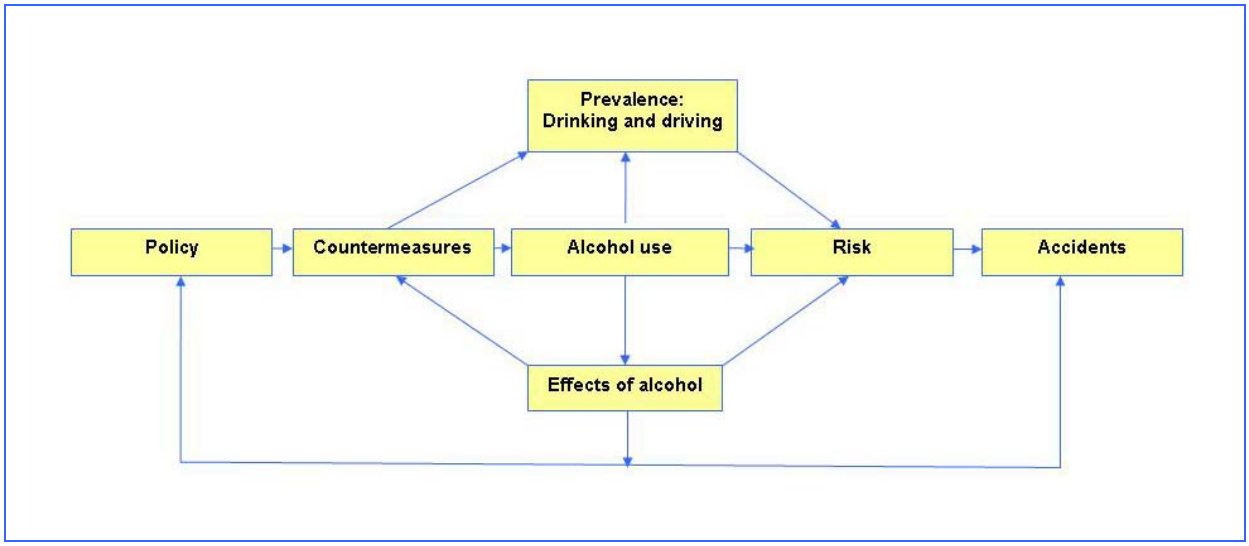
Alcohol

Transport

Project co-financed by the European Commission, Directorate-General Transport and Energy

1. Alcohol

Diagram & Summary



The scope of the problem
About 25% of all road fatalities in Europe are alcohol related whereas about only 1% of all kilometres driven in Europe are driven by drivers with 0.5 g/l alcohol in their blood or more. As the Blood Alcohol Concentration (BAC) in the driver increases, the crash rate also rises. The increase in crash rate that goes with increasing BAC is progressive. Compared to a sober driver the crash rate of a driver with a BAC of 0.8 g/l (still the legal limit in 3 of 25 EU-member states) is 2.7 times that of sober drivers. When a driver has a BAC of 1.5 g/l his crash rate is 22 times that of a sober driver. Not only the crash rate grows rapidly with increasing BAC, the crash also becomes more severe. With a BAC of 1.5 g/l the crash rate for fatal crashes is about 200 times that of sober drivers.

Why is drink driving so dangerous?
Alcohol diminishes one's driving skills at all possible levels. The driving task can be divided in three different levels. At the lowest level there are the tasks dealing with keeping a proper speed and keeping course (steering, accelerating, braking, etc.). Most of the skills related to this level, such as tracking performance, reaction times, and visual detection, already begin to deteriorate at a BAC below 0.5 g/l. At the intermediate level decisions are made dealing with concrete traffic situations (can I safely overtake that other car, do I have to give way, etc.). Skills related to this level are dividing attention, scanning capabilities, and, more in general, information processing. These skills also begin to deteriorate at very low BAC levels. At the highest level decisions are made whether one should drive or not. It is well known that after having consumed alcohol, self control becomes less stringent and when even a little bit drunk, people are more inclined to think that they are still able to drive safely.

What are effective measures?
The problem of drink driving is not new and very many measures have been taken. A very successful measure was the introduction of pocketsize breath testing devices by the police back in the 1970s. Despite the fact that drink drivers now know that they can be caught and that sanctions are tough, and despite public opinion regarding drink driving having changed considerably (most people in Europe nowadays wholeheartedly disapprove of drink driving),

alcohol impaired road users are still involved in about a quarter of all fatal crashes in Europe. New and better measures are needed.

At the core of the measures are the legal limits. This limit should be 0.5 g/l or lower for the general driver population, but not so low that, due to insufficient police capacity, it starts to hamper the detection of drivers with the highest BAC levels. The legal limit for novice drivers should be 0 or just above 0 when enforceability is taken into account.
Further more it is recommended:

- To have random breath tests for all drivers and not only for 'suspected' drivers
- To raise the chance of getting caught by carrying out more random roadside breath tests (especially at times and on spots where drink driving is expected)
- To have alcohol ignition interlocks installed in the cars of severe first time offenders and all recidivists in combination with a driver improvement course
- To have better public campaigns and education programmes (for all age groups) based on scientific research
- To reduce the availability of alcoholic beverages, especially for young novice drivers. This can be done by raising the age limit for buying alcohol and by banning the sales of alcoholic beverages in petrol stations and transport cafes.

2. Prevalence & rate of alcohol consumption

2.1 Alcohol consumption

Alcoholic beverages are popular throughout Europe. The drinking patterns and the type of drink (wine, beer, and spirits) that is predominantly preferred may vary from country to country, but in all EU-member states alcohol consumption is substantial. In Figure 1 the litres of pure alcohol consumed per capita (total population) of 23 EU-members states over the years 1997-2003 are presented. Information from Lithuania and Slovenia is missing.

Although drinking is popular in all EU-member states, there are considerable differences. In countries like Sweden and Malta the alcohol consumption per capita is only one third of that of Luxemburg, the Czech Republic and Hungary. When interpreting the results one has to realize that the actual consumption in Luxemburg is probably lower than mentioned in Figure 1. The amount of alcohol consumed is based on sales. Alcoholic beverages are relatively cheap in Luxemburg and Luxemburg is a small country. For this reason it is very attractive for inhabitants of neighbouring countries that live close to the border to buy spirits in Luxemburg and consume them in their own country. In Latvia, Estonia, Hungary, Finland, Cyprus, and the U.K there has been an increase in alcohol consumption over the years and in Germany, Portugal, France, Greece and Italy there is a downward trend. In the other countries the alcohol consumption has remained more or less the same over the years.

In some countries people tend to drink a regular amount of alcohol every day whereas in other countries people drink occasionally, but when they drink, they drink quite a lot. Figure 2 presents the self reported number of days in the past month in which alcohol was consumed in the 15 old EU member states.

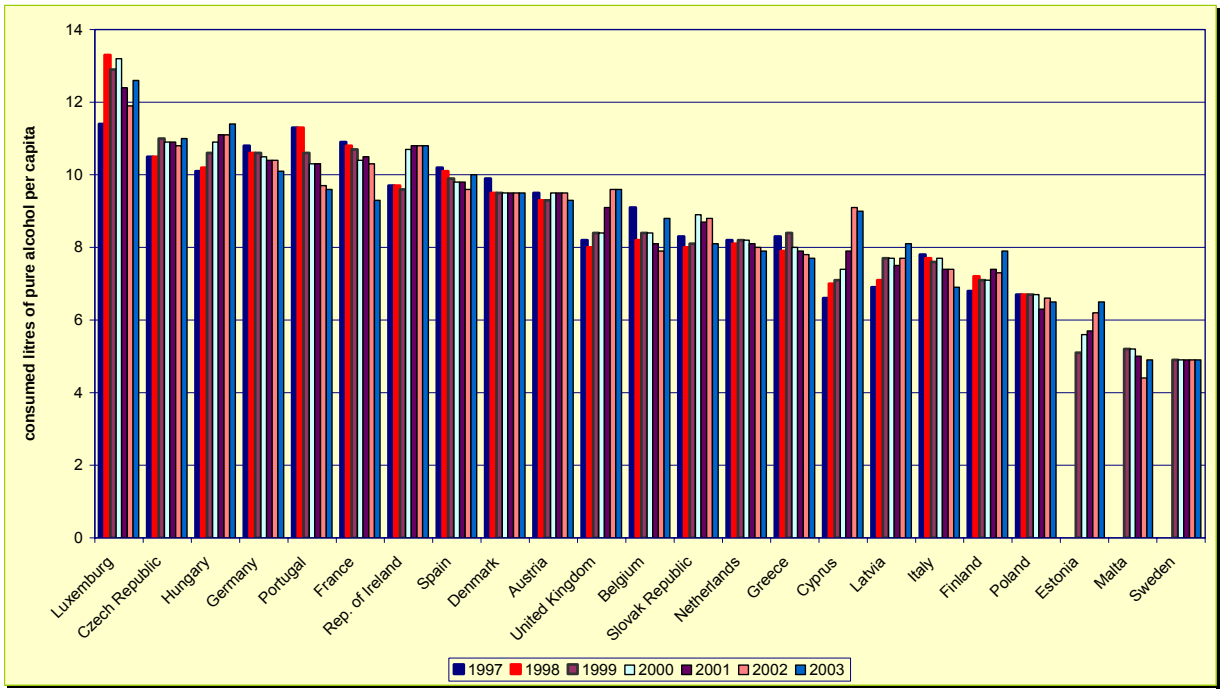


Figure 1: Consumed litres of pure alcohol per capita (1997-2003). Source: World Advertising Research Centre

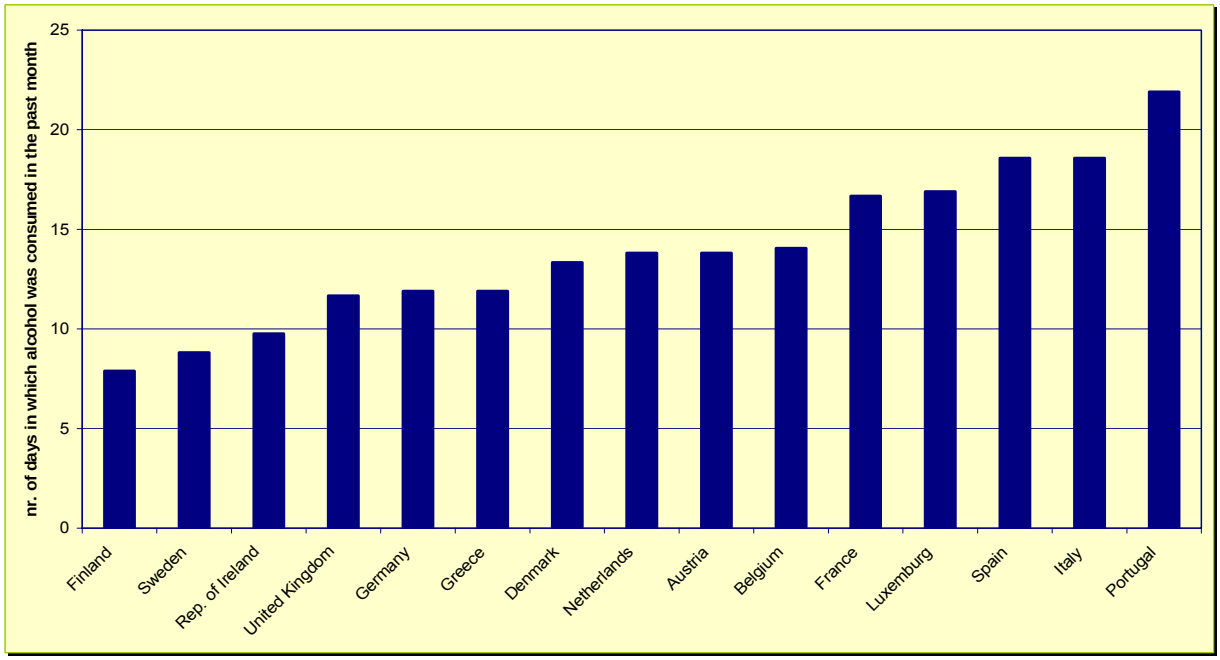


Figure 2: Self reported number of days in the past month in which alcohol was consumed. Source: Health, Food and Alcohol and Safety, European Opinion Research Group EEIG, special Euro barometer, European Commission (December, 2003)

In most of the southern wine producing countries like Spain, Italy and Portugal people tend to drink daily and in the northern countries (Finland and Sweden) people tend to drink only at the weekend. Considerably more men (72.9%) than women (49.9%) say that they have consumed alcohol in the past month. When the question is put: "How many times in the past

month have you consumed the equivalent of one bottle of wine, five pints/bottles of beer, or e measures of spirits on one drinking occasion?", the results are quite different (see Figure 3).

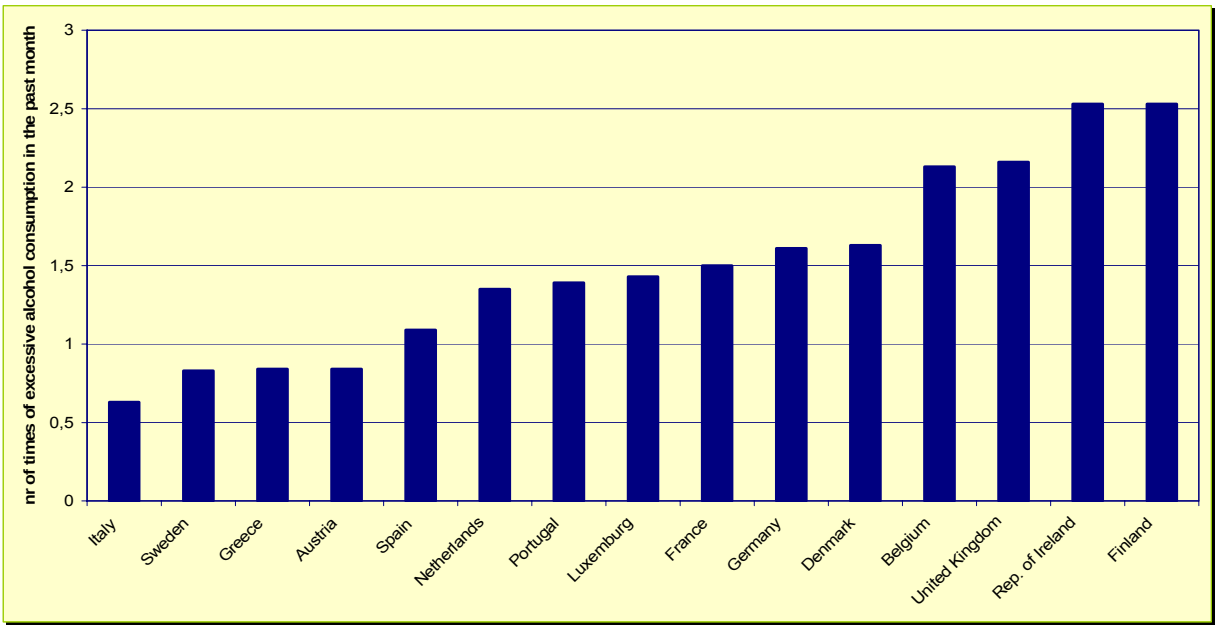


Figure 3: Self reported number of times the equivalent of one bottle of wine or five pints/bottles of beer or five measures of spirits on one drinking occasion was consumed in the past month. Source: Health, Food and Alcohol and Safety, European Opinion Research Group EEIG, special Euro barometer, European Commission (December, 2003)

Apparently in Finland people tend not to drink very often, but when they do, they drink a lot. Whereas in Italy quite a few people drink every day, but excessive drinking during one occasion is not common.

2.2. Drinking and driving

A good comparison in the prevalence of drink driving between the EU member states is not possible as the definitions of drink drivers and the research methods applied, differ between EU-member states. It is however possible to compare drivers from various countries on their answers on questions about their drink driving behaviour. A survey that was conducted in 2002 was SARTRE3. In each of the 23 European countries that participated in SARTRE3, about 1000 drivers filled in questionnaires. Some of the questions were about their drink driving behaviour. What one has to keep in mind when reading the results of SARTRE3 is that it is self-reported behaviour. People may forget things and although the SARTRE-questionnaire guaranteed anonymity, very few drivers will admit that they have driven with probably more than the legal limit. For this reason, results on the question regarding drinking over the legal limit in the SARTRE-questionnaire are not mentioned here.

A question in the SARTRE3-questionnaire was: "How many days per week do you drive after drinking even a small amount of alcohol?" In Figure 4 you see in descending order the percentage of drivers in each country saying that they never combine drinking and driving.

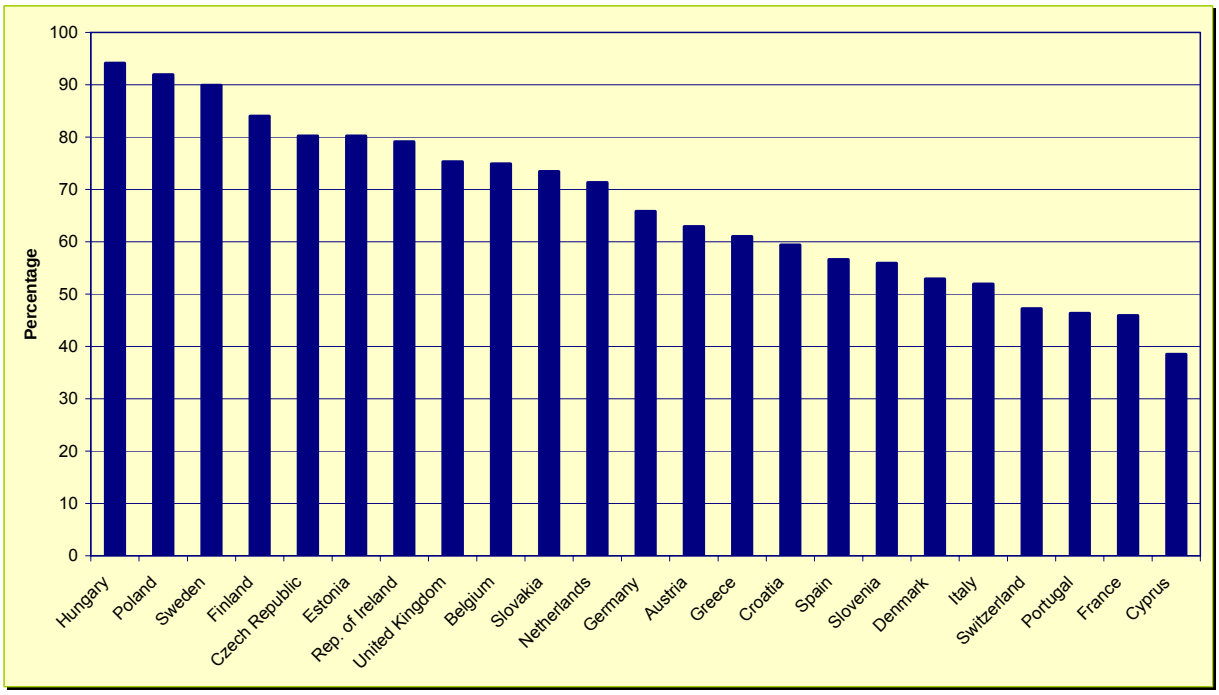


Figure 4: The answer "Never/Non drinker" on the question "How many days per week do you drive after drinking even a small amount of alcohol?". Source: SARTRE3

In Cyprus a minority of the drivers say that they have always been completely sober when driving, whereas in Hungary more than 90% says not to have consumed even the smallest amount of alcohol before driving.

Is drinking and driving more popular at certain ages? In Figure 5 one can see the percentage of drivers per age group that has replied "never" or "non drinker" to the question "How many days per week do you drive after drinking even a small amount of alcohol?".

In most countries the differences between age groups are quite moderate. People tend to think that young drivers combine drinking and driving most often, but Figure 5 shows that for most countries the opposite is the case. There are however exceptions. In Italy, Cyprus, Finland, and Belgium young drivers say that they drink and drive more often than in any other age group.

Do men combine drinking and driving more often than women? Figure 6 shows the percentages of men and women that say that they never drink and drive, be it that they are total abstainers or because they never combine drinking and driving.

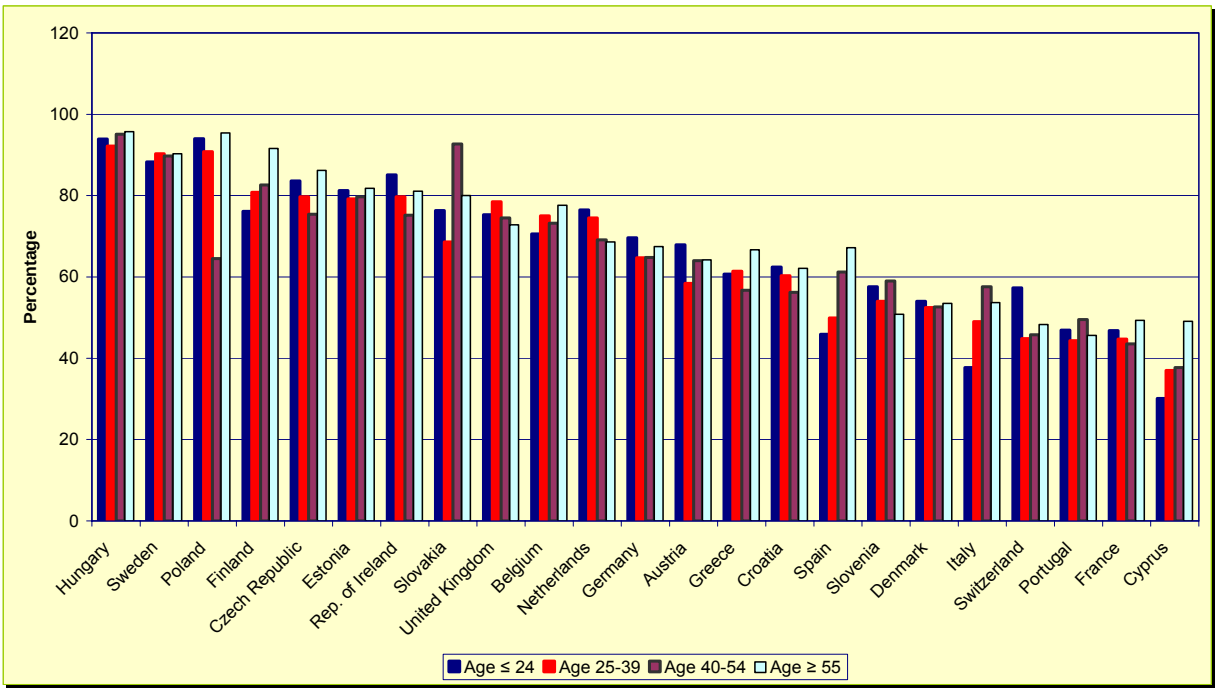


Figure 5: Drivers that say that they never drink and drive or never drink at all by age band. Source: SARTRE3

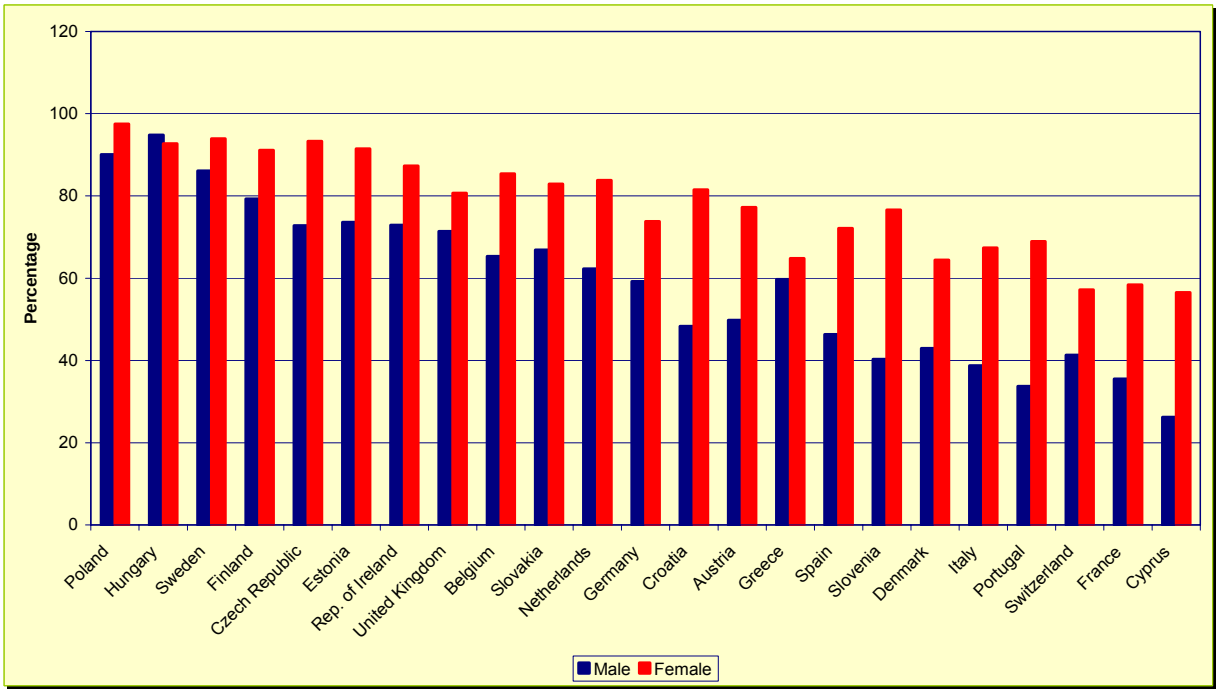


Figure 6: Drivers that say that they never drink and drive or never drink at all by gender. Source: SARTRE3

In all countries except in Hungary more women than men don't drink and drive. In Cyprus and Portugal even more than twice as many women than men say that they don't drink and drive.

2.3 The legal limit

The legal limit is not the same in all EU-member states. In the Table 1 the legal limits of the 25 EU-member states are presented. Some EU-member states have different penalties for different limits and have different limits for novice drivers and professional drivers. These limits are not mentioned in Table 1.

Country	Standard BAC limit (g/l)
Austria	0.5
Belgium	0.5
Cyprus	0.5 (was still 0.9 during SARTRE3)
Czech Republic	0
Denmark	0.5
Estonia	0
Finland	0.5
France	0.5
Germany	0.5
Greece	0.5
Hungary	0
Rep. of Ireland	0.8
Italy	0.5
Latvia	0.5
Lithuania	0.4
Luxemburg	0.8
Malta	0.8
Netherland	0.5
Poland	0.2
Portugal	0.5
Slovakia	0
Slovenia	0.5
Spain	0.5
Sweden	0.2
United Kingdom	0.8

Table 1: legal alcohol limits for the general driver population

It is only possible to estimate the prevalence of drivers that are over the legal limit in a particular country accurately, when random roadside breath tests are carried out in a systematic way. The roadside breath tests carried out by the police are not suitable for the assessment of the prevalence as most of these tests are not random, but are purposely carried out at particular times (weekend nights) and in particular spots (in the vicinity of bars and discos). Except for the Netherlands, no recent real random samples from breath tests could be found that makes it possible to estimate the prevalence of driving above the legal limit. In the Netherlands on the basis of these samples of real random roadside breath tests (all hours of the day, all days of the week) carried out between 2001 and 2004, it is estimated that of all the car kilometres driven annually, a little less than 1 percent is driven by drivers with 0.5 g/l (the legal limit in the Netherlands) or more alcohol in their blood. In the Figures 1 to 6, the Dutch performance is more or less average. This may indicate that drivers with a BAC of 0.5 g/l or more drive approximately 1 percent of the annual total of kilometres driven in Europe. In order to get accurate estimates about the prevalence of drink driving in Europe, and in order to monitor the prevalence of drink driving, it should be made obligatory for all EU-member states to carry out the same standardized random breath tests for research purposes.

2.4 Crashes and injuries

Drink drivers are clearly over-represented in road traffic crashes. Alcohol related crashes are also severe. In Germany for example, the severity of drink-drive crashes (expressed as fatalities per 1,000 injury crashes) is nearly twice as high as that of crashes in general [34]. Unfortunately, almost none of the European countries systematically test all road users involved in crashes for alcohol. Therefore, alcohol related crashes are underreported in the official statistics of most European countries. In Germany, in 2003, 6.8% of all crashes with personal injury were alcohol related, according to the police records. On the basis of a sample in which the police were instructed to try to obtain breath samples from the driver responsible for causing the crash, [23] however estimate that about 12% of all crashes in Germany are attributable to alcohol. In Finland it is compulsory to test all road users involved in a fatal crash for alcohol. From the results of these tests it is concluded that in Finland 24% of all the fatally injured drivers had a BAC of 0.5 g/l alcohol or more. In Sweden more than 90% of all fatally injured drivers are tested. 28% of the drivers that had died in traffic in Sweden in 2004 had alcohol or other drugs in their blood. And in France from a sample of 7458 fatal crashes that happened between October 1st 2001 and September 30th 2003, 28.6% (95% confidence interval; 26.8% - 30.5%) appeared to be attributable to drivers that had alcohol in their blood [29].

It is also possible to estimate the number of drink drivers that have died in traffic crashes on the basis of the number of drivers that have ended up in hospital after a crash and are tested for alcohol. In a random sample in the Netherlands, 25% of severely injured drivers that had ended up in hospital, had alcohol in their blood [26]. Drink drivers not only kill themselves, but they also kill other road users (their passengers and/or the occupants of the vehicles and pedestrians they crash into). Based on the above mentioned research in the Netherlands, we estimate that around 25% of all the annual traffic fatalities are attributable to alcohol. Not only drink driving but also drink walking, drink riding and drink cycling cause fatalities. For instance Keigan & Tunbridge [22] estimate that in the United Kingdom 39% of the fatally injured adult pedestrians have a BAC-level that exceeds the legal limit for drivers (0.8 g/l) in the UK. In regard of all the percentages mentioned, the rather speculative estimation made by the European Commission that one quarter of the entire annual road fatalities in the European Union are due to alcohol, is probably not an exaggeration. If one assumes that the prevalence of drivers with a BAC of 0.5 g/l or more in is around 1 % of the total driver population in Europe (as is estimated for the Netherlands), than 1% of the drivers is responsible for around 25 % of the road fatalities in Europe.

2.4.1 Crash rate

The crash rate is calculated on the basis of epidemiological studies. To estimate the relative rate for drink drivers of getting involved in a crash, the distribution of BAC-levels in the entire driver population (measured in random roadside breath tests) is compared with the distribution of BAC-levels among drivers involved in crashes. These so-called case-control studies have been repeated over and over again and the results are very similar. A much-cited one is the Grand Rapids study by Borkenstein [8]. Borkenstein and colleagues were the first to carry out a profound case-control study. With the aid of modern techniques it is possible to control for even more confounding factors than in the Grand Rapids study. A methodologically sound modern case-control study is the study by Compton [9]. The results of this study are shown in Figure 7.

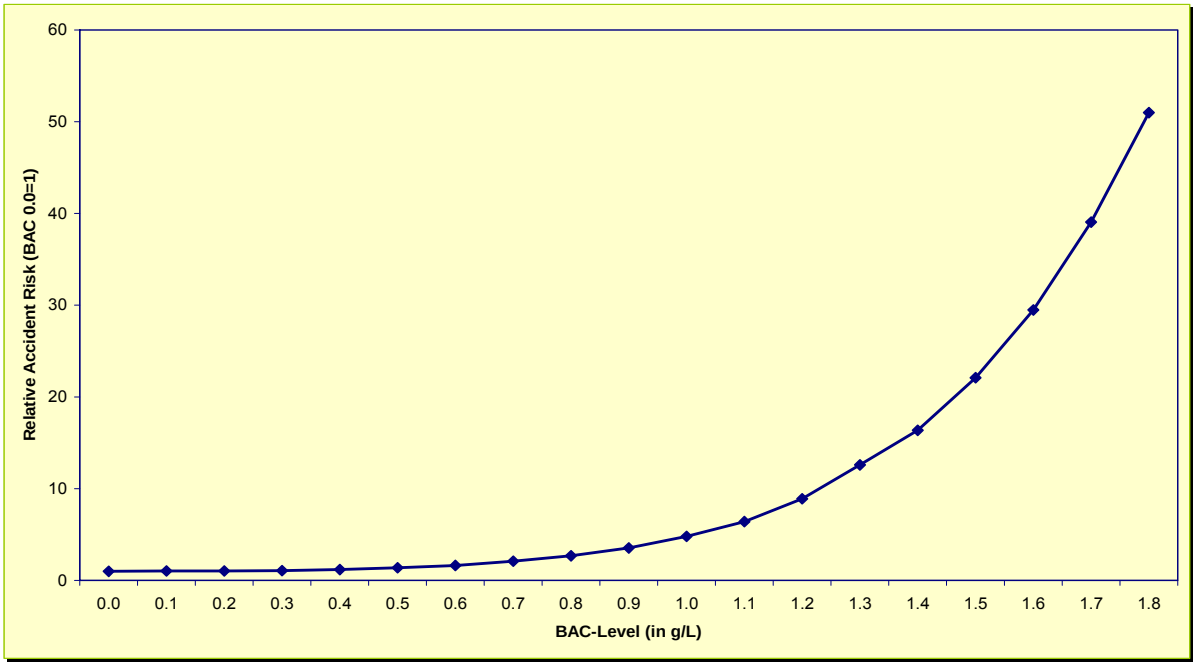


Figure 7: Relative rate for drink drivers to be involved in a crash as their BAC-level increases. The rate of a sober driver is set at 1. Source: Compton et al, 2002

The relationship between relative crash rate and BAC-level is exponential. From Figure 7 we may conclude that for instance the crash rate per kilometre driven for a driver with 0.8 g/l alcohol in his blood (still the legal limit in the United Kingdom, Ireland, Luxemburg, and Malta) is approximately 2.7 times higher than the rate for a sober driver. A difference between Figure 7 and the often cited but old 'Borkenstein curve' is, that the 'Borkenstein curve' had a small dip in relative crash rate for low BAC-levels between 0.0 g/l and 0.5 g/l. but the 'Compton curve' has not. Another difference is that the 'Compton curve' is steeper than the old 'Borkenstein curve'.

The curve for involvement in only fatal crashes is different from the curve for crash involvement in general. Up to BAC 1.0 g/l the rise in rate of crash involvement in general and the rise in rate of involvement in a fatal crash is more or less the same. Above this level the rise in rate for fatal crashes is much steeper than the rise in rate for all crashes. The relative crash rate for a driver with a BAC of 1.5 g/l is about 22, but his relative crash rate for fatal crashes with that amount of alcohol in his blood is about 200 [33]. Thus with increasing BACs not only the rate of a crash increases, but also the severity.

The increase in crash rate with increasing BACs is not the same for all age groups. In the United States, based on the crashes database (FARS) over the years 1987-1999, Preusser (2002) has developed Table 2:

	Relative Crash Rate								
Age	BAC 0.0	BAC 0.1	BAC 0.2-0.3	BAC 0.4-0.5	BAC 0.6-0.7	BAC 0.8-0.9	BAC 1.0-1.4	BAC 1.5-1.9	BAC ≥0.2
16-20	3.31	4.37	4.12	5.44	8.17	10.10	15.77	25.30	28.19
21-24	1.79	2.18	2.59	4.42	6.11	8.13	10.73	16.43	26.00
25-34	1.25	1.38	1.89	2.32	2.94	4.37	7.27	11.61	16.08
35-49	1.00	1.09	1.49	1.78	2.62	3.56	5.64	10.44	16.99
50-64	1.02	0.93	1.17	1.24	2.03	2.23	4.71	8.48	13.24
65+	2.04	1.97	2.49	2.50	2.50	3.55	4.83	7.48	9.48

Table 2: Relative crash rate by BAC and age group. Source: Preusser (2002)

From Table 2 we conclude that low doses of alcohol (lower than 0.5 g/l) have a far more devastating effect on young drivers (24 years of age and younger) than on older drivers (older than 24 years of age). Keall et al [20] did another study on this subject in New Zealand. Figure 8 is abstracted from this study.

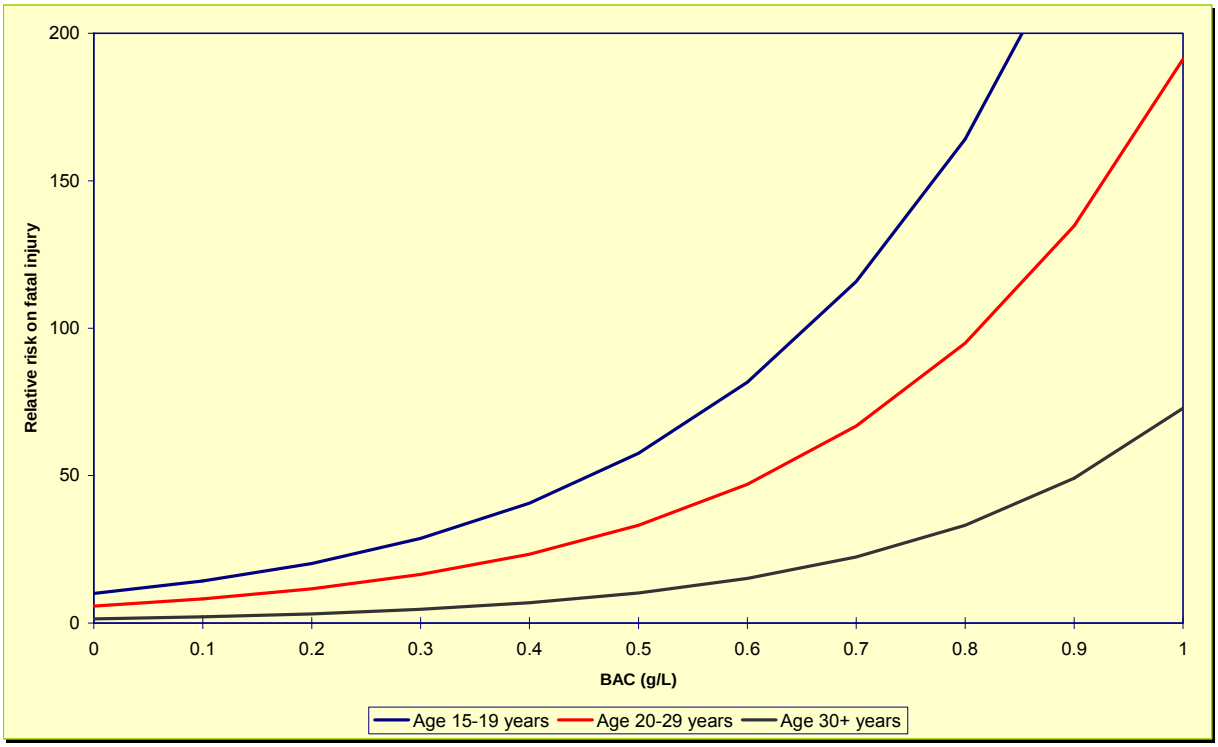


Figure 8: Relative rate of fatal injury and BAC-level per age group. Source: Keall et al (2004).

Alcohol is not the only substance that impairs one's driving skills, other substances also do. In particular when illicit drugs are combined with alcohol, the effects are devastating. A case-control study in the Netherlands [26] revealed that the relative injury rate of BAC 0.5-0.8 g/l was 8.28 (95% confidence interval; 2.73-25.2) when only alcohol was consumed. For BAC 0.2- 0.8 g/l + illicit drugs it was 12.9 (95% confidence interval; 3.78-44.2). For BAC ≥ 0.8 g/l in combination with illicit drugs it even was 179 (95% confidence interval; 49.9-638). In another case-control study in France [24] it was found for at fault drivers in fatal crashes, that the relative rate of drivers that were intoxicated by both alcohol and cannabis (a relative rate of 14) was about the same as the product of relative rate of cannabis alone (a relative rate of 1.78) and alcohol alone (8.51).

Developments over time

Is the drink driving problem in Europe increasing or decreasing? To answer this question one needs to know the annual proportion of all fatalities and injuries in all EU-member states that are attributable to alcohol over a long period of time. Some EU-member states have quite reliable statistics about prevalence and the number of fatalities attributable to alcohol, but most EU-member states have not.

Swedler et al [34] have analysed a large number of studies on the drink driving problem in various countries over the past decades. They conclude that improved laws, stricter enforcement, and public awareness brought about by citizens' concern during the 1980s, have led to dramatic decreases in drinking and driving in the industrialized world. The decreases amounted to about 50% in Great Britain, 28% in the Netherlands, 28% in Canada, 32% in Australia, 39% in France, 37% in Germany, and 26% in the United States. Some of these decreases may be due in part to changes in lifestyle, demographic shifts, and economic conditions. In most countries the decreases reversed in the early 1990s and drinking and driving began to increase. By the middle of that decade the increases stabilized and the rate of drinking and driving began to decrease once more. These decreases were much less dramatic than those in the 1980s. At the end of the 1990s and early in the new century, the numbers vary. In some countries like France and Germany (Germany until 2002)) drinking and driving continued to decrease while in other countries (Canada, the Netherlands, Great Britain, and the United States), there was stagnation and in some cases there was a small or even a large increase, as was the case in Sweden. A major part of the increase in Sweden is believed to be related to a changing culture concerning alcohol consumption, in which everyday consumption in accordance with “continental” European habits is more common. The changing distribution between different types of beverages, in which the consumption of wine and beer is increasing and that of hard liquor is decreasing, supports this explanation. Another support is found in the fact that drinking is changing from being a weekend activity to becoming an everyday activity [28]. As an example a quantitative development for the Netherlands is presented in the box.

Drink driving developments over time in the Netherlands

Some of the estimates used to produce Figure 9 were rather speculative. Both the number of drivers with a BAC of 0.5 or more and the number of casualties (fatalities and severely injured road users) because of drink driving (the drink drivers themselves, their passengers and/or the occupants of the vehicles, and pedestrians they crash into) were indexed at 100 for the period 1980-1984.

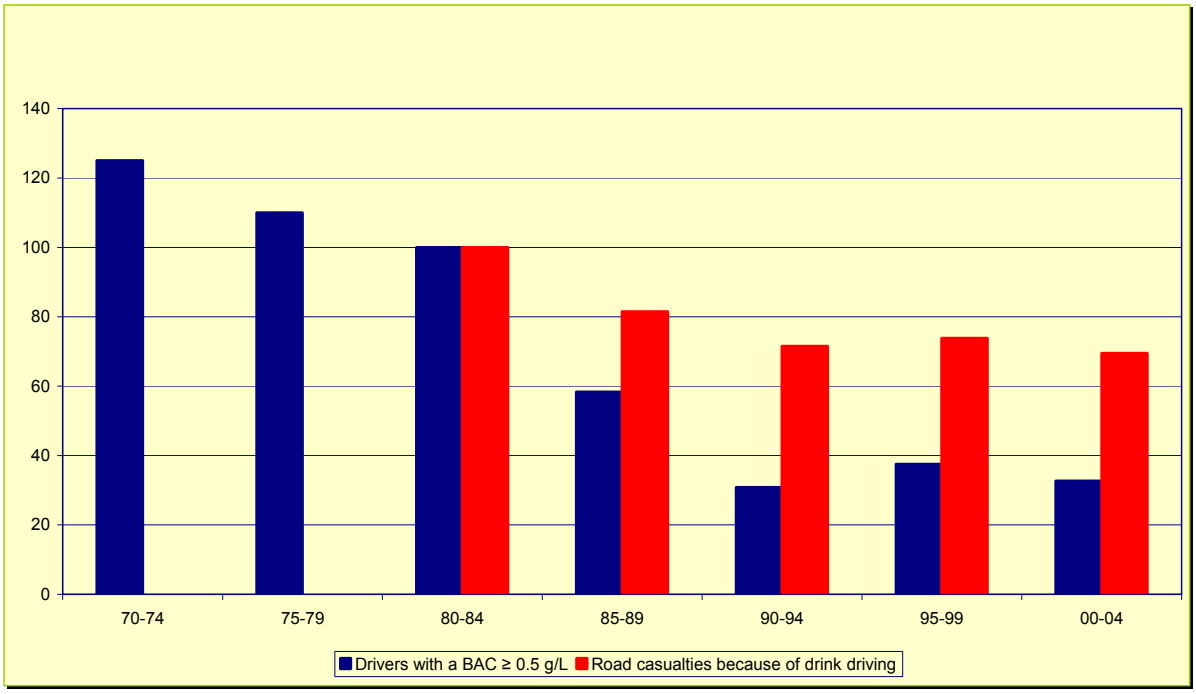


Figure 9: Indexed development in the Netherlands of the proportion of drivers with a BAC ≥ 0.5 of the entire driver population and the proportion of road casualties (fatal and seriously injured) due to drunk driving of all casualties (80-84=100). Source: Wegman, F. & Aarts, L. (Ed.) (2005)

It was not possible to estimate the proportion of casualties due to drink driving for the periods 1970-1974 and 1975-1979. From Figure 9 we conclude that in the Netherlands both the proportion of all drivers that drive with a BAC over the legal limit (BAC ≥ 0.5 g/l) in the Netherlands, and the proportion of casualties due to drink driving, are declining. However drink driving seems to decrease faster than the number of crashes that involve drink drivers. At first sight this seems strange. A possible explanation is that drink driving has indeed decreased, but the number of drivers that drive while being intoxicated by both alcohol and illegal drugs has increased. As already mentioned, in combination with drugs, even small quantities of alcohol (quantities below the legal limit) can deteriorate one's driving skills enormously. Another explanation is that at least in the period 2000-2004 the number of drivers that drive with a BAC that is over the legal has indeed decreased, but the number of hard-core drink drivers (drivers with a BAC that is high above the legal limit) has not. This relatively small group of hard-core drink drivers is probably responsible for many casualties.

3. Effects of alcohol consumption

The effects of alcohol on mental and physiological functions are numerous. Alcohol leads to both acute impairments and chronic impairments. Acute impairments are immediate but transient, whereas chronic impairments mostly develop gradually and are persistent.

3.1. Acute impairments due to alcohol consumption

Alcohol is easily absorbed in the bloodstream. The direct effects on the central nervous system (brain, spinal cord and the nerves originating from it) are the most noticeable. In the first place alcohol depresses the central nervous system. This is to say that after having consumed low quantities of alcohol, social inhibition starts to get less stringent and one begins to act and feel more emotional. However, cognitive, visual, and motor functions also begin to deteriorate after small quantities of alcohol have been consumed. Even with BAC as

low as 0.3 g/l, most people can divide their attention less adequately and are less vigilant than without alcohol. With BAC just above 0.5 g/l, most people also start to get perception problems; start to perform less well on cognitive tasks and tracking tasks. Also reaction times get longer. Motor impairment can be observed in most people with a BAC of 1.5 g/l and higher. Especially on young people, alcohol has a strong motivational and emotional impact. They get more euphoric, more impulsive and start to show off with more risk-taking behaviour. After consuming large quantities of alcohol people can become aggressive. High doses of alcohol lead to alcohol poisoning which can cause brain damage and death. There are not only acute effects because of brain dysfunctions due to alcohol, but also other parts of the body get affected. An important acute effect in relation to road safety is that the muscles weaken. This means that in case of a crash, the injuries will be more severe if a road user has consumed alcohol.

How strong the acute impacts of alcohol are depends on weight and sex. If a heavy but not fat man consumes the same quantity of alcohol as a light woman (and both are no regular drinkers), the man will be slightly less adversely affected than the woman. The reason for this is that alcohol dilutes itself in the water volume of the body and muscle tissue contains more water than fat tissue. On average men have more muscle and less fat than women.

Absorption of alcohol from a healthy adult body occurs at an average rate of about 8 grams per hour. This means that it takes about one hour and thirty minutes for one consumed glass of wine (12%) or one consumed glass (275 ml) of beer (5%) to be absorbed.

The maximum BAC-level a person has after having consumed alcohol can roughly be estimated with the help of 'Widmark formula'. This formula can be given as follows:

BAC-level (in g/l)= (Alcohol dose in grams) / (Body weight in kilograms x R)

R = the whole body alcohol distribution ratio:
R= 0.55 for females
R= 0.68 for males

Example: A man that weights 80 kilograms has consumed three cans of beer in a short period of time. Each beer can contains 33 cl beer and the volume percentage of alcohol in that beer is 5%. What would his maximum BAC-level be?

Calculation: The man has consumed (3x33cL) 1 L beer. As the alcohol concentration of that beer is 5 %, he has consumed 50 ml pure alcohol. 1ml alcohol = 0.789 grams alcohol. Thus the man has consumed (50 x 0.789) 39.45 grams alcohol. His maximum BAC-level now is: 39.45/(80 x 0.S68) = 0.9 g/l

The formula can be refined by also taking the rate of absorption of alcohol from the body in time into account. It must be stressed that the 'Widmark formula' is a rough indicator only

Even if the alcohol has completely disappeared from the body, there still can be acute effects. If alcohol has been consumed excessively, this will lead to a hangover. A hangover is the result of dehydration, low blood sugar, and poisoning. The symptoms of a hangover are: headache, thirst, vertigo, nausea, insomnia, and fine tremors of the hand. The psychological symptoms include: acute anxiety, guilt, depression, irritability, and extreme sensitivity.

3.1.1 Chronic impairments due to prolonged alcohol consumption over time

Daily consumption of no more than about 30 ml of pure alcohol for men, and about 20ml pure alcohol for women, will cause no health problems. Above these quantities there is an increasing health risk. Almost all organs of the body can be affected. Alcohol can have an impact on the following organs: liver, digestive system, heart and circulatory system, the bones, and the brain and nervous system. The diseases stemming from chronic alcohol abuse include: liver cirrhosis, Korsakoff's psychosis, cancer, strokes, pancreatitis, gastritis, high blood pressure, fertility problems, and impotence. Heavy drinking is also closely linked with social problems (at home and at work) and even mental illnesses (violence, suicide).

3.2 Effects on driver capabilities

According to an overview of studies carried out in laboratories, driving simulators and instrumented vehicles, Muscovite and Robinson [27] come to the conclusion that most skills related to the driving task already start to deteriorate at a BAC-level as low as 0.2 g/l.
The driving task can be divided in three subtasks. The first group of subtasks includes the tasks on the operational level. These are the actions that have to be carried out to keep speed and course. They include steering, changing gear, accelerating, braking but also other manual and mostly fully automated actions for manoeuvring and keeping the vehicle in an optimum operational state (i.e. switching on the windscreen wipers) while driving. The second group of subtasks includes the tasks at the tactical level. These are the decisions one has to take when participating in traffic. This consists of the application of the rules of the road (i.e. I have to yield for that other car) and decisions concerning manoeuvres that include other road users (i.e. now I can safely overtake that other car). The third group includes the tasks at the strategic level. These tasks deal with vehicle choice and route choice. In this particular case one can think of the decision a driver has to take whether he will drive or not after having consumed alcohol.

.

Alcohol affects task performance at all three levels. However the overwhelming majority of the research that has been carried out is on the effects alcohol has on the tasks at the operational level and the tactical level. Caird et al [10] give a recent overview of these studies. For the operational level of the driving task, their conclusions are:

- Tracking performance (keeping course) starts to deteriorate at a BAC as low as 0.18 g/l. Reductions in performance with respect to keeping a constant distance behind a leading vehicle (keeping headway) starts at a BAC of 0.54 g/l when the leading vehicle keeps a constant speed. When the leading vehicle changes speed, reductions in performance start at a BAC as low as 0.3 g/l
- Reaction times when driving get longer. There is a difference between a driver's capability on simple reaction time tasks and choice reaction time task. In a simple reaction time task a driver has to press a key as quickly as possible after a stimulus (auditory or visual) has been presented. In a choice reaction time task a driver has to respond differently to two stimuli by pressing one key for event A and a separate key for event B. Choice reaction time begin to deteriorate at a BAC of 0.6 g/l, and for simple reaction time task the BAC is considerably higher before significant prolonged reaction times appear
- Reactions on a visual detection task (perception*)* when driving starts to decrease significantly at a BAC of 0.8 g/l.

At the tactical level:

- Decrease in the ability to divide attention between the driving task and another task starts at BACs between 0.3 and 1 g/l (depending on the complexity of the second task). When

drivers have to divide their attention between driving and another task (i.e. having a conversation with a passenger) and this ability starts to deteriorate because of alcohol, subjects tend to focus on one of the two tasks at the expense of the other
- When BAC increases, drivers tend to fix their eyes more on the central visual field and fewer eye movements are made to the peripheral view. When under the influence of alcohol, drivers use fewer sources in the visual field to obtain information about the environment, they take longer to recognize and respond to aspects that present vital information about their environment (i.e. street signs) and they focus their attention on aspects occurring in their central field of vision often at the cost of peripheral information
- The increase in the number of mistakes and prolonged reaction times when drivers are confronted with a complex secondary task, even when small quantities of alcohol are consumed, indicates that alcohol causes information processing to be hampered.

The impact of alcohol on the performance of a driver at the strategic level cannot be studied in driving simulators or instrumented vehicles. However, according to the Theory of Planned Behaviour (TPB) [2], alcohol must have a significant impact on the strategic level. The TPB states that intentions are influenced by three mechanisms: attitudes, subjective norms and perceived behavioural control (pbc). Attitudes towards certain behaviour reflect the degree of positive or negative evaluation the individual has towards performing it (i.e. drink driving is dangerous). Subjective norms refer to the perceived social pressure to engage or not engage in certain behaviour. This reflects what one's 'important others' would think about the intended behaviour (i.e. my friend would disapprove when I drive while I'm drunk). PBC reflects the perceived ease or difficulty of undertaking a given behaviour (i.e. if I want to, I could easily drive safely when I'm drunk). Alcohol consumption leads to loss of self-control and thus it has an effect on PBC. After having consumed alcohol a driver is much more inclined to think that he can easily drive safely when he is a bit drunk.

4. Measures

A measure is effective when it leads to either a substantial reduction of the crash rate associated with alcohol consumption or to a substantial reduction of the number of kilometres driven while the driver is drunk (the prevalence). There is no treatment for drink drivers that will cure them from their acute impairments. If there were some kind of miracle pill that would make it perfectly safe to drive while drunk, the road safety problem due to alcohol would be solved. Such a pill doesn't exist, although some drivers erroneously believe that drinking coffee or drinking water after having consumed alcohol helps them to sober up. As there is no treatment possible, all measures are aimed at reducing the prevalence of drink driving. The measures to reduce drink driving can be categorized in five separate groups. These groups are:

Reducing the availability of alcohol
- Limiting selling points
- Raising prices
- Raising the minimum drinking age

Separating drinking from driving
- Alcohol ignition interlocks
- Designated driver programmes

Police enforcement
- Legal limits
- Amount of (random) roadside breath tests
- Sanctions

Education and information
- Education programmes on alcohol in schools and in driver training
- Driver improvement courses (rehabilitation courses)
- Public campaigns

Promotion of safety culture

4.1 Reducing the availability of alcohol

The problem of drink driving would not exist if alcohol were not available. It is not realistic to assume that a complete ban on the sale of alcohol for all EU-member states ever will come into force. And even if it is prohibited to sell alcohol, alcohol consumption would not disappear. However, it is possible to discourage drinking alcohol by increasing the price of alcohol (high taxes), having restrictions on the sale of alcohol in time (restricting the opening hours of the places where alcohol can be bought and where it can be consumed) and place (especially banning the sale of alcohol in petrol stations and transport cafes). Another measure in this category is raising the minimum drinking age (i.e. in the US alcohol is not for sale for people younger than 21).

4.1.1. Effectiveness of measures to reduce the availability of alcohol

Of all the measures mentioned in this category, only evaluation studies on changes in the general drinking age could be found. These studies have all been carried out in the United States. From these studies Elvik & Vaa [15] conclude that raising the drinking age (from 18 to 21) leads to a decrease of 24% of all fatal crashes involving drivers of 18 to 21 years of age and a 31% decrease of injury crashes in this age group.

4.2 Separating drinking from driving

4.2.1 Alcohol ignition interlocks

The most drastic measure in this category would be to make drink driving impossible for all drivers. Such a measure is not as futuristic as it may sound. In Sweden it is proposed that from the year 2012 all new cars must have an alcohol ignition interlock installed. This means that drivers can only start the engine after having completed a breath test that has indicated that they are sober. It is tempting to see the installation of alcohol ignition interlocks in all cars as the panacea for the drink-driving problem. Unfortunately there are still some technical drawbacks and inconveniencies. The overwhelming majority of drivers never drive over the legal limit. These drivers also have to install such a still costly device which needs to be calibrated and controlled regularly. Especially when it is cold, first performing a breath test before one can start a car; will mean that it will take several minutes before one can drive off. So far alcohol ignition interlocks are only used in rehabilitation programmes for drivers with a serious alcohol problem. At this moment of all EU member states, only Sweden uses them in rehabilitation programs and experiments are carried out in Spain, Belgium, Germany, and Norway.

4.2.2 Designated driver programmes

Another possibility to separate drinking from driving is not offering alcohol to drivers in restaurants, discos, pubs, bars etc. A possible way of doing this is the so-called 'designated driver programme'. Before a group of people decides to drive in one car to a certain place where they are about to consume alcohol, a designated driver is appointed. While the others drink the designated driver has to abstain from alcohol. To compensate for this inconvenience the designated driver is very often offered free soft drinks. A third measure in this category is to have good and cheap public transport and/or taxis to and from places where alcohol is consumed.

4.2.3 Effectiveness of alcohol ignition interlocks

According to a methodologically sound evaluation study on the installation of an alcohol ignition interlock in cars of offenders, the recidivism in this group dropped by about 65% in the first year after installation [7]. However, most studies also show that after removal of the lock, recidivism increases again, leading to almost no residual effect [6].
A possibility of getting a more permanent behavioural change is to combine an alcohol ignition interlock programme with a driving improvement course.

4.2.4 Effectiveness of designated driver programmes

It is very difficult to evaluate the effectiveness of designated driver programmes. Ditter et al [12] have carried out a systematic review of the sparse studies that were available on this subject. They only found one evaluation on a designated driver programme that was based on the propagation of this idea via the media, like the Bob-programmes in Europe. This was the "Pick-a-Skipper" campaign in Western Australia. Telephone surveys indicated a 13 percentage point increase in people always selecting a designated driver and these people were also more likely to report awareness of the 'Skipper' concept. However, there was no significant change in self-reported drinking and driving or riding with an alcohol-impaired driver. Ditter et al found more evaluations of small-scale designated driver programmes (i.e. a particular disco that has a designated driver programme). Some positive effects were found but overall the effects were quite modest.

4.3 Police enforcement

This is the most commonly used method to reduce drink driving. Police enforcement is only possible when there is a certain legal limit. The police must be able to detect when a driver has exceeded that legal limit and once this is detected, the driver must be punished. The effective element of police enforcement is deterrence and the effectiveness of deterrence depends on the impression the driver has of his chance getting caught when exceeding the limit and on how severe the punishment is. A distinction can be made between general deterrence and specific deterrence. The aim of general deterrence is to motivate all drivers not to breach the rules by creating fear of sanctions and by giving the idea that the chance of getting caught is high. The aim of specific deterrence is to improve the attitudes and behaviour of drivers once they are caught in order to prevent recidivism. For this purpose not only severe sanctions like suspension of the driving license are used ("I will never drink and drive again because the temporarily loss of my driving license has been a horrible experience.") but also remedial treatment programmes. Well-known remedial treatment programmes are the what are known as compulsory driver rehabilitation courses for offenders.

4.3.1 Effectiveness of police enforcement

As mentioned earlier, the effect of police enforcement is based on three elements: the level of the legal limit, the chance of getting caught when exceeding the limit and the severity of the sanctions. The effects of these elements will be dealt with separately.

4.3.2 The effect of having low legal limits

According to a meta-analysis carried out by Elvik & Vaa [15] reducing the existing BAC-limit for all drivers in a country leads to a reduction of 8 % in fatal crashes and a reduction of 4% in injury crashes. Allsop [1] estimates that in the United Kingdom 65 lives will be saved annually if the legal limit for the general driver population would be reduced from 0.8 g/l to 0.5 g/l. If a reduction of the BAC-limit always leads to a decrease in the number of crashes, a BAC-limit of 0 g/l for all drivers would be the very best to have. From the perspective of getting the clear message across 'one should never combine drinking and driving' a BAC-limit of 0 g/l indeed would be the best solution. If it is 0 g/l, it is clear to everyone that even the slightest amount of alcohol in the blood is forbidden for all road users. When the limit is above zero, there is always the appraisal a driver has to make whether that one glass of wine (or any other alcoholic beverage) can be consumed or not. From a jurisdictional and technical point of view however, a BAC-limit of 0 g/l might not be not such a good idea. For older (more experienced) drivers the crash rate starts to rise from 0.5 g/l onward. This means that up to 0.5 g/l older drivers are no substantial threat to other road users and themselves. Being sanctioned for something that is hardly dangerous is not fair. Another aspect is that with a BAC-limit of 0 g/l a driver also cannot use a mouth spray and the devices to measure the BAC-level are still not accurate enough to detect very low levels. A third drawback is that a very low limit might hamper catching the big fish (the drivers that drive with levels far above the legal limit). If too much time is spent on the small fish (drivers with a BAC between 0 and 0.5) and the enforcement system is not very efficiently organized, this may lower the chance of getting caught for drivers with a high BAC-level. And it is precisely the drivers with high BAC-levels who cause most of the crashes. Although a BAC-limit of 0 g/l for all drivers may cause problems, this is not the case for young drivers. As the crash rate for young drivers significantly starts to rise at very low levels, a BAC-limit of 0 g/l for young drivers is good for road safety . If one takes account of the inaccuracy of the devices and the fact that one can have a presence of alcohol in the mouth without having consumed alcohol, a BAC-limit of 0.1 g/l or 0.2 g/l for young drivers may be more realistic than 0 g/l. After implementing a BAC limit of 0.1 g/l in Austria for novice drivers, there was a 16.8% fall in fatal crashes involving drivers with a BAC-level of 0.8 g/l or more [3].

4.3.3 The effect of police enforcement

Some countries allow for random roadside breath testing and in others there must be some kind of suspicion (i.e. the smell of alcohol) before a policeman can test a driver. Both systems are effective, but random breath testing (RBT) is twice as effective as selective testing (only testing after suspicion) [20]. After each doubling of the number of RBTs in the Netherlands, the number of drink driving offenders has decreased by approximately 25% [25]. The effectiveness of RBT can be enhanced when it is targeted on the vicinity of places where alcohol is consumed and at times when the prevalence of drink driving is high, i.e. in weekend nights, and when publicity accompanies enforcement campaigns. Research and experience suggest that highly visible RBT (to deter) combined with targeted RBT that is not clearly visible (to detect) is the most effective [18].

On page 41 of the final report the ESCAPE-project called 'Traffic enforcement in Europe: effects, measures, needs and future' (Mäkinen et al, 2003) one can read:

"The Finnish police have pursued a systematic DUI (Drinking Under the Influence) surveillance, including random breath testing and extensive use of publicity, for over a quarter of a century. The risk of being caught for drink driving has increased considerably since 1977 when the police were first empowered to carry out random breath testing and were equipped with pocketsize Alcoholmeter breath analysers. Currently, some 40% of drivers are tested annually in Finland. The number of those caught for drink driving has fallen during the past 10 years from 0.33% to 0.14%. The overall positive trend is clear when evaluating the figures together with the results of roadside breath-testing studies. In the course of this process the punishments for drink driving have gradually eased."

The risk of being controlled for alcohol differs substantially between EU-member states. One of the questions in the SARTRE3-questionnaire (2002) was: "In the past 3 years, how many times have you been checked for alcohol?" The results are shown in Figure 10

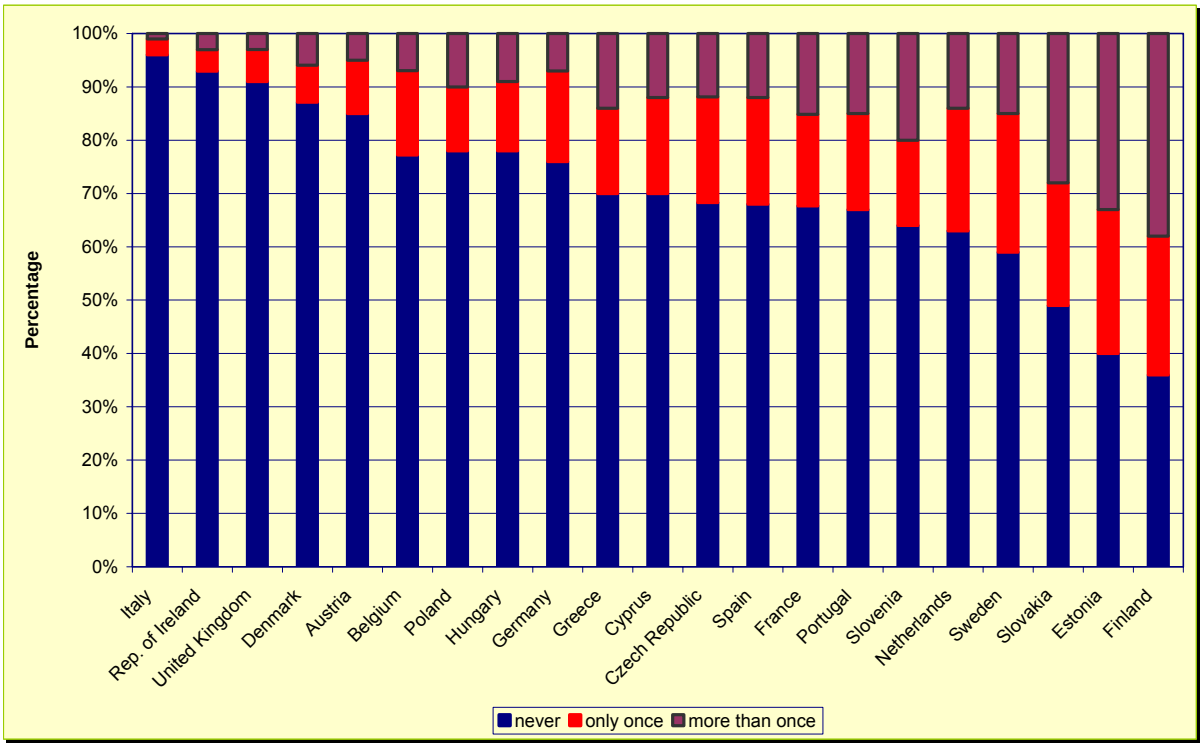


Figure 10: Self-reported frequency of alcohol controls over the past 3 years. Source: SARTRE3

In 2002 almost none of the drivers in Italy had been checked on alcohol in the past three years whereas in Finland only 36% was not checked in the past three years. In the Worldwide Brewing Alliance's 'Drink and driving- report 2005' the answers are listed that

Brewing Trade Associations were able to collect from the authorities in their countries. One of the questions was: "Please give brief details of the level of enforcement and rates of conviction for driving while under the influence of alcohol or drugs?" The answers reflect the percentages mentioned in Figure 10. The answer from Italy is: "The levels of enforcement are low. The road police have been supplied with pocketsize Alcoholmeter breath analysers but in insufficient quantities. Therefore controls of the BAC level are seldom made with the exception of some areas where discotheques are more widespread (Emilia Romagna). Whereas the answer from Finland is: "RBT is used frequently. Fairly high level of enforcement."

4.3.4 The effect of sanctions

Fines have some effect, but these effects don't last very long. In a Canadian case-crossover study concerning police enforcement in general (thus police enforcement regarding drink driving, but also regarding speeding and other violations) [31] discovered that the fatal crash rate in the month after conviction was about 35% lower than in a comparable month with no conviction However, 3-4 months after the conviction the drivers drove in an as unsafe manner as they did before the conviction. When the severity of the conviction increased (more demerit points), the effect on the relative rate reduction increased, but didn't last longer. However, if the conviction was very severe (two of these types of convictions would be enough to lose one's driving license), the effect on the reduction of the relative crash rate was small again.

According to a meta-analysis by Elvik & Vaa [15] driving license suspension leads to a reduction of all crashes by 18%. This makes driving license suspension very effective. There is however one drawback. If enforcement is rather weak, drivers who have lost their driving license may start to drive illegally.

Imprisonment seams to be less effective according to Elvik & Vaa [15]. A change in Norway and Sweden from imprisonment to a graduated tariff of fines and license suspension had lead to reduction of all crashes by 4%.

5. Education and information

Long before road users get access to the roads in or on motorized vehicles, they should know what the dangers of drink driving are and develop an attitude against drinking and driving. Besides this they should know what the dangers for drunken pedestrians and drunken cyclists are. The subject of the dangers of alcohol in traffic and what one can do about it should be part of the curriculum in both primary schools and secondary schools. For secondary schools more and more programmes are developed that confront students with the effects of alcohol in an as shocking as possible way. Traffic informers, for instance, are people that are mostly seriously disabled because of a road crash in which they have been at fault (i.e. they were drunk). They tell the students about their crash and how the consequences of the crash have affected their lives. What are known as 'road shows' are plays. In these plays the destructive consequences of road crashes are presented in an as much as possible emotionally charged and moving way. The opposite direction is chosen in an increasing number of high schools in the United States. These programmes are based on the concept of social norms. In these programmes nothing is communicated about the dangers. Instead students are told in a positive manner that the overwhelming majority of the students don't drink and drive. At first, research was carried out to find out if there is a discrepancy between the number of students that students think do drink and drive and how many students actually do. It appears that students mostly overestimate the percentage of students that really do drink and drive. After this, in a very positive manner they are told how many students in reality don't drink and drive. Often these messages are combined with

positive strategies to avoid drinking and driving. The assumption is that most students want to conform to what is considered normal in their social environment.
Also in formal driver training for obtaining the driving license, the subject of drinking and driving should be addressed. In some EU member states, still no attention is paid to the drinking and driving problem in basic driver training.
Public campaigns using mass media also aim at raising awareness of the dangers of drink driving and are intended to change attitudes and behaviours. There are very many ways in which this can be done. Some public campaigns only inform about the dangers of drinking and driving. These dangers can be presented in a quite neutral way but they can also be presented in a shocking manner. A more subtle way is not to show people that die in a road crash because of drink driving, but for instance, the remorse a young driver feels when he has to tell the parents of his girlfriend about the crash in which his girlfriend died and he survived. There are also public campaigns with the explicit intention to raise the impression of the chance of getting caught. Another category of public campaigns is the group of campaigns with a positive message. This can be the message that more and more people don't drink and drive and the promotion of strategies to avoid drinking and driving. Examples of this last type are public campaigns to promote designated driving (i.e. the so-called Bob-campaigns in Belgium and the Netherlands).

5.1 The effects of education programmes in schools and in basic driver training

The effect of having the subject of drinking and participating in traffic in the curriculum of primary and secondary schools is very difficult to evaluate. What the effects are of paying attention to the drinking and driving problem in basic driver training are also not known. Nevertheless it seems very important that this subject is in the school curriculum and also in the curriculum of basic driver training.

5.2 Driver improvement courses on alcohol (rehabilitation courses)

More is known about the effects of driver rehabilitation courses on alcohol for convicted drivers. These mandatory courses are not intended for drivers that are problem drinkers. For these drivers therapy would be more suitable. According to [5] various evaluations of driver rehabilitation courses for drink drivers (not being problem drinkers) indicate that the recidivism rate can be reduced by 50% compared to control-groups without course participation.

5.3 Public campaigns

Overall public campaigns seem to be effective [11]. However the effects can differ quite substantially. Public campaigns are more effective when first a study is carried out of how the target group can best be addressed, and when the public campaign is linked with other measures (enforcement and education). There are indications that fear arousing public campaigns regarding drink driving (i.e. a TV-spot in which a driver who had been drinking crashes into another vehicle and dies) are not so effective. Harré et al [19] discovered that a group that had watched fear-arousing clips regarding drink driving afterwards showed more crash-rate optimism than a group that had watched non-fear arousing clips. Crash-rate optimists believe that crashes might happen to others, but not to them. Despite the fact that some public campaigns may have been not so effective, in many industrialized countries the attitude towards drink driving has substantially changed over the past decades (from something that is not so dangerous to something that is considered to be a crime). This is probably caused by a combination of public campaigns and police enforcement.

5.4 Safety culture

When a driver has to drive on account of his job, the company of this employee can also take measures to prevent him from driving under the influence of alcohol. Measures of this type are mostly headed under the name 'safety culture'. A company has a safety culture when in all sections of the company, safety is considered to be of the utmost importance, and that the safety aspect is given weight to in all management decisions in all procedures and in all actions. More in particular, a company with a safety culture:

- Has a clear safety policy and the management not only promotes this policy but also the managers themselves act accordingly
- Analyses crashes and near misses made in the past, and is willing to learn from these crashes and near misses (crashes are not analysed in order to blame someone)
- Takes measures that tackle the root causes of crashes.

An example is that after having analysed a crash with all those involved in a Swedish company, the employees themselves proposed to put all the ignition keys of all company cars in a cupboard. This cupboard could only be opened after the employee had successfully done a breath test. The precise effects of the establishment of a safety culture in a company on drink driving are not known.

5.5 Summary of effective measures

The problem of drink driving is not new and very many measures have been taken. A very successful measure was the introduction of pocketsize breath testing devices by the police back in the 1970s. Despite the fact that drink drivers now know that they can be caught and that sanctions are tough, and despite public opinion regarding drink driving having changed considerably (most people in Europe nowadays wholeheartedly disapprove of drink driving), alcohol impaired road users are still involved in about a quarter of all fatal crashes in Europe. New and better measures are needed.

Depending on the circumstances the effectiveness of new measures may vary from country to country. However, in general it can be stated that the following measures are effective:

- To have random breath tests for all drivers and not only for 'suspected' drivers
- To raise the chance of getting caught by carrying out more random roadside breath tests (especially at times and spots where drink driving is expected). However it must be noted that an increase in random roadside breath tests is less effective in countries where those test are already carried out on a large scale than in countries where random roadside breath testing is carried out occasionally [14]
- To have a legal limit for the experienced driver of 0.5 g/l or lower and a legal limit for novice drivers of 0 g/l (or just above 0 g/l). However it must be noted that a very low legal limit (lower than 0.5 g/l) for the experienced driver can be counterproductive. This is the case when the energy spend on enforcement of low levels is at the expense of the energy on enforcement of high levels. As the rather small group with high levels is responsible for most of the alcohol related crashes, it is of the utmost importance to tackle the high levels in the first place
- To have alcohol ignition interlocks installed in the cars of severe first time offenders and all recidivists in combination with a driver rehabilitation course
- To have better public campaigns and education programmes (for all age groups) based on scientific research
- Restrict the availability of alcoholic beverages, especially for young novice drivers. This can be done by raising the age limit for buying alcohol and by banning the sales of alcoholic beverages in petrol stations and transport cafes

- In order to monitor the effects of measures it is necessary to improve the registration on the prevalence of drink driving and the involvement of drink drivers in crashes in all EU-member states.

In the long run it may be possible to equip all cars with fraudulent proof alcohol ignition interlocks that cause no inconveniencies for non-drinking drivers.
When developing a policy to combat the drink driving problem in a country, it is important not to single out one of the measures and forget about the others. There is no panacea for the drink driving problem. A package of interrelated measures will offer the best results. The focal point of such a package is the legal limit(s) which ultimately gives driver guidance about society's perception of safe drinking and driving levels.

6. Public support for measures

Public support for tough measures is not so much of a problem. In the SARTRE3-questionnaire (2002) some of the questions were on alcohol legislation. An overwhelming majority of the 24,000 interviewed drivers (88%) would like to have more severe penalties for drink drivers in their country. The differences on this subject between the EU-member states were small.
Of all the drivers, 45% of those who filled in the SARTRE-questionnaire are of the opinion that there should be a BAC-limit of 0 g/l. In Eastern Europe 60% of the respondents are of the opinion that there should be a BAC-limit of 0 g/l, and only 26% of the respondents in southern are in favour of this. The percentages for northern and western countries are respectively 47% and 43%. In Eastern Europe more drivers prefer a zero BAC-limit than in other parts of Europe. This is not so surprising as a couple of countries in Eastern Europe already have a BAC-limit of 0 g/l.
The lower the legal BAC-limit in a country is, the more drivers think that they can drink less alcohol to stay under the legal limit. 70% of the drivers of countries with a legal limit of 0 g/l (Czech Republic, Hungary, and Slovakia) state that they may not drink any alcohol at all to remain under the legal limit. In countries with a legal limit of 0.2 g/l (Estonia, Poland, Sweden) it is 33% of the driver population that think that they cannot drink at all before driving. When the legal limit is 0 g/l, 28% of the drivers think that they remain under the legal limit after having consumed the equivalent of one glass of wine (175 ml of wine with an alcohol percentage of 12) or beer (0.5 litre of beer with an alcohol percentage between 3-3.5). When the legal limit is 0.2 g/l 64% of the drivers have the opinion that they remain under the legal limit after one glass of wine or one glass of beer. When the legal limit is 0.5 g/l 78% of the drivers think that they remain under the legal limit after having consumed the equivalent of one glass of wine or one glass of beer. In countries with a BAC of 0.8 g/l, 42% of the drivers think that they can legally consume more than one glass of wine or one glass of beer before driving and in Cyprus (legal limit of 0.9 g/l) even 31% of the drivers estimate that they can drink more than one glass of wine or one glass of beer.
82% of all drivers of all countries in the SARTRE-project are 'very' or 'fairly' in favour of a BAC-limit of 0 g/l for novice drivers.
When asked if an alcohol ignition interlock should be installed in all cars, one third of the drivers is 'very much' in favour of this and 25% of the drivers is 'fairly much' in favour of this. In Sweden, France, Portugal, and Greece 70% is 'fairly much' to 'very much' in favour of this and only 30% of the drivers in Germany, Austria, and Greece approve of this technological support.
77% of the drivers are 'very much' to 'fairly much' in favour of courses like the driver rehabilitation courses for offenders. There is not much difference between the countries on this subject although support in eastern countries is a little bit less.

7. References

1. Allsop, R.E. (2005) How much is too much?-Lowering the legal drink-drive limit. In: Proceedings of the Brake Conference on Drink and Drug Driving, London, May 2005. http://www.pacts.org.uk/policy/briefings/AllsopBACpaper.pdf

2. Ajzen, I. (1991) The theory of planned behavior. In: Organizational Behavior and Human Decision Processes, 50, p. 179-211

3. Bartl, G. & Sturmvoll, G. (2000) Description of post licensing measures in Austria. In: Bartl, G. (Ed.). DAN-Report. Results of the EU-project: Description and Analysis of Post Licensing Measures for Novice Drivers

4. Bartl, G. (2001) EU-Project DAN. In: Proceedings of 7. Internationaler Kongress on Driver Improvement 8-10 October 2001

5. Bartl, G. Assailly, J.-P. Chatenet, F. Hatakka, M. Keskinen, and E. & Willmes-Lenz, G. (2002) EU-Project "ANDREA" : Analysis of driver rehabilitation programmes. Kuratorium für Verkehrssicherheit KfV, Institut für Verkehrspsychologie, 2002, 403 p., 60 ref

6. Bax, C. (Ed.); Käri, O., Evers, c., Bernhoft, I.M. & Mathijssen, R. (2001) Alcohol interlock implementation in the European Union: feasibility study. Final report of the European research project. D-2001-20, SWOV, Leidschendam

7. Beck, K., Rauch, w., Baker, E. & Williams, A. (1999) Effects of ignition interlock license restrictions on driver on multiple alcohol offences: a random trial in Maryland. In: American Journal of Public Health, 89, p. 1696-1700

8. Borkenstein, R.F., Crowther, R.F., Shumate, R.P., Ziel, W.B. & Zylman, R. (1974) Die Rolle des alkoholisierten fahrers bei Verkehrsunfällen (grand-rapids-studie); 2. auflage. In: Blutalkohol, Vol. 11, supplement 1, p. 1-132

9. Compton, R.P., Blomberg, R.D., Moskowitz, H., Burns, M., Peck, R.C. & Fiorentino, D. (2002) Crash rate of alcohol impaired driving. Proceedings of the sixteenth International Conference on Alcohol, Drugs and Traffic Safety ICADTS, Montreal

10. Craid, J.K, Lees, M. & Edwards, C. (2005) The Naturalistic Driver Model: a Review of Distraction, Impairment and Emergency. California PATH Research Report UBC-ITS-PRR-2005-4, Cognitive Ergonomics Research Laboratory CERL, Berkley

11. Delhomme, P. (ed.) (1999) GADGET-Project, deliverable 4: evaluated road safety media campaigns: an overview of 265 evaluated campaigns and some meta-analysis on crashes. RR-00-006-FR, INRETS, Arcueill

12. Ditter, S.M., Elder, R.W., Shults, R.A., Sleet, D.A., Compton, R. & Nicholson, J.L. (2005) Effectiveness of designated driver programs for reducing alcohol-impaired driving. In: American Journal of Preventive Medicine, Vol. 28 (5S), p.280-287

13. EEIG (2003) Health, Food and Alcohol and safety http://europa.eu.int/comm/public_opinion/archives/ebs/ebs_186_en.pdf

14. Elvik, R. (2001) Cost-Benefit analysis of Police Enforcement. Working Paper 1 of the ESCAPE-project. Technical Research Centre of Finland (VTT)

15. Elvik, R. & Vaa, T. (2004) The handbook of road safety measures. Elsevier Ltd, Oxford, UK

16. ESCAPE (2003) Traffic enforcement in Europe: effects, measures, needs and future. Final report of the ESCAPE consortium. Technical Research Centre of Finland (VTT)

17. ETSC (1995) Reducing traffic injuries resulting from alcohol impairment. Brussels

18. ETSC (1999) Police enforcement strategies to reduce traffic casualties in Europe, Brussels

19. Harré, N., Foster, S. & O'Neill, M. (2005) Self-enhancement, crash-rate optimism and the impact of safety advertisements on young drivers. In: British Journal of Psychology, Vol. 96, p.215-230

20. Henstridge, J., Homely, R. & Mackay, P. (1997) The long-term effects of random breath testing in four Australian States: A Time Series Analysis. Canberra, Australia: Federal Office of Road Safety

21. Keall, M., Frith, W. & Patterson, T. (2004) The influence of alcohol, age and number of passengers on the night-time rate of driver fatal injury in New Zealand. In: crash Analysis & Prevention, Vol. 36 p. 169-178

22. Keigan, M. & Tunbridge, R.J. (2003) The incidence of alcohol in fatally injured adult pedestrians. TRL Report 579, Transport Research Laboratory TRL, Crowthorne

23. Krüger, H. -P. & Vollrath, M. (2004) The alcohol-related crash rate in Germany: procedure, methods and results. In: crash Analysis & Prevention, Vol. 36, p. 125-133

24. Laumon, B., Gadegbeku, B., Martin, J-L, Biecheler, M-B & the SAM Group (2005). Cannabis intoxication and fatal road crashes in France: population based case-control study. In: British Medical Journal to be downloaded from: http://bmj.bmjjournals.com

25. Mathijssen, M.P.M. (2005) Drink driving policy and road safety in the Netherlands: a retrospective analysis. In: Transportation Research Part E 41 p. 395-408

26. Mathijssen, M.P.M. & Houwing, S. (2005).The prevalance and relative rate of drink and drug driving in the Netherlands: a case control study in the Tilburg police district. SWOV report R-2005-9, SWOV, Leidschendam

27. Moskowitz, H. & Robinson, C. (1987) Driving-related skills impairment at low blood alcohol levels. In: Noordzij, P. & Rosbach, R. (Eds.), Alcohol, drugs and traffic safety - T8, p. 79-86. Excerpta Medical Elsevier Science Publisher. Amsterdam

28. OECD (2006) Young Driver Rates and Effective Counter Measures. in print, Paris

29. OFDT (2005) Étude 'Stupéfiants et crashes mortels de la circulation routière' (SAM); Éléments de conclusion. Observatoire Français des Drogues et des Toxicomanies (OFTD). Saint-Denis La Pleine Cedex, France

30. Preusser, D.F. (2002) BAC and fatal crash rate. In: ICADTS 2002 Symposium Report 'The Issue of Low BAC', p. 937

31. Redelmeier, D.A. Tibshirani, R.J. & Evans (2003) Traffic-law enforcement and risk of death from motor-vehicle crashes: case-crossover study. In: The Lancet, Vol. 361, June 28 2003, pp. 2177-2182

32. SARTRE 3 report (2004) European drivers and road rate, Report on principal results. INRETS, Paris

33. Simpson, H.M. & Mayhew, D.R. (1991) The hard core drinking driver. Traffic Injury Research Foundation of Canada, Ottawa

34. Swedler, B.M, Biecheler, M.B., Laurell, H., Kroj, G., Lerner, M., Mathijssen, M.P.M., Mayhew, D. & Tunbridge, R.J. (2004) Worldwide trends in alcohol and drug impaired driving. In: Traffic Injury Prevention Volume 5, Issue 3. p. 175-184

35. Wegman, F. & Aarts, L. (ed.) (2005) Door met Duurzaam Veilig. Stichting Wetenschappelijk Onderzoek Verkeersveiligheid SWOV, Leidschendam

36. World Advertising Research Centre (2005) http://www.warc.com

37. Worldwide Brewing Alliance (2006) Drinking and driving Report 2005