the skills of older and younger pedestrians, and has been validated against in-the-field ratings. Thirty participants attend a no alcohol control condition and a further 30 attend an alcohol condition (0.10 ml/kg for a target BAC around 0.10%). Participants view a series of simulated traffic scenes in which vehicle speed and time gap are manipulated, and are required to make a yes/no response as to whether they would cross the road in that situation, and then a safety rating response. Participants also complete a battery of functional performance assessments.

**Results/Discussion**
Analysis of the data collected will be described in the full papers. The key outcome from this project is to establish this methodology as being a valid measure of the effects of alcohol intoxication on critical behaviours necessary for safe pedestrian activity. Future studies will develop the task to further explore the impairing effects of alcohol and other drugs on pedestrian behaviour.