SWOV Fact sheet

Driving under the influence of alcohol

Summary
Driving under the influence of alcohol is a threat to road safety. In the Netherlands, the legal limit for novice drivers is a blood alcohol concentration (BAC) of 0.2‰ and for all other drivers of 0.5‰. Young males and heavy drinkers form the most significant risk groups for drink-driving. In the Netherlands, the proportion of drivers under the influence of alcohol is only declining among the group of relatively light drinkers and not among heavy drinkers who have such a high risk that they cause the vast majority of crashes. Taking certain measures, like increasing enforcement among heavy drinkers and introducing an alcolock programme, can benefit road safety. This is also the case for random police checks provided that the subjective probability of detection among these drivers is high enough.

Background and content
Article 8 of the Dutch Road Traffic Act makes it "an offence for a person to drive or to be in charge of a motor vehicle, when he is under such influence of a substance of which he knows or reasonably should know that its use – either in combination with or not in combination with the use of another substance – could diminish driving skills, and that he must therefore be considered unfit to drive". These substances include alcohol, drugs and psychoactive medicines (see also SWOV Fact sheet *Driving under the influence of drugs and medicines*). In the Netherlands, the legal alcohol limit for novice drivers (drivers who have not yet possessed their licence for five years) is a blood alcohol concentration (BAC) of 0.2‰ and 0.5‰ for other drivers.

How has alcohol consumption among drivers developed over time?
Alcohol consumption among drivers in Dutch traffic has since 1970 been monitored in the research project *Driving and Drinking Behaviour*. Until 1999, SWOV was commissioned by the Ministry of Transport, Public Works and Water Management to conduct this research project and did so in close cooperation with the police. In 1999, the former Netherlands Transport Research Centre (AVV), now the Centre for Transport and Navigation (DVS), a department in the Directorate-General for Public Works and Water Management, took over the research project. The research project consists of pulling over random motorists during weekend nights in autumn and testing them for alcohol consumption.

Figure 1 shows the development of the proportion of drivers under the influence of alcohol during weekend nights since 1973. Between 1973 and 2010, alcohol consumption among drivers on Dutch roads during weekend nights decreased by about 80%. The decrease over the last 40 years is mainly the result of the introduction of a legal alcohol limit of 0.5‰ in 1974, the increased enforcement due to the introduction of electronic breath testing devices in 1984, and the introduction of breath analysis for evidence purposes in 1987. In addition, regional traffic enforcement teams were introduced in 1999, and the 'Bob' public information campaign was launched in 2001. Lastly, the legal alcohol limit for novice drivers was lowered to 0.2‰ on 1 January 2006. The notable decrease in alcohol use in 1974 was caused by drivers estimating the probability of being detected as being extremely high during the first period following the introduction of the alcohol limit; the so-called subjective probability of apprehension was very high. After a while, when it became clear that the probability of detection was not nearly as high as they had estimated, the number of offenders rapidly increased again. Even so, their proportion remained significantly smaller than during the period before the alcohol limit was introduced.

In the most recent decade, between 2002 and 2010, the proportion of alcohol offenders in weekend nights decreased by about one third to approximately 3%. In 2010 their proportion had even declined to 2.4%, but it is as yet unclear whether this has been a chance fluctuation or a real decline. However, the decline could only be observed among the light offenders; among the serious offenders, who have a relatively high risk, hardly any decline was visible (DVS, 2011).

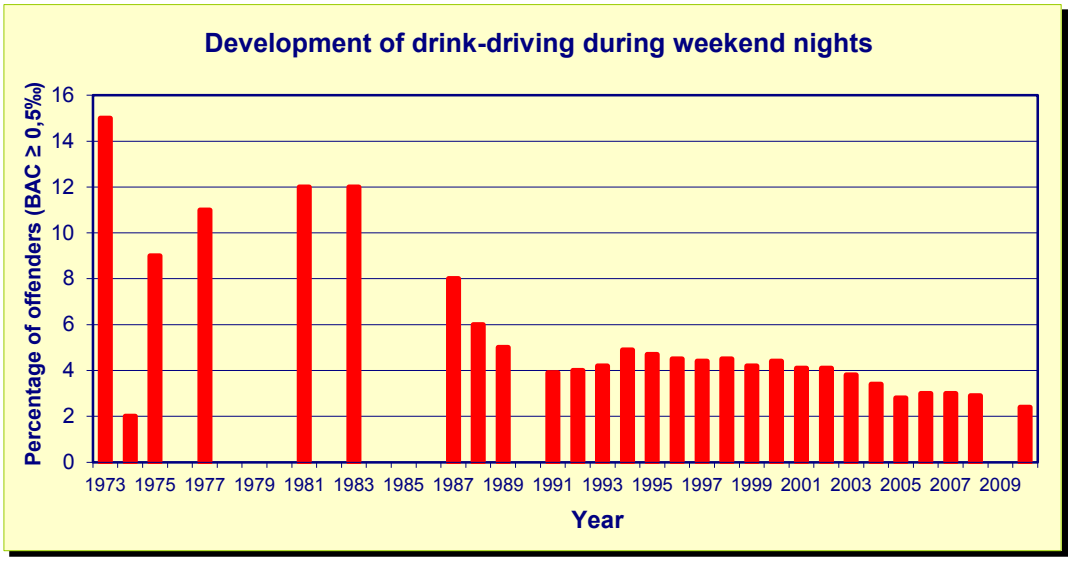

Figure 1. *Proportion of alcohol offenders throughout the years.*
Sources: SWOV (through 1998); DVS (from 1999).

Combination of alcohol and drugs
Within the framework of the large-scale European research project DRUID (Driving Under the Influence of Drugs, Alcohol and Medicines) a study was carried out in the period 2007-2009. This study investigated the use of psychoactive substances in traffic in six police regions in the Netherlands (Houwing et al., 2011a). The results of the study indicated that, on average for all days and times of the week, 0.24% of the drivers had used a combination of alcohol and drugs. This proportion is similar to that found in a previous study that was carried out in the Dutch city of Tilburg between 2000 and 2004 (Mathijssen & Houwing, 2005). In Tilburg the combined use of alcohol and drugs was then found to be 0.3% for all days and times per week. The results of the DRUID study also indicate that the proportion is highest among men younger than 35 during night time hours.

What are the risks of driving under the influence of alcohol?
After consumption, alcohol enters the stomach and is then absorbed into the bloodstream through the walls of the stomach and small intestines. Once in the blood, the alcohol reaches the brain in about ten minutes. Alcohol has a numbing effect on the brain resulting in a lowering of inhibitions, a reduction in the ability to concentrate and remember, and an increase of the user's overestimation of his abilities.

The consumption of alcohol also affects driving behaviour. Because the driver cannot steer the car as effectively, he begins to swerve. The driver's reaction also becomes slower. Because drivers under the influence of alcohol become indifferent, they will also be less inclined to compensate for their reduced driving skills. In addition, these drivers overestimate their own abilities and underestimate the risks (Steyvers & Brookhuis, 1996).

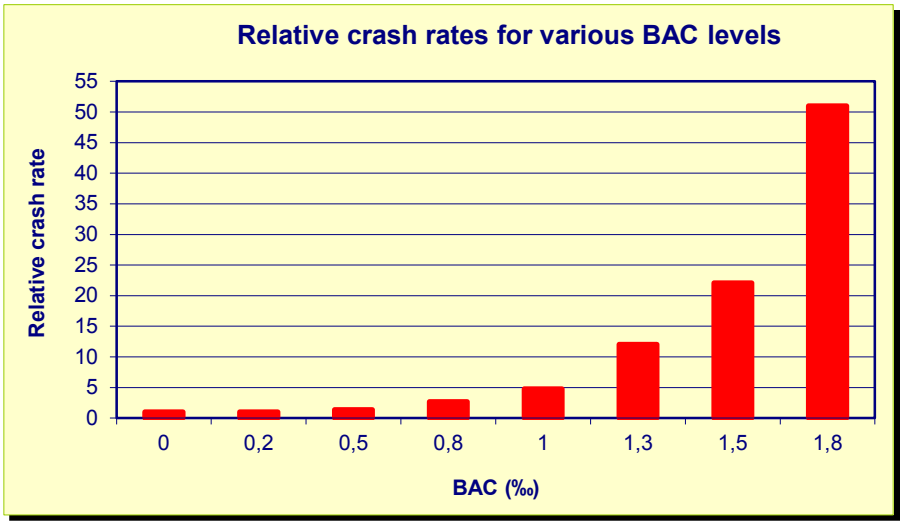

Figure 2. *Relative crash rates for various BAC levels (Blomberg et al., 2005).*

Figure 2 shows that driving under the influence of alcohol leads to an increased crash rate (Blomberg et al., 2005). The relative cash rate for a certain BAC level is the crash rate compared to that of a sober driver. The risk increases exponentially as the BAC level increases. Blomberg et al. (2005) estimate the risk for drivers with a BAC of 0.5‰ to be approximately 40% higher. At 1.0‰, the risk is almost 4 times higher and at a BAC of 1.5‰. it even becomes 20 times higher.

Combination of alcohol and drugs
Drivers who combine the use of alcohol and drugs and/or medicines are about twice as likely to be injured in a road crash as a driver who has consumed only alcohol. Mathijssen & Houwing (2005) found that drivers who combine the use of drugs and/or medicines with alcohol and who have a BAC exceeding 0.8‰ are about a hundred times more likely to be injured in traffic than sober drivers. The DRUID study also estimates the relative risk after the combined use of alcohol and drug to be extremely high (Hels et al., 2011).

The BAC level not only affects the crash rate, it also has an influence on injury severity. The outcome of crashes involving alcohol use is generally serious. Drivers with more than 1.5‰ of alcohol in their blood, for example, are about two hundred times more likely to die in a road crash than sober drivers. This must be attributed to both the higher risk of being involved in a crash and the more severe injury in the event of a crash (Simpson & Mayhew, 1991).
The more severe injuries in road crashes are mainly due to the fact that drivers under the influence of alcohol often speed and less frequently use their safety belt. The reduced physical condition of heavier drinkers may be yet another factor (Desapriya et al., 2006).

How many casualties are due to alcohol-related crashes?
The degree to which drink-driving affects road safety is illustrated by the number of fatalities and injuries resulting from alcohol-related crashes. These are crashes in which at least one of the drivers involved has consumed alcohol. Data on the numbers are available from the police crash registration. This data, however, is an underestimation of the problem, as the police tests nowhere near all the drivers involved in a crash for alcohol consumption. Drivers who die in a crash, for example, are rarely tested for alcohol since this is considered useless from the angle of criminal proceedings.

Casualties	2002	2003	2004	2005	2006	2007	2008	2009
Road fatalities	97	72	68	62	40	44	48	46
Serious road injuries (MAIS 2+)	694	668	641	602	455	504	521	351
Total	791	740	709	664	495	548	569	397

Table 1. *Police registered numbers of casualties resulting from alcohol-related crashes according to the severity of the injury (Source: Ministry of Infrastructure and the Environment).*

Table 1 shows that the *number* of registered alcohol-related casualties is decreasing in the Netherlands. The *proportion* of registered alcohol-related casualties (fatalities and serious road injuries), however, has remained approximately constant since 1993, between 7% and 10% for twenty years (not included in the table). The actual proportion of alcohol-related casualties is considerably higher than can be seen in the police registration. SWOV has estimated the actual proportion based on the trend in driving under the influence in weekend nights and the risk data per BAC category. The result is that, about 20% of the road fatalities in the Netherlands are the result of alcohol, either in combination with drugs or not. Of these road fatalities, around five sixths (17%) involve only alcohol and one sixth (3%) have used a combination of alcohol and drug (Houwing, Reurings & Bos, 2011b).

Which groups are more likely to drive under the influence of alcohol?

Research (e.g. Blomberg et al., 2005; Mathijssen & Houwing, 2005) shows that that young males and heavy drinkers are more likely to be involved in alcohol-related crashes.

Young males

Although in 2009 young males aged 18-24 formed only 4% of the total Dutch driving licence holders (Statistics Netherlands, DVS), they accounted for 23% of the seriously injured drivers who were under the influence of alcohol. The proportion of young women among driving licence holders was also 4%, but no women were found in the random selection of 186 seriously injured drivers, either sober or under the influence (Isalberti et al., 2011). Despite the fact that young drivers consume less alcohol when they drive than older drivers, they are over-represented in the group of casualties and drivers involved in alcohol-related crashes (Mathijssen & Houwing, 2005). Due to their lack of experience, young novice drivers not only have a higher crash rate even when they are sober, but their crash rate after consuming alcohol increases faster than that of older, more experienced drivers. This can be seen in *Figure 3* (Blomberg et al., 2005; Mathijssen, 1999b; Peck et al., 2008; Keall et al., 2004).

Houwing et al. (2011a) found that the group of young males (ages 18-34) also counted the highest number of alcohol-drugs users. Whereas the combined use among drivers was 0.24%, it was about three times higher for the young male drivers.

Heavy drinkers

The Dutch hospital study within the DRUID project (Isalberti et al., 2011) shows that about two-thirds of the seriously injured drivers in severe alcohol-related crashes had a BAC exceeding 1.3‰. The small group of heavy drinkers (0.2%) in Dutch traffic is therefore responsible for the majority of serious alcohol-related crashes (Houwing et al., 2011a).

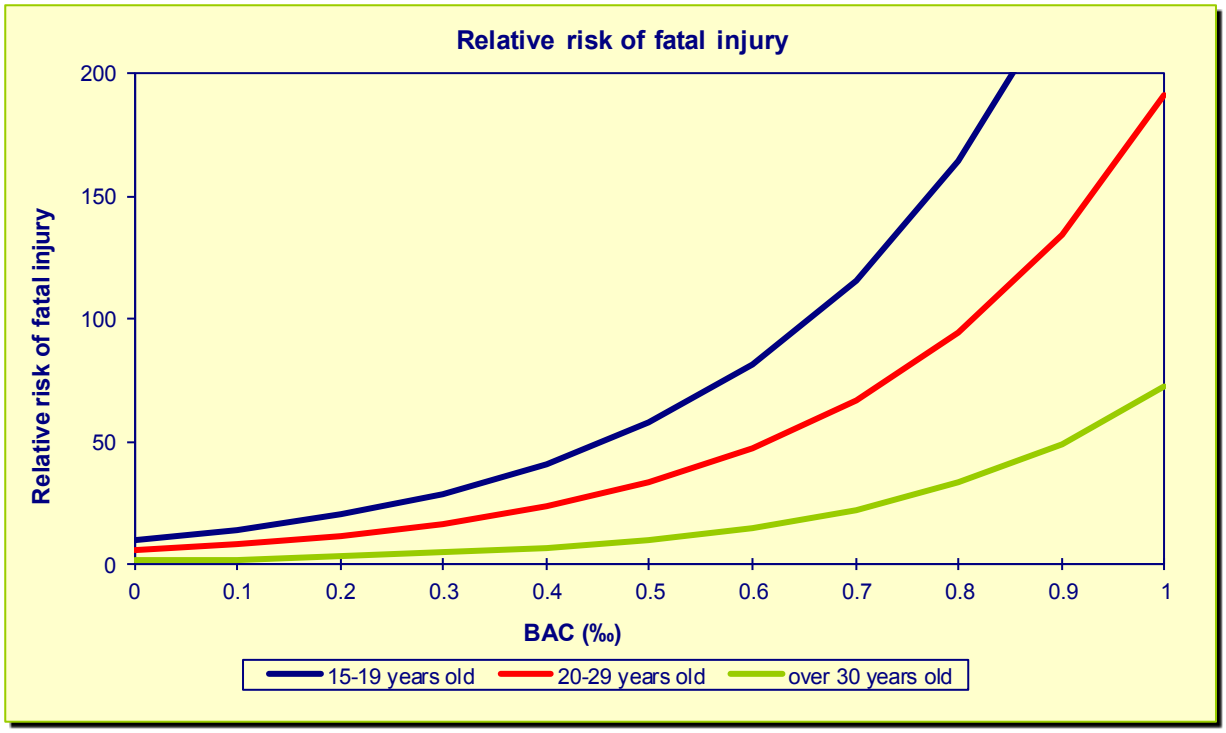

Figure 3. *Risk of fatal injury per age group and BAC (Keall et al., 2004).*

What measures can be taken?

Lower limits

As of 1 January 2006 the legal alcohol limit for novice drivers was reduced to 0.2‰. In 1999, SWOV had estimated the effects of such a measure. At the same level of police enforcement, this could result in a 5% reduction in the total number of alcohol-related crashes (Mathijssen, 1999b). An additional advantage of the measure is that it can contribute to reducing combined alcohol and drug use that is more frequent among young males in particular and which leads to a very high crash rate. Data on the use of alcohol in weekend nights (DVS, 2011) shows that during the period 2005-2010 the use of alcohol among young novice drivers showed a relatively larger decrease than the alcohol use among older drivers ((BAC categories 0.2-0.5‰ and 0.5-0.8‰). No decrease could be observed among the more serious offenders (0.8‰ and higher).

According to SWOV, a general reduction of the legal limit has an adverse effect on the total number of alcohol-related crashes if it is not accompanied by increased police enforcement. The real, objective probability of detection for heavy drinkers would then be much lower since the police would have to process many more offenders with the same capacity. A study of the effects of reducing the legal limit in Finland reached the same conclusion (Penttilä et al., 2004).

Enforcement

Enforcing legal measures is a major factor in the duration of the effects as well as in their degree of success (Fell & Voas, 2004; Geary & Preusser, 2004). Various studies (e.g. Mathijssen 2001; Erke et al., 2008) showed that enforcement is more effective when supported by publicity. Publicity about intensified enforcement results in a higher subjective probability of being caught and to a more rapid decrease in the number of offenders. The establishment of regional traffic enforcement teams in 1999 resulted in an increase in the enforcement of drink-driving. This was accompanied by a slight decrease in drink-driving (AVV, 2003). The recent increase in random alcohol testing at the national level has been particularly effective in the case of light offenders. The reduction in drink-driving between 2002 and 2010 occurred only among relatively light offenders and not among the serious offenders who are responsible for the vast majority of crashes (DVS, 2011). Over the next few years, enforcement should therefore focus on increasing the objective (and thus simultaneously the subjective) probability of detection among the heavy drinkers.

Public information and education

Campaigns are nearly always carried out in combination with other measures. This is why their direct effect on behaviour associated with drink-driving cannot be proven. However, campaigns can

contribute to maintaining desired behaviour which has more or less been forced on people (Schults et al., 2004). Indications of this in the Netherlands were found particularly during the early 1990s. Despite a significant decrease in the enforcement of drink-driving that resulted from a reorganisation of the police, driving under the influence increased only very slightly at that time (Mathijssen, 1999a).

Higher penalties
In comparison with many other European countries, the penalties for drink-driving in the Netherlands are relatively light. Research into the opinions, preferences and behaviour of Dutch drivers indicates that they are against drink-driving and would like to see it punished more severely (SARTRE, 2004). However, it is doubtful whether increased penalties would lead to a substantial reduction in drink-driving. In any case, a considerable increase in the penalties issued in 1992 did not result in a decrease in drink-driving in following years. It even increased slightly, probably partly because of a sharp drop in the enforcement level (Mathijssen, 1994). This indicates that the severity of penalties has less impact than the probability of detection (also see the SWOV Fact sheet *Penalties in traffic*).

Educational Measure Alcohol and Traffic
The Educational Measure Alcohol and Traffic (EMA) consists of a three-day course imposed on drivers with relatively high BACs as well as on recidivists. At first, the EMA was imposed on drivers with a BAC between 1.3 and 2.1‰, but the upper limit was lowered to 1.8‰ in 2000. In 2002 the lower limit was reduced to 0.8‰ for novice drivers. A study into the effectiveness of the EMA showed an increased knowledge among the participants of drink-driving, but no effect on recidivism (Nägele & Vissers, 2000).

Alcolock
An alcolock is an in-vehicle alcohol tester which is connected to the starting mechanism and acts as an ignition interlock. Only after an alcohol test has been successfully passed can the engine be started. Various provisions and regular enforcement make fraud very difficult (Beirness, 2001). Various assessments have shown that an alcolock is more effective in preventing recidivism than licence suspension. Research in North America and Canada, indicates that for comparable alcohol offences recidivism is two to three times higher among the serious offenders whose licence had been suspended than among offenders who had to drive a car with an alcolock installed (Bax et al., 2001). However, after the alcolock programme had been completed, the participants became recidivists as often as the drivers whose licences had been suspended. Experiences in the United States indicate that an alcolock should be part of a broader programme aimed at preventing recidivism. A possible extension of the alcolock programme and providing assistance to treat these drivers' alcohol problem could reduce recidivism among drivers (Silverans et al., 2006). An alcolock programme was introduced in the Netherlands on 1 December 2010. More information about this topic is available in the SWOV Fact sheet *Alcolock*.

Conclusions and recommendations
The proportion of drivers who drive under the influence of alcohol is still decreasing. This drop, however, is occurring only among the relatively light offenders. Measures such as random testing, alcohol campaigns and the EMA appear to have little if any effect on the heavier drinkers, whereas these are precisely the ones who are responsible for the vast majority of alcohol-related crashes. In addition to taking these measures, the percentage of alcohol-related casualties can be further reduced by subjecting the group of heavy drinkers to specific forms of enforcement. If these drinkers were then included in an alcolock programme, this would have a positive effect on road safety.

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