Prevention of driving under the influence of alcohol and drugs

Final Report

Authors: M. Modijefsky, R. Janse, W. Spit (Ecorys), D. Jankowska-Karpa, I. Buttler (ITS), B. Eikefjord

April – 2021

EUROPEAN COMMISSION

Directorate-General for Mobility and Transport
Directorate C — Land
Unit C2 — Road Safety

Contact: MOVE C2 secretariat

E-mail: MOVE-C2-secretariat@ec.europa.eu

European Commission
B-1049 Brussels

Prevention of driving under the influence of alcohol and drugs

Final Report

Directorate-General for Mobility and Transport

LEGAL NOTICE

Luxembourg: Publications Office of the European Union, 2022

ISBN 978-92-76-34080-5
doi: 10.2832/284545

TABLE OF CONTENTS

ABBREVATIONS

BAC	Blood alcohol concentration
BCR	Benefit-cost ratio
CARG	Compound Annual Growth Rate
CBA	Cost-Benefit Analysis
CEN	European Committee for Standardization
CENELEC	European Committee for Electrotechnical Standardization
COM	Communication
DADSS	Driver Alcohol Detection System for Safety
DDR	Driver drowsiness and distraction recognition
DRUID	Driving under the Influence of Drugs
DSST	Digit Symbol Substitution Test
DUI	Driving under influence
DWI	Driving While Intoxicated
EC	European Commission
EFTA	European Free Trade Association
EMCDDA	European Monitoring Centre for Drugs and Drug Addiction
EN	European Norm
ESRA	E-Survey of Road Users' Attitudes
ESPAD	European School Survey Project on Alcohol and Other Drugs
EU	European Union
FIT	Field Impairment Tests
g/dL	Grams per decilitre
g/L	Grams per litre
GC	Gas chromatography
GHB	Gamma Hydroxybutyrate
HGV	Heavy goods vehicles
ICADTS	International Council on Alcohol, Drugs and Traffic Safety
LC	Liquid chromatography
LSD	Lysergic acid diethylamide
MDMA	Methylenedioxymethamphetamine
MS	Mass spectrometry
NPS	New psychoactive substances
RBT	Random breath testing
RIT	Roadside Impairment Testing
SBT	Selective breath testing
SDLP	Standard deviation of lateral position
SFTS	Standard Field Sobriety Tests
THC	Tetrahydrocannabinol
TISPOL	European Traffic Policy Network
US	United States
VOSL	Value of Statistical Life
WHO	World Health Organisation

Summary

In 2001, the European Commission adopted Recommendation (2001/115/EC) on the maximum blood alcohol concentration (BAC). Today, most Member States have adopted legislation fixing maximum BAC limits in accordance with it.

The measures aimed at tackling the problem of driving under the influence of alcohol or other psychoactive substances belong to the domain of driver behaviour, which remains in the remit of Member States competences. Nevertheless, almost twenty years after the recommendation was adopted, driving under the influence of alcohol remains one of the most common accident factors.

In the Strategic Action Plan on Road Safety adopted as part of the III Mobility Package (Annex I to COM(2018) 293 final), the Commission committed to evaluate how to strengthen the Commission recommendation of 2001.

This study is intended to provide the Commission services with up-to-date information on the role of alcohol and other psychoactive substances as accident causation factors and policies and measures implemented by Member States to address driving under the influence of alcohol and drugs. Specifically, the study provides information on:

- Prevalence and impacts of driving under the influence of alcohol and drugs;
- Legal frameworks, enforcements and sanctions currently in place;
- Technologies for enforcement of driving under the influence of alcohol and drugs;
- Technologies for prevention of driving under the influence of alcohol and drugs, including a cost-benefit analysis of the installation of alcohol interlock devices.

Findings in relation to alcohol in traffic

It is found that alcohol consumption clearly affects the ability to drive.

Scientific literature provides confidence to support the conclusion that a BAC of 0.05% impairs faculties required in the operation of a vehicle. Furthermore, for many faculties it has been found they are increasingly impaired with an increasing BAC level. Faculties required for more complex task being impaired at lower BAC levels than most the skills required for simpler tasks. For some, impairment from alcohol can begin with BACs as low as 0.01 or 0.02%. However, relationships between BAC and impairment of higher level driving functions are less well understood, with mixed research findings on the influence of specific skills.

Research evidence consistently demonstrates that the risk of having an accident increases exponentially as more alcohol is consumed. With a blood alcohol concentration level of 1.5 g/L, the probability of a driver getting fatally injured is approximately 200 times higher than for a sober driver.

With increasing BAC levels the increase in crash rate with severe or fatal injuries is not the same for all age groups. The risk of a road accident for each dose of alcohol consumed by a young driver (aged 16-20) is three to five times higher than for the same concentration for drivers aged 30 and over.

Despite the increased risk, people continue to drive while having consumed alcohol. Data from roadside sobriety checks at national level indicate between 1-4% of the general driving population in Europe drives with BAC levels above the legal limit. A large scale user survey with a uniform approach conducted across 20 European countries in 2018 found at least one in ten road users had driven a car when they may have had a BAC over the legal limit.

Nevertheless, progress has been made in reducing the number of road fatalities with alcohol. National statistics show the number of road fatalities related to alcohol has reduced with 63

percent within the EU between 2008-2018. This downward trend has slowed down in recent years. Despite progress made, there almost 2750 alcohol-related road fatalities in the EU in 2018 according to national statistics. The share of alcohol-related fatalities in total road fatalities was 15% in the EU in 2018.

There is a wide-spread believe national statistics in most countries underreport the number of road fatalities with alcohol involvement. Not all countries use the same definition for alcohol-related road fatalities (e.g. definition by the European project SafetyNet). In addition, not all active road users involved in a road collision that resulted in road death or serious injury are systematically tested for alcohol.

It is estimated the actual share alcohol-related fatalities in total road fatalities is between 19% - 26%. This bandwidth is slightly lower compared to findings of a European Commission funded study, which estimated the share of road fatalities with involvement of alcohol in the EU27 for 2011 at 20-28%.

Since the publication of the EU Recommendation (2001/115/EC) BAC limits in the EU have further harmonised. At least 8 countries have introduced a lower BAC level for divers and 14 for novice and professional drivers after publication of the Recommendation. Currently, EU Member States, as well as Switzerland and Norway, have a legal BAC limit of 0.5 g/L or lower. Furthermore, 24 of the analysed 30 European countries apply lower BAC (0.0-0.3 g/L) for inexperienced drivers. In addition, most European countries have a BAC limit for professional drivers of 0.3 g/L or lower.

Research has shown lowering BAC limits to 0.5 g/L has been effective in reducing road fatalities in the European countries, but it is stressed the effectiveness is also determined by (increased) enforcement of and awareness-raising on these limits.

While it is often assumed further lowering BAC-limits improves road safety, there is little empirical evidence to support lowering BAC-limits from 0.5 g/L to 0.2 g/L or lower results in large reductions in road fatalities.

Differences in social perceptions and awareness related to risks and acceptability of drinking and driving and of enforcement, are all believed to result in differences in drink-driving and accidents with alcohol involvement.

Public surveys show consistent high support for the introduction of a (near) zero BAC limit for young or novice drivers. Similarly, there is support for (near) zero BAC limits for professional drivers. The majority of European countries reviewed already apply such limits.

There are reliable devices which can be used to either screen or collect evidence on drivers' BAC levels for enforcement of drink-driving regulation. Their use is widespread in European countries. No major barriers for their application in drink-driving enforcement have been found in terms of costs or otherwise.

Available data (13 countries) shows the number of police sobriety checks per 1000 inhabitants increased by 25% in Europe between 2010 and 2019. This increase largely occurred until 2014 and has remained at a similar level since. There are large differences between countries, with several countries actually reducing enforcement intensity. European surveys (19 countries) show 76% of respondents consider that the police enforcement of drink-driving traffic rules is not sufficient.

A wide variety of legal sanctions for drink driving is applied in European countries and there are large differences between countries in the choice of sanctions and how these are applied. There are many indications that the majority of drivers are not aware of penalties level that they are facing for driving above the legal alcohol limit.

In order to prevent driving under influence of alcohol, eight EU Member States have an active operating alcohol interlock offender/rehabilitation programme in place for drink-driving offenders. Several countries (i.e. Finland, Sweden, France, Lithuania and Norway) (also) have preventive/mandatory alcohol interlock programmes in place for specific types of vehicles (e.g. school transport, buses, coaches and trucks). Experience from Norway shows preventive interlock schemes can be introduced successfully in dialogue with the transport sector.

Alcohol interlocks are an effective means of avoiding drink driving recidivism during participation in the programme. In offender/rehabilitation programmes effectiveness increases significantly when accompanied with intensive guidance and/or supervision.

High costs, including costs incurred for guided/supervised participation, are a key barrier for drivers to enter in a (offender/rehabilitation) interlock programme. Some countries have therefore opted to apply a "low-supervision" approach. Especially in the later cases, no reliable data is available to assess the effectiveness due to recent introduction of the programme or limited monitoring. It therefore remains to be seen how the two approaches compare in terms of overall (cost) effectiveness.

In professional transport - an international, highly competitive economic sector – imposing different national requirements for installation and driving with alcohol interlocks could pose barriers for competition. Differences in BAC-limits applied between countries form a barrier for uniform introduction of alcohol interlocks in European countries.

Cost-benefit analysis has been carried out for policy options for EU-wide mandatory implementation of alcohol interlocks, under various scenarios leading to lower or higher cost-effectiveness. Of the policy options targeting mandatory factory fitting of alcohol interlocks in either passenger cars, buses and coaches or heavy goods vehicles (HGV), the latter is expected to result in net social-economic benefits in the 'high' and 'middle' scenarios. For ex-factory installation in passenger cars and buses and coaches the total costs outweigh the economic benefits in all scenarios.

Benefit-cost ratios for ex-factory installation of alcohol interlocks in the EU per 2026:

Policy Option	Benefit-cost ratio (low-high)
Alcohol interlock passenger cars	0.3 – 0.9
Alcohol interlock buses and coaches	0.1 – 0.4
Alcohol interlock heavy goods vehicles	0.2 – 1.9

Factory installation of alcohol interlocks in passenger cars could result in a reduction between 470 - 1170 road fatalities per year in the EU27. Although this reduction is much higher than for buses and coaches or HGVs, the size of the vehicle fleet that would need to be fitted with an alcohol interlock is also much bigger, and therefore the costs. In contrast, the fleet of buses and coaches in the EU is much smaller. However, for buses and coaches the number of alcohol-related casualties is already low. This reduces the cost-effectiveness of installing an alcohol interlock.

Among policy options reviewed, this study has also considered targeting two specific groups of drivers for mandatory installation of an alcohol interlock: young/novice drivers and high-BAC offenders. Both groups have higher risks of getting involved in an alcohol-related fatal road accident. It is noted that in case high-BAC offenders, alcohol interlocks are a sanction for a DUI-offence. As such, it touches upon the Member State competence for enforcement. Mandating alcohol inter-locks for high-BAC offenders is not a policy option that the Commission has proposed. The analysis of alcohol interlocks for high-BAC offenders in this report has an informative character only, estimating the impact in case all Member States would choose to implement it at national level.

Cost benefit analysis of the policy options requiring alcohol interlocks for these groups, shows these options are expected to deliver net social-economic benefits, in scenarios assuming medium to high effectiveness. The absolute number of fatalities which could be avoided by requiring these groups to drive with an alcohol interlock range between 130-1040 per year for young/novice drivers and 5-50 per year for high-BAC offenders

Benefit-cost ratios for installation of alcohol interlocks for novice drivers and high-BAC offenders in the EU per 2026:

Policy Option	Benefit-cost ratio (low-high)
Alcohol interlock young/novice drivers	0.2 – 2.9
Alcohol interlock high-BAC offenders	0.1 – 17.8

Recommendations related to alcohol in traffic

Taking into account the findings related to alcohol in traffic and technologies for enforcement and prevention of driving under influence of alcohol, the study provides the following recommendations:

- The goal of eliminating drink driving deaths and serious injuries by the 2050s requires effective measures. Consideration could be given to the development of a specific catalogue of recommendations for preventive solutions targeting drink driving.

- Effective prevention policy requires reliable, periodically updated data. It is therefore necessary to revise and unify the existing definitions relatively quickly, to define the scope of data that would be required and to agree on how to collect it. The data collected should make it possible to assess the effectiveness and efficiency of the solutions implemented and to make international comparisons.

- In order to draw confident conclusions about the impairment effect of alcohol on driving, especially more complex driving behaviour, more research would be required. On the one hand, further research could focus on the replicability of results of several potentially useful tests and their predictive validity of actual driving impairment. On the other hand, future endeavours could go beyond the normal performance measures and look into patterns of behavioural reactions in more complex driving scenarios, scenarios that one encounters in everyday driving.

- There are differences in enforcement and sanctions applied across Europe to prevent and manage drink driving. Very limited up-to-date information is available about the impacts of these differences. Research into the effects of these variations in policies and their execution, could help create better understanding of key success factors of effective strategies. Based on this recommendations on regulations and their effectuation could be provided. A similar solution has been attempted in the United States by empowering the National Committee on Uniform Traffic Laws and Ordinances to prepare a model DWI (Driving While Intoxicated) law. This model included BAC testing, BAC test refusals, higher penalties for high-BAC drivers, administrative licence revocation hearing procedures, and many other proposals. States can use the NCUTLO model as a reference point in reviewing their laws. It may be worth considering whether this experience could also be used in Europe. Such action could be building on the EC Recommendation on Enforcement in the field of Road Safety (2004/345/EC).

- Action could be taken to further promote the adoption of a 0.2 g/L BAC limit for professional drivers in order to facilitate introduction of alcohol interlocks without risk of significant adverse effects on competition.

- Via their procurement policy, public authorities could promote the use of interlocks through the requirement of having an interlock in the vehicles they purchase or in the vehicles used for the provision of publicly procured services (e.g. (public) transport, waste collection, courier service etc.).

- Promote the use of alcohol interlocks in HGVs and by high-BAC offenders. The use of interlocks in buses and coaches could also be considered, this could support the familiarisation with interlocks and promote a safety culture.

Findings related to drugs in traffic

The use of drugs, including medicines can have negative impact on several driving skills. However, large variations in impact have been found between individual drugs, combination of drugs, duration of use and between users. Much is still unclear about these variations.

Findings from research suggest an increase risks of accident involvement, including with injuries or fatalities, related to drug-driving in relation to some drugs. Increased risks have been found for amphetamines in particular, but also for cocaine and benzodiazepines. The majority of estimates indicate that the increase in risk is lower than twofold, thus far less than for alcohol. The increase in accident risk is largest for fatal accidents. However, findings are inconsistent, in particular for THC (cannabis). Many studies are based on small sample size, are difficult to compare and have been criticised for lack of methodological rigour.

Prevalence of drugs in traffic is becoming more apparent in recent years. The share of persons driving under the influence of drugs in the general driving population is estimate between 2-5% based on roadside checks and self-report survey data. On some days and times (e.g. weekend, nights, holidays) this share can increase to an estimated 27% on average. THC and benzodiazepines are most observed.

Not all countries record traffic fatalities with involvement of drugs. Countries that do, apply various definitions of traffic fatalities in relation to drugs. In addition, differences exist in the kind of drugs tested for, affecting the numbers recorded in national statistics.

In sixteen Member States, at least 1020 people died in 2018 in road accidents with involvement of drugs. The number of these fatalities has grown with 39% between 2010-2018. Also the share of fatalities with drug involvement has increased in almost all EU Member States over the past decade. For 6 % of road fatalities in 2018 drugs were involved, according to national statistics. Extrapolating this share to the EU27 this implies there were 1360 drugs-related road fatalities in 2018.

As with alcohol-related road fatalities, it is believed there is also underreporting of road fatalities related to drugs. Based on epidemiological studies of road fatalities at national level it is estimated the share of road fatalities with involvement of drugs (including medicines) is 15-25%.

Three types of legislation exist to regulate driving under influence of drugs: "impairment" legislation, "per se" legislation and the "two-tier" approach that combines both. The impairment approach is executed in 14 European countries, zero-tolerance or 'per se' limits in 9, and a combination of these two approaches into a two-tier system – in 7. There is no strong evidence on differences in impacts between these regulatory approaches the number of drugged drivers in traffic or on drug-related accidents and fatalities. In addition, little is known about the effects of applying stricter norms or thresholds on deterrence of driving under influence of drugs.

Roadside impairment testing (i.e. testing of psychomotor functions and cognitive functions of a driver) for drugs has been widely applied across European countries. However, it requires well-trained staff and it is costly and time consuming. There is a limited number of trained staff. In addition, doubt is being raised over the effectiveness in detecting drug impaired drivers. There is a need to both improve the current practical implementation of impairment testing, for example by training additional staff to conduct RIT, and to introduce standard Roadside Chemical Testing in addition.

Unlike for (breath) alcohol testing devices, there are no international or EU standards set out for drugs screening devices. To date, no complete type approval specification has been drawn up for these devices by either the OIML (International Organization for Legal Metrology) or CEN (European Committee for Standardization).

Roadside drug testing with screening devices using an oral fluid sample testing offers simple, rapid, non-invasive, observed specimen collection. Confirmation analysis is highly recommended.

Overall, the accuracy of roadside drug testing devices currently available is considered medium to high based on evidence available. Screening devices can test for a limited number of drugs found present in drivers. Not all drugs commonly found in drivers can be detected with the same accuracy. There are also variations in differences in detection time between substances compared to blood. Furthermore, there are differences accuracy between devices, with no device found to have higher accuracy across all studies and all drugs.

Although blood is generally considered to be the "gold standard" for determining drug concentrations, there are several countries that use oral fluid for confirmation (evidence) testing. Oral fluid screening is compatible with a regulatory approach of in such zero-tolerance for drug-driving, especially in relation to "illicit drugs".

Relatively high cost of screening devices and time required for the testing drivers, form a barrier from efficient large scale deployment of roadside drug-testing. There is hope that continuing technological development will result in possibilities which can increase efficient roadside chemical testing. For the moment, these are not there yet.

Enforcement intensity (i.e. number of checks per 1 000 inhabitants) has been increasing in the past decade, but is considered still low, compared to the average enforcement intensity for alcohol of European countries (n=13), which is almost 200 times higher. In addition, a large survey conducted in 19 European countries in 2018, showed that on average 4% of respondents had at least once undergone drug checks during the last 12 months, against 23% for alcohol.

The sanctions for drug driving offences vary between countries. In the majority of European countries sanctions are similar to those for drink driving. In most countries there is no differentiation of penalties according to the type of drug or its concentration in the human body.

Recommendations related to drugs in traffic

Taking into account the findings related to alcohol in traffic and technologies for enforcement and prevention of driving under influence of drugs, the study provides the following recommendations:

- In order to improve the knowledge of prevalence of drugs in traffic it is recommended to
    - Promote the adoption of a common definition of drug driving fatalities and the manner in which these are recorded, similar to provisions made for alcohol. This could include alignment of minimum range of drugs tested for;
    - Carry out an / promote performance of an epidemiological study, preferably across European countries and applying the same methodology (e.g. follow-up study of the DRUID study, which more than 10 year after the study was conducted still is the main source of information for main studies an policies prepared since).
- Expanding the research on drugs in relation to driving impairment and accident risk, in particular psychoactive medicines and NPS. In addition, conduct monitoring and evaluation of effectiveness of drug driving policies and enforcement. Develop a comprehensive policy on drug-driving based on evidence collected from (abovementioned) research efforts.
- Facilitate development of guidelines for police to assess the most efficient and effective locations and times to deploy their roadside testing unit for random drug testing.
- Promote the development of international standards for drugs screening devices and continue to support R&D in technologies which can improve functionalities of these devices
- Investigate options to promote joined procurement of drugs screening devices as a solutions to reduce costs. This could also involve investigating an approach to purchasing drug testing equipment and to consider developing a national guideline that sets out both the roadside drug testing and the laboratory testing procedures that produce accurate test results and admissible evidence in court.

Résumé

En 2001, la Commission européenne a adopté la Recommandation (2001/115/CE) concernant le taux maximal d'alcool dans le sang autorisé (TA). Aujourd'hui, la plupart des États membres ont adopté une législation fixant un taux maximum d'alcool dans le sang conformément à cette recommandation.

Les mesures visant à s'attaquer au problème de la conduite sous l'influence de l'alcool ou d'autres substances psychoactives appartiennent au domaine du comportement du conducteur, qui reste du ressort des États membres. Néanmoins, près de vingt ans après l'adoption de la recommandation, la conduite sous l'emprise de l'alcool reste l'un des facteurs d'accident les plus courants.

Dans le plan d'action stratégique pour la sécurité routière adopté dans le cadre du Paquet Mobilité III (annexe I de COM(2018) 293 final), la Commission s'est engagée à évaluer comment renforcer la recommandation de la Commission de 2001.

Cette étude vise à fournir aux services de la Commission des informations actualisées sur le rôle de l'alcool et des autres substances psychoactives en tant que facteurs de cause d'accident et sur les politiques et mesures mises en œuvre par les États membres pour lutter contre la conduite sous l'influence de l'alcool et des drogues. Plus précisément, l'étude fournit des informations sur :

- la prévalence et les impacts de la conduite sous l'influence de l'alcool et des drogues ;
- les cadres juridiques, les mesures d'application et les sanctions actuellement en place ;
- les technologies de lutte contre la conduite sous l'emprise de l'alcool et des drogues ;
- les technologies de prévention de la conduite sous l'influence de l'alcool et des drogues, y compris une analyse coûts-avantages de l'installation d'éthylotests anti-démarrage.

Résultats relatifs à l'alcool au volant

Il est démontré que la consommation d'alcool affecte clairement l'aptitude à conduire.

La littérature scientifique permet d'étayer la conclusion selon laquelle un taux d'alcoolémie de 0,05 % altère les facultés nécessaires à la conduite d'un véhicule. En outre, il a été établi que de nombreuses facultés sont altérées de manière croissante avec l'augmentation du TA. Les facultés requises pour des tâches plus complexes sont altérées à des TA plus faibles que la plupart des facultés requises pour des tâches plus simples. Pour certains, les déficiences des faculté dues à la consommation d'alcool peuvent commencer avec des taux d'alcoolémie aussi bas que 0,01 ou 0,02 %. Cependant, les relations entre le taux d'alcoolémie et l'altération des fonctions supérieures de la conduite sont moins bien comprises, et les résultats des recherches sur l'influence de compétences spécifiques sont mitigés.

Les recherches démontrent systématiquement que le risque d'avoir un accident augmente de façon exponentielle avec la consommation d'alcool. Avec un taux d'alcoolémie de 1,5 g/l, la probabilité qu'un conducteur soit mortellement blessé est environ 200 fois plus élevée que pour un conducteur sobre.

Avec l'augmentation du taux d'alcoolémie, l'augmentation du taux d'accidents avec blessures graves ou mortelles n'est pas la même pour tous les groupes d'âge. Le risque d'accident de la route pour chaque dose d'alcool consommée par un jeune conducteur (16-20 ans) est trois à cinq fois plus élevé que pour la même concentration chez les conducteurs de 30 ans et plus.

Malgré le risque accru, les gens continuent à conduire en ayant consommé de l'alcool. Les données issues des contrôles routiers de sobriété au niveau national indiquent qu'entre 1 et 4 % de la population générale des conducteurs en Europe conduit avec un taux d'alcoolémie supérieur à la limite légale. Une enquête à grande échelle auprès des usagers avec une approche uniforme menée dans 20 pays européens en 2018 a révélé qu'au moins un usager de la route sur dix avait conduit une voiture alors qu'il pouvait avoir un taux d'alcoolémie supérieur à la limite légale.

Néanmoins, des progrès ont été réalisés pour réduire le nombre de décès sur la route impliquant la consommation d'alcool. Les statistiques nationales montrent que le nombre de décès sur la route liés à l'alcool a diminué de 63 % dans l'UE entre 2008 et 2018. Cette tendance à la baisse s'est ralentie ces dernières années. Malgré les progrès réalisés, il y a près de 2750 décès routiers liés à l'alcool dans l'UE en 2018 selon les statistiques nationales. La part des décès liés à l'alcool dans le total des décès sur les routes était de 15 % dans l'UE en 2018.

Il est largement entendu que les statistiques nationales de la plupart des pays sous-estiment le nombre de décès liés à l'alcool sur les routes. Tous les pays n'utilisent pas la même définition des décès routiers liés à l'alcool (par exemple, la définition du projet européen SafetyNet). En outre, tous les usagers de la route impliqués dans une collision routière ayant entraîné un décès ou une blessure grave ne sont pas systématiquement soumis à un test d'alcoolémie.

On estime que la part réelle des décès liés à l'alcool dans le total des décès sur la route se situe entre 19 % et 26 %. Cette fourchette est légèrement inférieure aux résultats d'une étude financée par la Commission européenne, qui estimait à 20-28% la part des décès sur la route liés à l'alcool dans l'UE27 en 2011.

Depuis la publication de la recommandation de l'UE (2001/115/CE), les limites TA dans l'UE se sont davantage harmonisées. Au moins 8 pays ont introduit un taux d'alcoolémie plus bas pour les conducteurs et 14 pour les conducteurs novices et professionnels après la publication de la Recommandation. Actuellement, les États membres de l'UE, ainsi que la Suisse et la Norvège, ont un taux d'alcoolémie autorisé légal de 0,5 g/l ou moins. En outre, 24 des 30 pays européens étudiés appliquent un TA inférieur (0,0-0,3 g/L) pour les conducteurs inexpérimentés. En outre, la plupart des pays européens ont fixé un TA de 0,3 g/l ou moins pour les conducteurs professionnels.

Les recherches ont montré que l'abaissement du TA à 0,5 g/l a permis de réduire le nombre de tués sur les routes dans les pays européens, mais il est souligné que l'efficacité est également déterminée par l'application (accrue) de ces limites et la sensibilisation à celles-ci.

Alors que l'on suppose souvent qu'un abaissement supplémentaire du taux d'alcoolémie autorisé améliore la sécurité routière, il existe peu de preuves empiriques permettant d'affirmer qu'un abaissement du taux d'alcoolémie de 0,5 g/l à 0,2 g/l ou moins entraîne une réduction importante du nombre de tués sur les routes.

Les différences dans les perceptions sociales, dans la sensibilisation aux risques, dans l'acceptabilité de l'alcool au volant et dans le domaine de l'application de la loi sont toutes censées entraîner des différences dans la conduite en état d'ivresse et les accidents liés à l'alcool.

Les enquêtes publiques montrent un soutien élevé et constant à l'introduction d'un taux d'alcoolémie (presque) nul pour les jeunes conducteurs ou les conducteurs novices. De même, les conducteurs professionnels sont favorables à un taux d'alcoolémie (quasi) nul. La majorité des pays européens examinés appliquent déjà de telles limites.

Il existe des dispositifs fiables qui peuvent être utilisés pour dépister ou recueillir des preuves du taux d'alcoolémie des conducteurs afin de faire respecter la réglementation sur l'alcool au volant. Leur utilisation est répandue dans les pays européens. Aucun obstacle majeur à leur utilisation dans le cadre du contrôle de l'alcool au volant n'a été constaté, que ce soit en termes de coûts ou autres.

Les données disponibles (13 pays) montrent que le nombre de contrôles de sobriété effectués par la police pour 1000 habitants a augmenté de 25% en Europe entre 2010 et 2019. Cette augmentation s'est largement produite jusqu'en 2014 et est restée à un niveau similaire depuis. Il existe de grandes différences entre les pays, plusieurs d'entre eux ayant en fait réduit l'intensité des contrôles. Les enquêtes européennes (19 pays) montrent que 76 % des personnes interrogées considèrent que l'application par la police des règles de circulation en matière d'alcool au volant n'est pas suffisante.

Une grande variété de sanctions légales pour conduite en état d'ivresse est appliquée dans les pays européens et il existe de grandes différences entre les pays dans le choix des sanctions et la manière dont elles sont appliquées. De nombreux éléments indiquent que la majorité des conducteurs ne sont pas conscients du niveau des sanctions auxquelles ils s'exposent s'ils conduisent au-dessus de la limite légale d'alcoolémie.

Afin de prévenir la conduite sous l'emprise de l'alcool, huit États membres de l'UE ont mis en place un programme actif de réadaptation incluant l'utilisation d'antidémarreurs éthylométriques pour les contrevenants qui ont conduit sous l'emprise de l'alcool. Plusieurs pays (Finlande, Suède, France, Lituanie et Norvège) ont également mis en place des programmes préventifs/obligatoires avec antidémarreurs éthylométriques pour certains types de véhicules (transports scolaires, autobus, autocars et camions, par exemple). L'expérience de la Norvège montre que les programmes préventif avec utilisation d' antidémarreurs éthylométriques peuvent être introduits avec succès dans le cadre d'un dialogue avec le secteur des transports.

Les antidémarreurs éthylométriques sont un moyen efficace d'éviter la récidive de conduite en état d'ivresse pendant la participation au programme. Dans les programmes de réinsertion des contrevenants, l'efficacité augmente considérablement lorsqu'elle s'accompagne d'une assistance et/ou d'une surveillance intensive.

Les coûts élevés, y compris les coûts encourus pour la participation guidée/supervisée, constituent un obstacle majeur pour les conducteurs qui souhaitent participer à un programme avec antidémarrage (contrevenant/réhabilitation). Certains pays ont donc choisi d'appliquer une approche de " faible surveillance ". Dans ces derniers cas en particulier, aucune donnée fiable n'est disponible pour évaluer l'efficacité en raison de l'introduction récente du programme ou d'un suivi limité. Il reste donc à voir comment les deux approches se comparent en termes d'efficacité (coût) globale.

Dans le transport professionnel - un secteur économique international et hautement compétitif - imposer des exigences nationales différentes pour l'installation et la conduite avec un antidémarreur éthylométrique pourrait constituer un obstacle à la concurrence. Les différences entre les limites d'alcoolémie autorisées appliquées entre les pays constituent un obstacle à l'introduction uniforme des antidémarreurs éthylométriques dans les pays européens.

Une analyse coûts-bénéfices a été réalisée pour déterminer les options en termes de politiques de mise en place obligatoire d'antidémarreurs éthylométriques dans toute l'UE, ce dans le cadre de différents scénarios conduisant à un rapport coût-efficacité plus ou moins élevé. Parmi les options de politiques visant à rendre obligatoire l'installation en usine d'antidémarreurs éthylométriques sur les voitures particulières, les autobus et les autocars ou les poids lourds, cette dernière apportera un profit significatif dans les scénarios "élevé" et "moyen". Pour l'installation en usine dans les voitures particulières et les autobus et autocars, les coûts totaux dépassent les avantages économiques dans tous les scénarios.

Rapport avantages-coûts de l'installation en usine d'antidémarreurs éthylométriques dans l'UE d'ici 2026 :

Options de politique	**Rapport avantages-coûts (faible-élevé)**
Antidémarreur éthylométrique sur les voitures particulières	0.3 – 0.9
Antidémarreur éthylométrique sur les autobus et les autocars	0.1 – 0.4
Antidémarreur éthylométrique sur les poids-lourds	0.2 – 1.9

L'installation en usine de dispositifs antidémarrage avec éthylomètre dans les voitures particulières pourrait entraîner une réduction de 470 à 1 170 décès par an sur les routes de l'UE27. Bien que cette réduction soit beaucoup plus importante que pour les autobus et autocars ou les poids lourds, la taille de la flotte de véhicules qui devrait être équipée d'un antidémarreur éthylométrique est également beaucoup plus importante, et par conséquent les coûts sont plus élevés. Au contraire, la flotte d'autobus et d'autocars dans l'UE est beaucoup plus faible. Toutefois, dans le cas des autobus et des autocars, le nombre de victimes de l'alcool est déjà faible. Cela réduit la rentabilité de l'installation d'un antidémarreur éthylométrique.

Parmi les options politiques examinées, cette étude a également envisagé de cibler deux groupes spécifiques de conducteurs pour l'installation obligatoire d'un antidémarreur éthylométrique: les jeunes conducteurs/novices et les contrevenants au taux d'alcoolémie élevé. Ces deux groupes présentent des risques plus élevés d'être impliqués dans un accident de la route mortel lié à l'alcool. Il est à noter que dans le cas des contrevenants ayant un taux d'alcoolémie élevé, les antidémarreurs éthylométriques sont une sanction pour conduite en état d'ivresse. En tant que tel, il touche à la compétence des États membres en matière de respect de la loi. Rendre obligatoire l'utilisation d'antidémarreurs éthylométriques pour les contrevenants au taux d'alcoolémie élevé n'est pas une option politique proposée par la Commission. Dans ce rapport, l'analyse relative aux éthylotests anti-démarrage pour les contrevenants au taux d'alcoolémie élevé n'a qu'un caractère informatif, car elle estime l'impact de cette mesure au cas où tous les États membres choisiraient de l'appliquer au niveau national.

L'analyse coûts-avantages des options politiques exigeant la mise en place d'éthylotests antidémarrage pour ces groupes montre que ces options devraient apporter des avantages socio-économiques nets, dans des scénarios supposant une efficacité moyenne à élevée. Le nombre absolu de décès qui pourraient être évités en exigeant de ces groupes qu'ils conduisent un véhicule équipé d'un antidémarreur éthylométrique varie entre 130 et 1040 par an pour les jeunes conducteurs et les conducteurs novices, et entre 5 et 50 par an pour les contrevenants au taux d'alcoolémie élevé.

Rapport avantages-coûts de l'installation de dispositifs antidémarreurs éthylométriques pour les conducteurs novices et les contrevenants au taux d'alcoolémie élevé dans l'UE d'ici 2026.

Options de politique	Rapport avantages-coûts (faible-élevé)
Antidémarreur éthylométrique pour les conducteurs jeunes/novices	0.2 – 2.9
Antidémarreur éthylométrique pour les contrevenants au TA élevé	0.1 – 17.8

Recommandations relatives à l'alcool dans le trafic routier

Compte tenu des conclusions relatives à l'alcool au volant et aux technologies de contrôle et de prévention de la conduite sous l'influence de l'alcool, l'étude formule les recommandations suivantes :

- L'objectif d'éliminer les décès et les blessures graves dus à l'alcool au volant d'ici les années 2050 nécessite des mesures efficaces. On pourrait envisager l'élaboration d'un catalogue spécifique de recommandations pour des solutions préventives ciblant l'alcool au volant.

- Une politique de prévention efficace exige des données fiables et périodiquement mises à jour. Il est donc nécessaire de réviser et d'unifier assez rapidement les définitions existantes, de définir l'étendue des données qui seront requises et de convenir de la manière de les collecter. Les données collectées devraient permettre d'évaluer l'efficacité et l'efficience des solutions mises en œuvre et d'effectuer des comparaisons internationales.

- Afin de tirer des conclusions fiables sur l'effet de l'alcool sur la conduite, en particulier sur les comportements de conduite plus complexes, des recherches supplémentaires seraient nécessaires. D'une part, les recherches futures pourraient se concentrer sur la reproductibilité des résultats de plusieurs tests potentiellement utiles et sur leur validité prédictive de l'altération réelle des facultés de conduite. D'autre part, les efforts futurs pourraient aller au-delà des mesures normales de performance et examiner les modèles de réactions de comportement dans des scénarios de conduite plus complexes, scénarios que l'on rencontre dans la conduite quotidienne.

- Il existe, en Europe, des différences dans l'application de la loi et des sanctions pour prévenir et gérer l'alcool au volant. On dispose de très peu d'informations actualisées sur l'impact de ces différences. La recherche sur les effets de ces variations dans les politiques et leur exécution pourrait aider à mieux comprendre les facteurs clés de succès des stratégies efficaces. Sur cette base, des recommandations sur les réglementations et leur mise en œuvre pourraient être fournies. Une solution similaire a été tentée aux États-Unis en habilitant le '*National Committee on Uniform Traffic Laws and Ordinances'* (NCUTLO) à préparer un modèle de loi sur la conduite en état d'ivresse. Ce modèle comprenait des tests d'alcoolémie, des refus de tests d'alcoolémie, des sanctions plus élevées pour les conducteurs ayant un TA élevé, des procédures administratives pour les audiences liées au retrait du permis, et de nombreuses autres propositions. Les États peuvent utiliser le modèle NCUTLO comme référence pour la révision de leurs lois. Il pourrait être intéressant d'examiner si cette expérience pourrait également être utilisée en Europe. Une telle action pourrait s'appuyer sur la

Recommandation de la CE sur l'application de la législation dans le domaine de la sécurité routière (2004/345/CE).

- Des mesures pourraient être prises pour promouvoir davantage l'adoption d'une limite d'alcoolémie de 0,2 g/l pour les conducteurs professionnels afin de faciliter l'introduction des éthylotests anti-démarrage sans risque d'effets néfastes importants sur la concurrence.

- Par leur politique d'approvisionnement, les pouvoirs publics pourraient promouvoir l'utilisation des antidémarreurs éthylométriques en incluant l'obligation dans les marchés publics que les véhicules à acquérir disposent d'antidémarreurs éthylométriques ou les services à acquérir (par exemple les transports (publics), la collecte des déchets, les services de messagerie, etc.) sont fournis en utilisant des véhicules disposant d'antidémarreurs éthylométriques.

- Promouvoir l'utilisation d'éthylotests anti-démarrage pour les poids lourds et les contrevenants au taux d'alcoolémie élevé. On pourrait en outre envisager d'utiliser les antidémarreurs éthylométriques dans les autobus et les autocars; cela pourrait contribuer à se familiariser avec les antidémarreurs et à promouvoir une culture de la sécurité.

Résultats relatifs aux drogues dans le trafic routier

La consommation de drogues, y compris de médicaments, peut avoir un impact négatif sur plusieurs facultés de conduite. Toutefois, de grandes variations d'impact ont été constatées entre les différentes drogues, les combinaisons de drogues, la durée de la consommation et entre les usagers. Beaucoup de points concernant ces variations ne sont toujours pas clairs.

Les résultats de la recherche suggèrent une augmentation des risques d'accident, y compris des blessures ou des décès, liés à la conduite sous l'emprise de drogues pour certaines drogues. Des risques accrus ont été constatés pour les amphétamines en particulier, mais aussi pour la cocaïne et les benzodiazépines. La majorité des estimations indiquent que l'augmentation du risque est inférieure au double, donc bien moins que pour l'alcool. L'augmentation du risque d'accident est la plus importante pour les accidents mortels. Toutefois, les résultats sont contradictoires, en particulier pour le THC (cannabis). De nombreuses études reposent sur des échantillons de petite taille, sont difficiles à comparer et ont été critiquées pour leur manque de rigueur méthodologique.

La présence de drogues dans la circulation est de plus en plus évidente ces dernières années. La proportion de personnes conduisant sous l'influence de drogues dans la population générale des conducteurs est estimée entre 2 et 5% sur la base de contrôles routiers et de données autodéclarées tirées de sondages. Certains jours et certaines heures (par exemple le week-end, la nuit, les jours fériés), cette proportion peut atteindre 27 % en moyenne. Le THC et les benzodiazépines sont les plus observés.

Tous les pays n'enregistrent pas les accidents mortels liés à la drogue. Les pays qui le font appliquent différentes définitions des accidents mortels de la circulation liés à la drogue. En outre, il existe des différences dans le type de drogues recherchées, ce qui affecte les chiffres enregistrés dans les statistiques nationales.

Dans seize États membres, au moins 1020 personnes sont mortes en 2018 dans des accidents de la route avec implication de drogues. Le nombre de ces décès a augmenté de 39 % entre 2010 et 2018. En outre, la part des décès liés à la drogue a augmenté dans presque tous les États membres de l'UE au cours de la dernière décennie. Dans 6 % des cas de décès sur la route en 2018, des drogues étaient impliquées, selon les statistiques nationales. En extrapolant cette part à l'UE27, cela suppose que 1360 accidents mortels liés à la drogue sont survenus sur les routes en 2018.

Comme pour les décès liés à l'alcool, on pense qu'il y a aussi une sous-déclaration des décès liés aux drogues. Sur la base d'études épidémiologiques sur les accidents de la route au niveau national, on estime que la part des accidents mortels liés aux drogues (y compris les médicaments) est de 15 à 25 %.

Il existe trois types de législation pour réglementer la conduite sous l'influence de drogues : "la législation sur les déficiences de facultés", la législation "per se" et l'approche "à deux niveaux" qui combine les deux. L'approche fondée sur l'affaiblissement des facultés est appliquée dans 14 pays européens, la tolérance zéro ou les limites "per se" dans 9 pays, et la combinaison de ces deux approches dans un système à deux niveaux, dans 7 pays. Il n'existe pas de preuves solides des différences d'impact entre ces approches réglementaires sur le nombre de conducteurs drogués dans le trafic, ou sur les accidents et les décès liés à la drogue. En outre, on sait peu de choses sur les effets de l'application de normes ou de seuils plus stricts en matière de dissuasion de la conduite sous l'influence de drogues.

Les tests de contrôle des facultés réduites sur le bord des routes (c'est-à-dire les tests des fonctions psychomotrices et des fonctions cognitives d'un conducteur) ont été largement appliqués dans les pays européens. Toutefois, ils nécessitent un personnel bien formé, sont coûteux et prennent du temps. Le nombre de personnels formés est limité. Par ailleurs, des doutes sont émis quant à l'efficacité de la détection des conducteurs sous l'emprise de drogues. Il est nécessaire à la fois d'améliorer la mise en œuvre pratique actuelle des tests de contrôle des facultés réduites, par exemple en formant du personnel supplémentaire pour effectuer les tests de contrôle des facultés réduites et d'introduire en plus des tests standard de dépistage de substances chimiques sur le bord des routes.

Contrairement aux appareils de dépistage de l'alcool (dans l'haleine), il n'existe pas de normes internationales ou européennes pour les appareils de dépistage des drogues. À ce jour, aucune spécification d'homologation complète n'a été établie pour ces dispositifs, que ce soit par l'OIML (Organisation internationale de métrologie légale) ou le CEN (Comité européen de normalisation).

Le dépistage routier des drogues à l'aide d'appareils de dépistage utilisant un échantillon de salive permet un prélèvement d'échantillons simple, rapide, non invasif et observé. Une analyse de vérification est fortement recommandée.

Dans l'ensemble, la précision des dispositifs de dépistage routier des drogues actuellement disponibles et sur la base des preuves présentes, est jugée moyenne à élevée. Les dispositifs de dépistage peuvent tester un nombre limité de drogues présentes chez les conducteurs. Toutes les drogues couramment trouvées chez les conducteurs ne peuvent pas être détectées avec la même précision. Par ailleurs, il existe des différences de temps de détection entre les substances en comparaison avec le sang. Enfin, il existe des différences de précision entre les appareils, et aucun appareil ne s'ést avéré être plus précis lors de toutes les études et pour toutes les drogues.

Bien que le sang soit généralement considéré comme "l'étalon-or" pour déterminer les concentrations de drogues, plusieurs pays utilisent la salive pour les tests de vérification (preuve). Le dépistage salivaire est compatible avec une approche réglementaire de tolérance zéro pour la conduite sous l'emprise de drogues, notamment en ce qui concerne les "drogues illicites".

Le coût relativement élevé des appareils de dépistage et le temps nécessaire pour tester les conducteurs constituent un obstacle au déploiement efficace à grande échelle des tests de dépistage routier de drogues . On peut espérer que le développement technologique continu débouchera sur des possibilités permettant d'accroître l'efficacité des tests de substances chimiques en bord de route. Pour l'instant, ces possibilités n'existent pas encore.

L'intensité de mise en application de la loi (c'est-à-dire le nombre de contrôles pour 1 000 habitants) a augmenté au cours de la dernière décennie, mais elle est encore considérée comme faible, comparée à l'intensité moyenne de mise en application de la loi sur l'alcool dans les pays européens (n=13), qui est presque 200 fois plus élevée. De plus, une vaste enquête menée dans 19 pays européens en 2018, a montré qu'en moyenne 4% des personnes interrogées avaient subi au moins une fois un contrôle de drogue au cours des 12 derniers mois, contre 23% pour l'alcool.

Les sanctions pour les infractions de conduite sous l'emprise de drogues varient selon les pays. Dans la majorité des pays européens, les sanctions sont similaires à celles appliquées pour la conduite en état d'ivresse. Dans la plupart des pays, il n'existe pas de différenciation des sanctions en fonction du type de drogue ou de sa concentration dans le corps humain.

Recommandations relatives aux drogues dans le trafic routier

Compte tenu des conclusions relatives à l'alcool dans la circulation et aux technologies de contrôle et de prévention de la conduite sous l'influence de drogues, l'étude formule les recommandations suivantes :

- Afin d'améliorer la connaissance de la prévalence des drogues dans le trafic routier, il est recommandé de :
  - Promouvoir l'adoption d'une définition commune des décès liés à la conduite sous l'influence de drogues et de la manière dont ils sont enregistrés, à l'instar des dispositions prises pour l'alcool. Cela pourrait inclure une harmonisation de la gamme minimale de drogues à tester ;
  - Réaliser ou promouvoir une étude épidémiologique, de préférablement dans plusieurs pays européens et en appliquant la même méthodologie (par exemple, une étude de suivi de l'étude DRUID, qui, plus de 10 ans après sa réalisation, reste la principale source d'information pour les principales études et politiques préparées depuis).
- Développer la recherche sur les drogues en relation avec les troubles de la conduite et le risque d'accident, en particulier les médicaments psychoactifs et les NPS. En outre, effectuer un suivi et une évaluation de l'efficacité des politiques en matière de drogues au volant et de leur mise en œuvre.
- Élaborer une politique globale sur la conduite sous l'emprise de drogues sur la base des données recueillies dans le cadre des efforts de recherche (susmentionnés).
- Faciliter l'élaboration de lignes directrices permettant à la police d'évaluer les lieux et les moments les plus efficaces pour déployer son unité de contrôle routier pour le dépistage aléatoire des drogues.
- Promouvoir l'élaboration de normes internationales pour les dispositifs de dépistage des drogues et continuer à soutenir la R&D dans les technologies susceptibles d'améliorer les fonctionnalités de ces dispositifs.

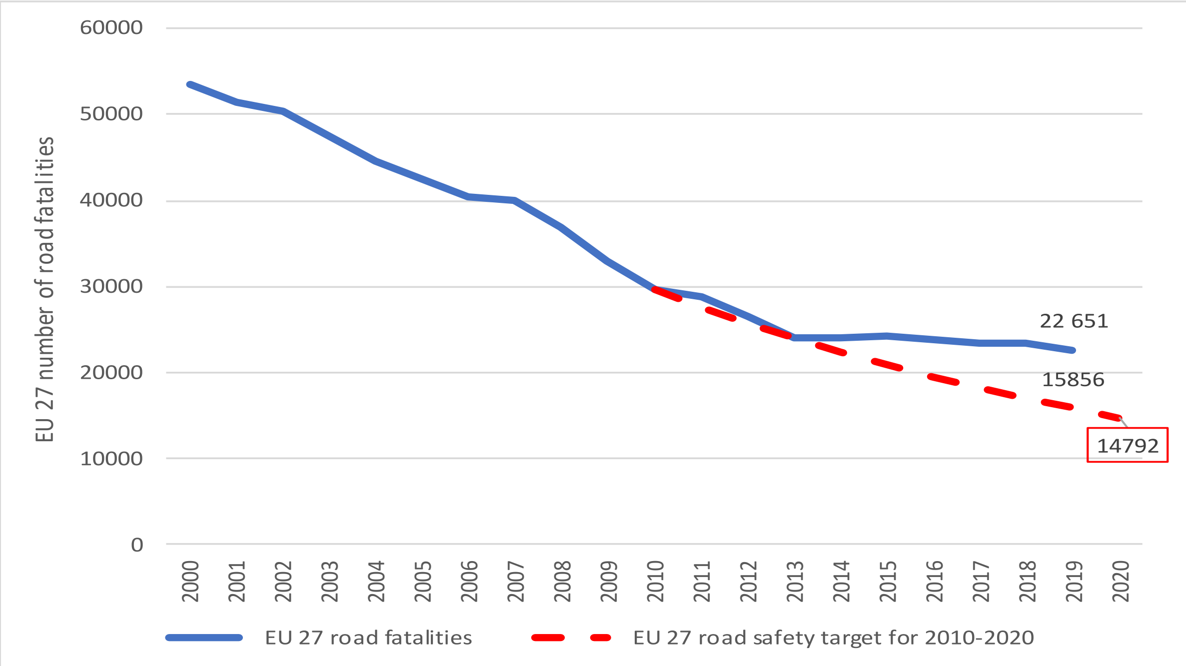
Étudier les possibilités de promouvoir l'achat groupé de dispositifs de dépistage des drogues comme solution pour réduire les coûts. On pourrait inclure l'étude d'une approche pour l'achat d'équipements de dépistage de drogues et l'élaboration d'une directive nationale définissant les procédures de dépistage de drogues sur la route et en laboratoire qui aboutissent à des résultats précis et des preuves admissibles devant les tribunaux.

1 Introduction

According to preliminary figures published by the European Commission (2020), there were around 22,800 fatalities in road accidents in the EU 27 in 2019 and some 120,000 people were seriously injured. The number of road fatalities in Europe decreased with 23% compared to 2010 figures.

With an average of 51 road deaths per million inhabitants, Europe remains by far the safest region in the world when it comes to road safety. At the same time, statistics (Figure 1.1) also show that the EU target of halving the number of road deaths by 2020 (relative to the 2010 baseline) will not be met.

Figure 1.1 Evolution of European road fatalities and target for 2020



Source: Eurostat (2020) and EU Road Safety Policy Framework 2021-2030.

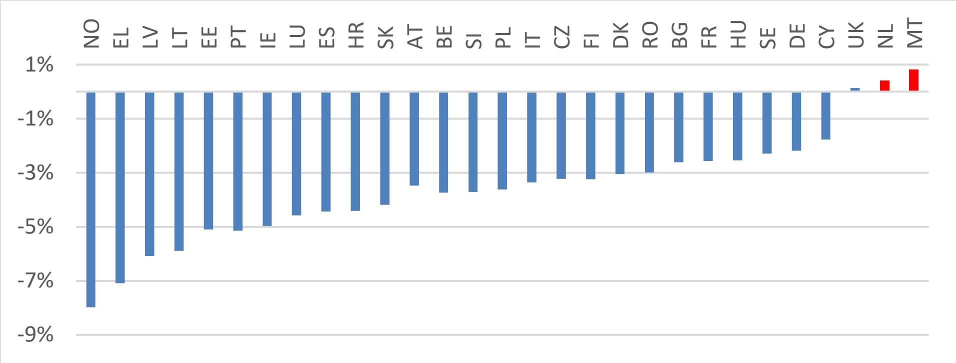
In addition, the EU average number of road fatalities masks significant differences between Member States. While the performance gap between the Member States has narrowed significantly since the year 2000, there are still proportionally four times more road deaths in the least performing country than in the best.

In the "Europe on the Move" package in May 2018, the European Commission put forward a new approach to EU road safety policy[1], along with a medium term Strategic Action Plan[2]. The Road Safety Policy Framework for 2021-2030 (European Commission, 2020) sets out how the new policy is being translated into action. In these documents, the Commission confirms the EU's long-term goal of moving close to zero fatalities and serious injuries in road transport by 2050. The new interim targets, responding to the 2017 Valletta Declaration on Road Safety[3] by transport ministers are to cut the number of road deaths by 50% between 2020 and 2030, and to halve the number of serious injuries in the same period. As outlined in the EU staff working

1 European Commission (2018), COM (2018) 293 final.
2 Annex I to the Communication (https://eur-lex.europa.eu/resource.html?uri=cellar:0e8b694e-59b5-11e8-ab41-01aa75ed71a1.0003.02/DOC_2&format=PDF)
3 https://eumos.eu/wp-content/uploads/2017/07/Valletta_Declaration_on_Improving_Road_Safety.pdf

document[4], the Commission decided to base its road safety policy framework for the decade 2021 to 2030 on the Safe System approach. Sober driving (from alcohol and drugs) is an important part of this Safe System approach.

Figure 1.2 Change in road deaths between 2010 and 2019 by country



Source: Eurostat (2020), ETSC (2020).

The problem of driving under the influence of alcohol and/or drugs is difficult to quantify. A large number of studies has been conducted on the impact of alcohol on road fatalities or (serious) injuries. Methodologies, data availability and quality and resulting estimates vary greatly across studies and countries. There is a widespread consensus that the actual number of alcohol-related road deaths in many countries is higher than the officially reported numbers.

Compared to alcohol, the road safety impact of driving under the influence of drugs in the EU is even more difficult to ascertain. Definitions vary across Member States, no harmonised test methods exist and data is not yet collected systematically.

The measures aimed at tackling the problem of driving under the influence of alcohol or other psychoactive substances (e.g. drugs) belong to the domain of driver behaviour, which remains in the remit of Member State competences. In 2001, the European Commission adopted its recommendation (2001/115/EC) on the maximum permitted blood alcohol content (BAC) for drivers of motorised vehicles. In addition, the EC Communication on an EU alcohol strategy[5], invited the Member States to consider a zero BAC limit for young and novice drivers and drivers in public transport and of dangerous goods. For substances other than alcohol no such recommendations have been made.

Today, acting on the Recommendation 2001/115/EC, most Member States have adjusted their drink-driving legislation by lowering maximum BAC limits. Nevertheless, driving under influence remains one of the most common accident factors. In the Strategic Action Plan on Road Safety adopted as part of the III Mobility Package (Annex I to COM(2018) 293 final), the Commission committed to evaluate how to strengthen the Commission recommendation of 2001 and give guidance on the use of alcohol interlocks.

1.1 *Objectives of the study*

This study is intended to provide the Commission services with up-to-date information on the role of alcohol and other psychoactive substances as accident causation factors and on the policies and measures implemented by Member States to address it. Following the Terms of Reference (ToR), the purpose of this study is to provide the Commission with relevant

---

4 https://ec.europa.eu/transport/road_safety/sites/default/files/move-2019-01178-01-00-en-tra-00_3.pdf

5 COM(2006) 625 final: An EU strategy to support Member States in reducing alcohol related harm https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:52006DC0625&from=EN

information that will assist in deciding if and how to update the Commission recommendation of 2001.

Specifically, this study provides up-to-date information on:

- Prevalence and impacts of driving under the influence of alcohol and drugs;
- Legal frameworks, enforcements and sanctions currently in place;
- State-of-the-art technologies to enforce alcohol and drugs;
- Potential safety benefits and costs of alcohol interlock programmes.

1.2 *Structure of the report*

The structure of the report and a brief description of each chapter is outlined below:

Chapter 2 provides a global overview of the methodology applied for this study. It clarifies some of the terms frequently used throughout this report.

Chapter 3 and **4** present up-to-date information on the prevalence of driving under the influence of alcohol and other psychoactive substances. They review how this affects driving performance, including the role of alcohol and other psychoactive substances as contributory factors to accidents resulting in fatalities or serious injuries across the EU and the EFTA countries. In addition, the chapters describe the legal framework related to driving under the influence of alcohol and other psychoactive substances in Europe. They describe the different limits for driving under influence applied across the EU, enforcement activities and sanctions. Finally, the impact of legal limits and enforcement activities is reviewed.

Chapter 5 and **6** review technologies used by and available to police forces to test whether drivers are under the influence of respectively alcohol and/or other psychoactive substances. It includes an overview of current state of the art of technologies for enforcement (for roadside testing and confirmation as well as advantages and drawbacks of these technologies. In addition, the chapters include an outlook of what may be expected from new technologies under development.

Chapter 7 reviews the two technologies for the prevention of impaired driving: alcohol interlocks and driver drowsiness detection. The chapter describes the technical standards, the operation and performance of these, so called, advanced driver assistance systems.

Chapter 8 provides an inventory of alcohol interlock programmes in Europe. It shows which countries have implemented alcohol interlock programmes and how these national schemes are organised. It also reflects on the costs and strengths and weaknesses of the programmes.

Chapter 9 assesses the potential (safety) effect of the use of alcohol interlock devices. The effectiveness of requiring specific target groups to drive with an alcohol interlock will be discussed. It involves professional drivers, high-BAC offenders and young drivers.

Chapter 10 provides a cost-benefit analysis of policy options mandating the installation of alcohol interlocks in specific vehicle categories and/or as a condition for driving by specific groups of drivers. In line with the terms of reference, the chapter first provides cost-benefit analysis of mandating ex-factory installation of alcohol interlocks in respectively passenger cars, buses and coaches and heavy goods vehicles. Additional cost-benefit analysis is provided for policy options where this requirement is extended to include retrofitting in existing vehicles in these categories. Finally, cost-benefit analysis is provided for policy options mandating alcohol interlocks for young/novice drivers and high-BAC offenders.

Chapter 11 provides conclusions and recommendations on how the European Commission can effectively support Member States to reduce the number of road accidents related to alcohol and other psychoactive substances.

2 Methodology

2.1 *Driving under influence – terminology*

This report is on prevention of driving under the influence of alcohol and drugs. International literature as well as legal frameworks use different wording to refer to situations of driving under influence (DUI) of alcohol and drugs, which are often collectively referred to as 'psychoactive substances'.

Psychoactive substances are substances that, when taken in or administered into one's system, affect mental processes, e.g. cognition or affect. This term and its equivalent, psychotropic drug, are the most neutral and descriptive term for the whole class of substances, licit and illicit, of interest to drug policy, as well as road safety policy. 'Psychoactive' does not necessarily imply dependence-producing, and in common parlance, the term is often left unstated, as in 'drug use'.

As mentioned, there are many psychoactive substances. Examples include alcohol (ethanol), caffeine and nicotine, but also recreational and medicinal drugs such as cocaine, heroin, amphetamines, cannabis (THC), and tranquilizers/benzodiazepines, sedative hypnotics, some antidepressants and antihistamines. In this report, we distinguish alcohol from 'other drugs'. Were relevant, these 'other drugs' will be further distinguished into more specific groups or classes.

What psychoactive substances can be legally used in general varies per country. For medicinal drugs, it is important to distinguish regular therapeutic use, according to prescription, from abuse of these drugs. This plays a role for example for opioids and benzodiazepines.

In addition to legislation on general use of psychoactive substances, countries have specific legislation on substance use by drivers of a vehicle, because use of these substances impairs the driver's ability to operate a vehicle. Also here the wording differs between countries and studies. Impaired driving, drink or drunk driving, driving under influence (DUI) of alcohol and/or drugs and driving while intoxicated (DWI) are all terms frequently used.

Impaired driving typically relates to operating a vehicle while the driver's ability to do so has been compromised to any degree by consuming alcohol, drugs or a combination of the two. In some cases a distinction is made between being impaired and being intoxicated or drunk. In those cases, impaired driving does not necessarily mean that the driver was drunk or intoxicated, only that their ability to drive was affected by the consumption of alcohol and/or drugs. It is sometimes referred to as the "appreciable impairment definition". Using this definition, drivers are considered impaired in case substance use has "appreciably" (or "noticeably") limited their mental or physical faculties, leaving them not fit to drive, regardless of the level of psychoactive substance in the body. Impairment is often established based on interview, clinical signs and psychomotor tests and not on analysis of psychoactive substances in body fluids, which only provides corroborating evidence as to the cause of the impairment.

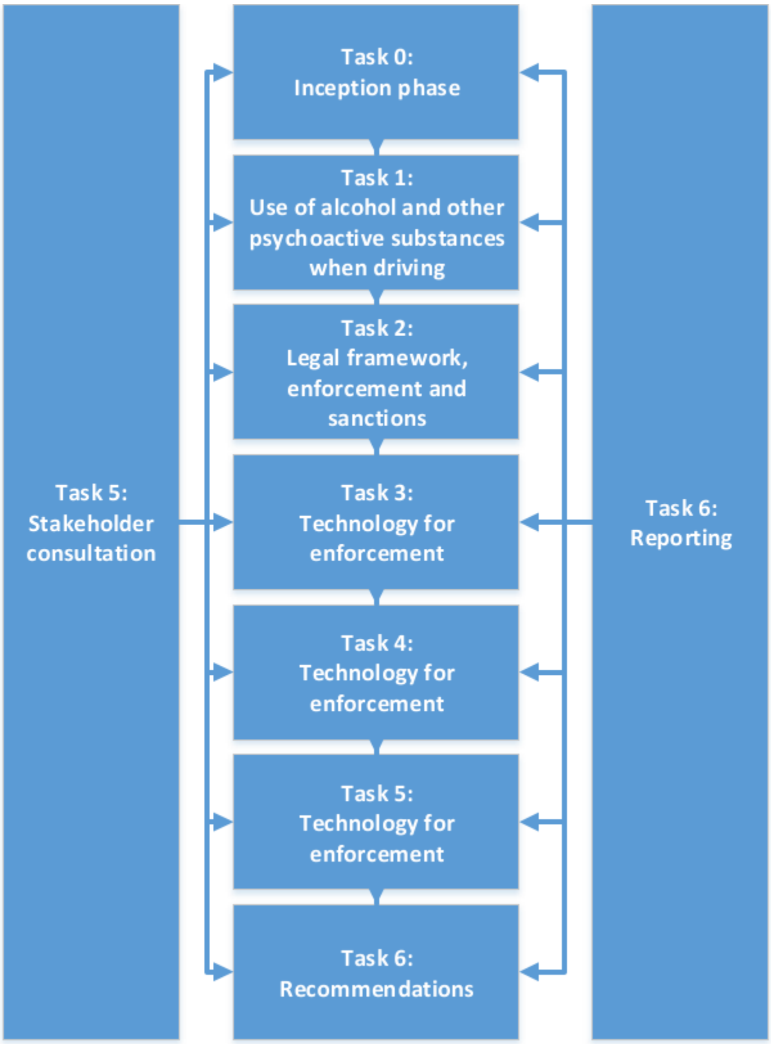
In other cases, impaired driving is directly linked to a level of intoxication. Also definitions of being drunk or drugged are often linked to a certain level of intoxication. In such a zero-tolerance/per se limits approach driving is prohibited if drivers have alcohol or drugs present in their system above a certain threshold. Thresholds applied vary for substances and across countries. In this report, we will therefore use 'driving under influence' (DUI) when referring to drivers who have used any amount of alcohol or drugs.

2.2 *Methodology*

This fact-finding study reviews the role of alcohol and other drugs as accident causation factors and on the policies and measures to address it implemented by Member States and other European countries. The focus is on findings from the EU27 Member States, the EFTA countries and the United Kingdom. In addition, where relevant findings are included from countries which offer interesting examples of comparison, such as Australia, New Zealand and the US.

The study consists of the following main tasks, which follow the ToR. The figure below shows the tasks and their interrelation.

Figure 2.1 Project overview: steps and tasks



2.2.1 Desk research

Desk research has been carried out of all available sources of information on alcohol and drugs related fatalities in road traffic; the legal frameworks, enforcement and sanctions; technologies to enforce alcohol and drugs in use and under development; and implementation and impact of alcohol interlock devices. The data sources include general literature; websites; EU and national statistical databases; EU Member States' national legislation; targeted reports by stakeholder organisations; reports of EU funded and Member States' projects dealing with alcohol, drugs and road safety, and alcohol interlock devices. The focus has been on collecting information produced over the past decade and, in particular, after the publishing on the last large European study DRUID (Driving under the Influence of Drugs, Alcohol and Medicines), which collected data between 2006 and 2011. Statistics are provided up until the year for which at least 2/3 of the countries could provide data. Data has been collected over the period 02/02/2020 and 15/12/2020.

2.2.2 Stakeholder consultation

Stakeholders have provided valuable input to this study.

On the one hand, stakeholders have been consulted to validate the most up-to-date information on usage of alcohol and drugs when driving, legal frameworks, enforcement and sanctions across European countries and also different technologies in place. During interviews and a stakeholder webinar, these findings were tested on robustness and completeness. The study has benefited from the contribution of a panel of national experts. These experts have been approached for the provision of statistics and other information included in this study. Overviews of the panel of experts and participants in the webinar are included in Annex 1.

2.2.3 Cost-benefit analysis

The report contains an analysis of socio-economic benefits and costs, which could result from scenarios where ex-factory installation of alcohol interlocks and installation in all vehicles (i.e. ex-factory and retrofitting) is mandated. These scenarios include:

- Mandatory ex-factory installation of alcohol interlocks for passenger vehicles (section 10.1.1);
- Mandatory ex-factory installation of alcohol interlocks in buses and coaches (section 10.1.2);
- Mandatory ex-factory installation of alcohol interlocks in heavy goods vehicles (section 10.1.3);
- Mandatory installation of alcohol interlocks for all passenger vehicles (section 10.2.1);
- Mandatory installation of alcohol interlocks in all buses and coaches (section 10.2.2);
- Mandatory installation of alcohol interlocks in all heavy goods vehicles (section 10.2.3);
- Mandatory installation of alcohol interlocks for high-BAC offenders (section 10.2.4);
- Mandatory installation of alcohol interlocks for all novice / young drivers (section 10.2.5).

The analysis has been carried out using a standard Cost-Benefit Analysis (CBA) methodology. This means, amongst others, that the policy options have been compared to a baseline scenario. The baseline considers the uptake of alcohol interlocks in vehicles in the absence of any EU-level political initiative to boost the retrofitting of the existing vehicle fleet. In addition, it has been reviewed what the overall benefits of a deployment of interlocks could be, thus including potential impacts from autonomous trends and current deployment levels.

3 Alcohol use and road safety

In order to assess the role of alcohol use in road safety, this chapter reviews:

- How alcohol use affects driving skills and behaviour;
- Prevalence of alcohol in traffic across the EU;
- Alcohol-related fatalities in the EU.

3.1 *Effect of alcohol use on driving performance*

The effects of alcohol on mental and physiological functions are numerous, causing both acute and chronic impairments. Amongst others, alcohol intoxication impairs a wide range of skills necessary for carrying out the many tasks involved to drive a vehicle. Generally, these driving tasks are related to three levels of behaviour, the control level, the manoeuvring level, and the strategic level (Michon, 1985). The control level contains automatic action patterns. This entails a set of basic skills that are needed to operate a vehicle, such as steering, changing gear, accelerating, and braking. At the tactical level drivers exercise manoeuvre control, allowing them to negotiate the prevailing circumstances. It involves tasks in relation to route navigation, the interaction with other traffic and adherence to the rules of the road. Examples include actions like overtaking, turning or gap acceptance. Also the strategic level entails conscious behaviour related to the general planning stage of a trip, such as deciding on the route.

The majority of this research focusses on the effects of alcohol on tasks performance at the control and tactical levels. There is general consent alcohol impairs driving-related skills, in particular at the control level, but not all skills are impaired at the same Blood Alcohol Content (BAC) levels. Based on studies providing a systematic review and meta-analysis of the effect of alcohol on driving performance (Moskowitz, H. et al., 2000); (Schnabel, 2012); (Li, Li, Zhao, & Zhang, 2019) concluded that alcohol impairs some driving skills beginning with any significant departure from zero BAC.

Moskovitz, et al. (2000) found some skills are significantly impaired by BACs of 0.01 g/dl, while others do not show impairment until BACs of 0.06 g/dl. By BACs of 0.05 g/dl, the majority of the experimental studies examined reported significant impairment. By 0.08 g/dl, more than 94% of the studies reviewed exhibited skills impairment. The lack of standardisation of testing methods, instruments, and measures in the studies reviewed was considered the key reason for discrepancies between the reported BAC threshold of impairment within a behavioural area.

Among others (Martin, et al., 2013) and Schnabel (2012) concluded the impairment effect of alcohol depends upon the complexity of the driving task, with complex tasks being more affected than simple tasks and with psychomotor functions being more affected than cognitive functions.

Based on a meta-analysis of the findings of 450 studies Schnabel (2012) also established a global impairment function, concluding that, similar to most skills for more specific driving tasks, alcohol impairs general safe driving capability at BACs of 0.05%. It is noted that Moskowitz reported much lower BACs at which performance of various skills was impaired. The reasons for this discrepancy lies in a different way to review scientific findings. Moskowitz focused on significant findings when selecting studies and findings for inclusion in the analysis, while excluding non-significant findings for his reviews. However, the lack of a significant effect does not necessarily mean that no genuine effect exists (Borenstein, Hedges, Higgins, & Rothstein, 2009).

In addition, the study by Schnabel found no evidence of a threshold effect for alcohol. Alcohol gradually affects driving skills. There is no sudden transition from unimpaired to impaired occurring at a particular BAC level. Lack of standardised test methods also makes it especially difficult to draw straightforward conclusions about the effects of alcohol (and drugs) on higher level driving behaviour (Van Dijken, et al., 2020).

In a review of laboratory tests applied in 179 experimental studies (Jongen, Vuurman, Ramaekers, & Vermeeren, 2016) showed that a cued go/no-go task and a divided attention test with primary tracking and secondary visual search were consistently sensitive to the impairing effects at medium (0.31 to 0.60 mg/ml) and high (0.61 to 1.0 mg/ml) blood alcohol concentrations. These tests can be related to skills for driving tasks at manoeuvring and strategic levels. Executive functions are needed, i.e. planning and strategy in the divided attention test and inhibitory control in the cued go/no-go task.

However, the study also found higher cognitive functions, such as divided attention were far less consistent in indicating alcohol induced impairment in simulated driving in comparison with divided attention in laboratory tasks.

Simulated driving studies (Irwin, Iudakhina, Desbrow, & McCartney, 2017); (Jongen, Vuurman, Ramaekers, & Vermeeren, 2016) have consistently shown that swerving behaviour (measured with SDLP), lane crossings and speed variation (measured with SDSP) increased under the influence of alcohol. In contrast, the studies did not find statistically significant changes in speed.

At the manoeuvring level, several simulated driving studies have demonstrated negative impacts on driving skills, such as the ability to respond timely to dangerous situations and keep distance to other vehicles. However, findings are not consistent across studies and the effects are likely to depend on the situation, the different response possibilities available and types of responses required. For example, Van Dijken, et al. (2020) found that reaction time of drivers increased significantly under the influence of alcohol when reacting to a traffic light, but not in reaction to a car unexpectedly merging into traffic. The study concludes that while the indicator response time is the same across tests, the measured outcome depends on variety of variables which often differ within the test environment. In the study by Van Dijken, et al. (2020), test drivers in the driving simulator did not found themselves in identical situations as traffic in the used scenario was generated randomly in order to create a driving experience that was as naturalistic as possible. With no standard test it is difficult to show systematic differences between the alcohol and placebo conditions. It also offers an explanation for the contradicting findings in the literature.

A recent comprehensive meta-analysis by Simmons (2020) adds to the body of research on the impact of alcohol on driving performance by looking at impacts on several indicators of task performance and correcting for some methodological shortcomings noted in previous meta-analysis. The study finds a clear detrimental effect of alcohol on driving performance and changes in driver behaviour. Alcohol was consistently associated with statistically significant average increases in crashes, hazard RT, lateral position variability, lane excursions, time out of lane, speed, speed variability and time speeding. Significant effects were small to moderate in magnitude. Simmons also notes, many of the performance indicators were associated with wide prediction intervals, indicating that the influence of alcohol is not necessarily consistent from circumstance to circumstance. In part this is due to the influence of BAC level. Findings on the dose-response relationship between BAC level and the performance indicator were mixed. For the mentioned indicators a dose-response relationship could be established for BAC groups between 0.04 – 0.06%[6] and 0.07 – 0.09%, but for doses above and below these levels there is insufficient evidence to conclude such a relationship.

In order to draw (more) confident conclusions about the impairment effect of alcohol on driving, especially more complex driving behaviour, more research would be required. On the one hand, further research could focus on the replicability of results of several potentially useful tests and their predictive validity of actual driving impairment. On the other hand, future endeavours could go beyond the normal performance measures and look into patterns of behavioural reactions in more complex driving scenarios, scenarios that one encounters in everyday driving (Jongen, Vuurman, Ramaekers, & Vermeeren, 2016).

Methodological difficulties may also explain why the impact of alcohol on the performance of a driver at the strategic level has been studied far less than impacts at the control and tactical levels. These difficulties include the skills and actions at this level cannot be studied in driving simulators or instrumented vehicles (Spit, Houwing, Hagenzieker, Mathijssen, & Modijefsky, 2014).

Despite a well-established relationship between alcohol and risky behaviour in the natural environment, results of experimental studies seeking to demonstrate acute alcohol-induced increases in risk-taking behaviour have been more equivocal (Lane, 2004). Still, reviews of experimental studies have established an increase in behavioural risk taking while under the influence of alcohol (Weafer & Fillmore, 2016; Martin, et al., 2013). Also here, the search for measures to best assess behavioural risk taking under influence of alcohol is ongoing. Weafer & Fillmore (2016) conclude findings from their review suggest both below- and above- 80 mg/100ml BAC of alcohol impair inhibitory control and increase risk-taking, and that specific task characteristics (i.e., response pre-potency, discrete risky choice options) influence task differences in sensitivity to alcohol. Another systematic review of experimental paradigms assessing the effects

6 A BAC level of 0.04% means that there are 0.04 grams of alcohol in every 100ml of blood.

of the dose of alcohol on various behavioural risk taking tasks, suggest that higher alcohol doses (0.6 g/kg and above) produces the most robust increase in behavioural risk taking across tasks, compared to lower doses of alcohol (<0.6 g/kg) (Harmon, Haas, & Peterkin, 2021).

While behavioural risk taking is a complex, multifaceted phenomenon impaired decision-making at the strategic level is often related to drivers overestimating their ability to drive safely, increased acceptance of risk and inability to assess their impairment (e.g. BAC) level (Tyszka, Macko, & Stańczak, 2015). Hence, we conclude that alcohol has a negative impact on driving tasks at the strategic level.

Overall, scientific literature provides confidence to support the conclusion that a BAC of 0.05% impairs faculties required in the operation of a vehicle. Furthermore, for many faculties it has been found they are increasingly impaired with an increasing BAC level. Faculties required for more complex task being impaired at lower BAC levels than most the skills required for simpler tasks. For some, impairment from alcohol can begin with BACs as low as 0.01 or 0.02%.

The figure below provides an overview of the relation between alcohol intake, BAC levels and impact of driving skills.

Figure 3.1 BAC and effects on driving

BLOOD ALCOHOL CONCENTRATION (BAC) IN g/dL		PREDICTABLE EFFECTS ON DRIVING
.02	About 2 beers	Decline in visual functions (rapid tracking of a moving target), decline in ability to perform two tasks at the same time (divided attention)
.05	About 3 beers	Reduced coordination, reduced ability to track moving objects, difficulty steering, reduced response to emergency driving situations
.08	About 4 beers	Concentration, short-term memory loss, speed control, reduced information processing capability (e.g., signal detection, visual search), impaired perception
.10	About 5 beers	Reduced ability to maintain lane position and brake appropriately
.15	About 7 beers	Substantial impairment in vehicle control, attention to driving task, and in necessary visual and auditory information processing

Source: Adopted from National Highway Traffic Safety Administration, 2005 and Centre for Disease Control and Prevention.

While it should be noted the quantity of alcohol required to reach certain BAC levels varies between persons depending on factors like weight, body fat percentage and metabolism, the impairment effect of a certain BAC level on driving skills found in experimental studies does not. (Schnabel, 2012) concludes that differences in the magnitude of alcohol impairment between categories of age, gender, and drinking practices found in studies were small, inconsistent in direction, and did not reach statistical significance. Also (Martin, et al., 2013) found that variables such as age, gender, driving skill, and tolerance were shown to have limited impact on impairment.

3.2 *Alcohol and accident risk*

In 1964, a large-scale field study at Grand Rapids in the USA established that a driver's relative risk of an accident is directly related to the BAC level (Borkenstein et al., 1964; Anderson, P., 2007). The accident rate was calculated based on epidemiological studies. To estimate the relative rate of getting involved in an accident for drunk drivers, the distribution of BAC-levels in the entire driver population (measured in random roadside breath tests) was compared with the distribution of BAC-levels among drivers involved in accidents (DG Move, 2019). The results of Grand Rapids have contributed to a better understanding of the role of alcohol in road accidents and in later years have often been a reference point for new research results. shows the results of the original Grand Rapid study and two subsequent accident risk studies carried out in the United States.

Table 3.1 Relative accident risk by BAC level

BAC level (g/L)	Borkenstein Grand Rapids Study (1964)	Blomberg, R. D. et al. (2009)	Compton, R. P. et al. (2015)
0.0	1.00	1.00	1.00
0.1	0.92	1.03	0.54
0.2	0.96	1.03	0.85
0.3	0.8	1.06	1.2
0.4	1.08	1.18	1.60
0.5	1.21	1.38	2.07
0.6	1.41	1.63	2.61
0.7	1.52	2.09	3.22
0.8	1.88	2.69	3.93
0.9	1.95	3.54	4.73
1.0	5.93	4.79	5.64
1.1		6.41	6.67
1.2	4.94	8.90	7.82
1.3		12.60	9.11
1.4	10.44	16.36	10.56
1.5		22.10	12.18
1.6	21.38	29.48	13.97
1.7		39.05	15.96
1.8		50.99	18.17
1.9		65.32	20.60
2.0		81.79	23.29
2.1		99.78	
2.2		117.72	
2.3		134.26	
2.4		146.90	
2.5+		153.68	

Source: (Blomberg R. , Peck, Moskowitz, Burns, & Fiorentino, 2009); Compton et al., 2015.

Despite the differences in the estimation of accident risk, research evidence consistently demonstrates that the risk of having an accident increases exponentially as more alcohol is consumed. At any blood alcohol concentration (BAC) level greater than zero, the risk of being involved in an accident increases. For the general driving population this risk rises significantly at levels higher than 0.4 g/L (Peden et al., 2004) or even 0,3 g/L (Compton, R. P. et al., 2015). The probability of accident involvement increases rapidly at BACs over 0.8 g/L and becomes extremely high at BACs above 1.5 g/L. In Europe, similar research, albeit on a smaller scale, has been carried out in the DRUID project. The result of the DRUID study is shown in Table 3.2.

Table 3.2 Relative risk of serious injury or fatality at various BAC-levels compared to sober drivers

Substance use	Risk increase	Risk level
0.1 g/L ≤ BAC< 0.5 g/L	1-3	Slightly increased risk
0.5 g/L ≤ BAC < 0.8 g/L	2-10	Medium increased risk
0.8 g/L ≤ BAC < 1.2 g/L	5-30	Highly increased risk
BAC ≥ 1.2 g/L	20-200	Extremely increased risk

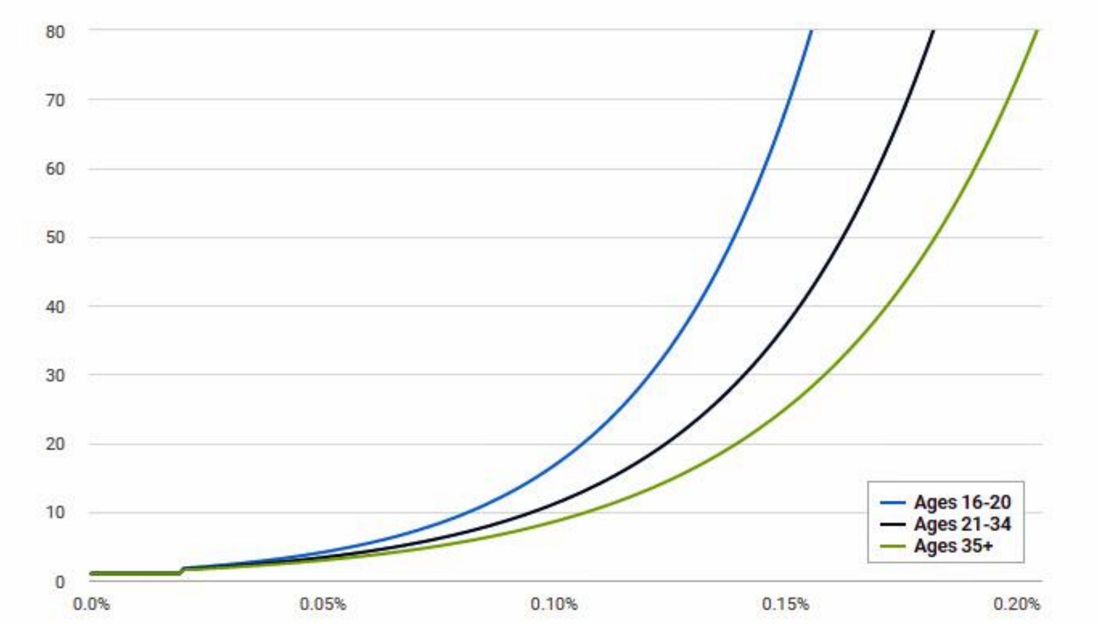
Source: Bernhoft (2011).

As the blood alcohol level increases, not only the probability of an accident increases, but also its severity. With a blood alcohol concentration level of 1.5 g/L, the probability of a driver getting fatally injured is approximately 200 times higher than for a sober driver.

With increasing BAC levels the increase in crash rate with sever or fatal injuries is not the same for all age groups (EC, 2018). The risk of a road accident for each dose of alcohol consumed by a young driver (aged 16-20) is three to five times higher than for the same concentration for older drivers aged 30 and over (WHO, 2007; EC, 2015). For example, at a BAC of 0.8 g/L compared with a zero BAC, the likelihood of involvement in a fatal accident is ten times as high among 16-20 years old drivers, seven times as high among drivers aged 21-34, and 6 times as high among drivers 35 years and older. Leskovšek et al. (2018 found that, with the alcohol concentration of 0.8‰, drivers aged from 15 to 19 years are 87 times more likely to be involved in a road accident, while the odds of drivers over 30 years, having the same alcohol limit, are 16 times higher, compared to sober drivers.

At the same BAC, fatal accident risk is the same for male and female drivers in a given age group (Voas, R. B. et al., 2012). The next figure shows these relationships graphically.

Figure 3.2 Relative risk of fatal accident involvement at various BACs compared with zero BAC, passenger vehicle drivers by age group



Source: Voas, R. B. et al., 2012.

Young drivers not only have a higher crash rate even when they are sober, but their crash rate when driving after having consumed alcohol increases faster than that of older, more experienced drivers (Keall et al., 2004). This is despite the fact that international studies confirm that, perhaps contrary to popular belief, younger drivers are less likely to drive under influence and generally consume less alcohol when driving than older drivers (Brion, Meunier, & Silverans, 2019). Also, it is noted that although young people are at the highest relative risk of having a drink-driving accident, the number of road accidents and alcohol-related deaths is higher among middle-aged drivers.

Studies provide various explanations for the increased accident risk of young drivers. These include being overconfident about their driving skills and tolerance of alcohol, a larger predisposition to risk taking (Killoran, A. et al., 2010), fatigue and especially, a lack of driving experience. Regarding the latter, it is noted that distinguishing the role of age and experience can be difficult, as not all young drivers are inexperienced and not all inexperienced drivers young. Furthermore, influences of being young and being a novice driver intersect in young drivers. In addition, the years of experience of drivers involved in accidents is usually not registered. Therefore data availability is limited. Based on a literature review (Dupont, Martensen, & Silverans , 2010) conclude driving inexperience has the largest effect on the increased accident risk. Even at low BAC various driving skills are affected and precisely these skills (distribution of attention, detection of and reaction to hazards, control of the vehicle is not yet automatic) are insufficiently developed in inexperienced drivers.

3.3 *Prevention of alcohol in traffic in the EU, EFTA and UK*

The European Commission Recommendation 2001/115/EC[7] estimated that between 1% and 5 % of drivers at the time had a BAC level above maximum national legal limits. It has been estimated that up to 1.5-2% of kilometres driven on European roads are driven with a BAC above the legal limit. These values have not changed much over the last several years (EC, 2015, Jeanne Breen Consulting et al., 2018, Avenoso, 2019, Avenoso, 2020, Moreau et al., 2020). However, most estimates have been based on national research with differing study approaches. Few studies have been performed on the prevalence of alcohol in road traffic in Europe. This section reviews the prevalence of DUI in Europe based on roadside surveys by the police, records of road accident statistics and public surveys.

Before elaborating on the findings, a clarification is provided on the types of roadside surveys that can be distinguished:

- Random breath testing (RBT) is defined as a test given by the police to drivers chosen by chance to measure the amount of alcohol the drivers have. It means that any driver can be stopped by the police at any time to test the breath for alcohol consumption;
- Sobriety checkpoints or selective breath testing (SBT) checkpoints are defined roadblocks established by the police on public roadways to control for drink driving. Here a further distinction can be made between checkpoints were all drivers or randomly selected drivers are checked for alcohol, and those police must have reason to suspect the driver has been drinking before demanding a breath test. In this context it is noted that not all countries allow random breath testing.

3.3.1 Alcohol – DUI estimates from roadside surveys

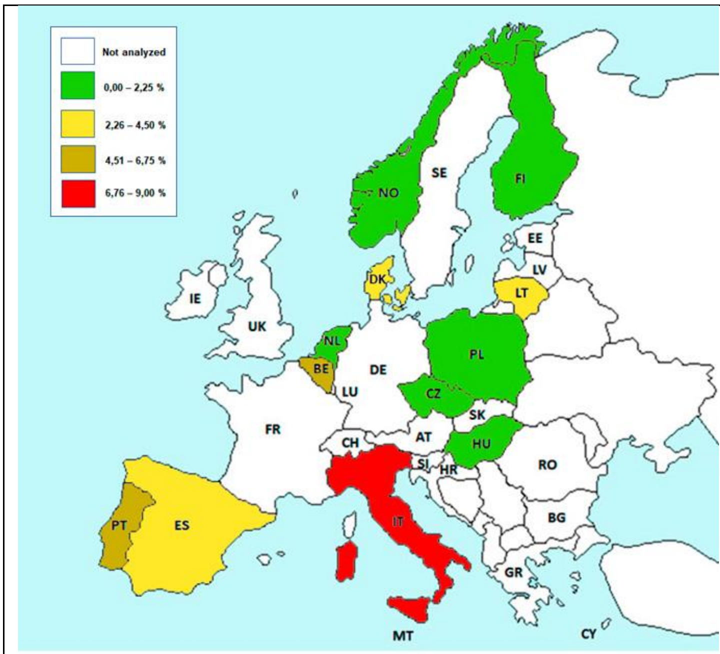
One of the sources for assessing the alcohol-related road toll is roadside studies. Roadside surveys are used to estimate the frequency of driving a motor vehicle after consuming alcohol (drink-driving) among the general driving population.

To date, the DRUID study (Driving under the Influence of Drugs, Alcohol and Medicines) is still the most recent roadside study on driving under the influence of alcohol, which has been carried out simultaneously in several EU countries, while applying the same methodology.

The main aim of this study was to update the knowledge about the presence of alcohol, drugs and medicines in road traffic. The DRUID programme also included studies on the prevalence of psychoactive substances in the driver population in 13 European countries, but the state of sobriety of drivers was controlled only in 12 countries: Denmark, Finland, Norway, Sweden, Czech Republic, Hungary, Poland, Lithuania, Spain, Portugal, Italy, Belgium and the Netherlands. In all countries, roadside studies were conducted according to the same methodological guidelines and over the same period of time (from September 2008 to June 2010). During these tests, traffic police randomly stopped drivers of passenger cars and vans and checked their state of sobriety. The drivers were also asked for a sample of saliva, which was then checked for other psychoactive substances in the laboratory. Based on these study findings, it was estimated that on average 3.48% of all drivers in European traffic are driving after drinking alcohol (Houwing, S. et al., 2011). The results of the DRUID study also show that alcohol is the most common psychoactive substance in European traffic. Figure 3.3 shows the prevalence of alcohol in road traffic in the 12 countries participating in the study.

[7] Commission Recommendation of 17 January 2001 on the maximum permitted blood alcohol content (BAC) for drivers of motorised vehicles. Official Journal L 43, 14/02/2001, p. 31.

Figure 3.3 Prevalence of alcohol in road traffic in 12 European countries



Italy	8.59%
Belgium	6.42%
Portugal	4.93%
Spain	3.92%
Lithuania	3.86%
Denmark	2.53%
Netherlands	2.15%
Poland	1.47%
Czechia	0.99%
Finland	0.64%
Norway	0.32%
Hungary	0.15%
Weighted European mean -	**3.48%**

Source: Houwing, S. et al., 2011.

The next table shows the prevalence of alcohol among drivers by BAC category.

Table 3.3 Prevalence of alcohol alone by BAC (g/L) category and country

	Standard BAC	Total	0.1 – 0.5 g/L	0.5 – 0.8 g/L	0.8 – 1.2 g/L	1.2 g/L +
Hungary	0.0 g/L	0.15%	0.05%	0.02%	0.00%	0.08%
Czechia	0.0 g/L	0.99%	0.54%	0.24%	0.15%	0.06%
Norway	0.2 g/L	0.32%	0.26%	0.04%	0.02%	0.01%
Poland	0.2 g/L	1.47%	0.89%	0.18%	0.27%	0.14%
Finland	0.5 g/L	0.64%	0.38%	0.10%	0.02%	0.13%
The Netherlands	0.5 g/L	2.15%	1.54%	0.26%	0.14%	0.21%
Denmark	0.5 g/L	2.53%	2.05%	0.28%	0.18%	0.02%
Lithuania	0.4 g/L	3.86%	1.55%	0.43%	0.41%	1.47%
Spain	0.5 g/L	3.92%	2.31%	0.90%	0.23%	0.49%
Portugal	0.5 g/L	4.93%	3.71%	0.44%	0.47%	0.31%
Belgium	0.5 g/L	6.42%	4.27%	1.33%	0.42%	0.41%
Italy	0.5 g/L	8.59%	3.35%	2.02%	1.81%	1.40%

Source: Houwing, S. et al., 2011.

The average European prevalence of alcohol of BAC at level at least 0.5 g/L, which is the legal limit in most European countries, was 1.49%. The prevalence in Italy (5.23%) was more than twice as high as in the second and third ranked countries: Lithuania (2.31%) and Belgium (2.16%). In Italy and Lithuania there was also the highest percentage of drivers with BAC of 1.2 g/L and higher. In contrast, there were barely any drivers under the influence of such high BAC-levels in Norway and Denmark (Houwing et al., 2011).

Since the DRUID study studies on the prevalence of alcohol in the population of road users in Europe have been carried out occasionally in individual countries, often limited to selected groups of road users (e.g. drivers punished for traffic offences or road accident victims) or regions. A short overview of the results of recent studies is presented below:

- From September 2014 to October 2015, a research was carried out in Finnmark (Norway) on the prevalence of alcohol and potentially impairing drugs among the general driving population (Gjulem Jarnt et al., 2017). A total of 3 228 drivers were asked to participate in the study. The refusal rate was equal to 6.2%. Alcohol was detected in 0.3% of the sample. The total prevalence of alcohol among the general driving population in Finnmark was low and similar to previous Norwegian roadside surveys;

- In 2015, a study on the prevalence of alcohol and illicit drugs use in a representative nationwide sample of the general population of drivers was carried out in Spain (Domingo-Salvany, A., 2017). Some 2 744 drivers were tested. The presence of alcohol was detected in 2.6% of the drivers. The proportion of positive results was more likely among men and on urban roads, but did not change with age and increased among drivers recruited at night. Compared to the previous edition from 2013, a significant decrease in positive cases for alcohol (from 3.4% in 2013 to 2.6% in 2015; $p < 0.05$) was observed;
- From April 2016 to April 2017, research was carried out in the south-eastern part of Norway on the prevalence of alcohol and potentially impairing drugs among the general driving population (Furuhaugen et al., 2018). 5 556 drivers of cars, vans, motorcycles, and mopeds took part in the study. The weighted prevalence of alcohol concentrations above the legal limit of 0.2 g/L was 0.2%. The result was similar to the finding in the 2008-2009 survey. The proportion of samples that tested positive for alcohol had not changed since 2008-2009;
- From September 10th to October 10th, 2018, a research was carried out in Belgium (Brion et al., 2019), in which 8 499 drivers (car and van) were tested for alcohol. The seventh edition of the "Driving under the influence of alcohol" behavioural measure showed that 1.94% of intercepted motorists had a blood-alcohol level above the legal limit (0.22 mg of alcohol per litre of exhaled alveolar air, equivalent to 0.5 g of alcohol per litre of blood). This prevalence was substantially lower than noted in the previous three editions (which was around 2.65%). However, it was difficult to identify a clear trend in the longer term – for example, the 2007 edition of the measure reported a prevalence very similar to the current edition, at level of 1.97%;
- These findings are within the ranges found by the DRUID study. Although some of the examples included comparison with previous editions of a particular roadside study, these examples do not provide robust evidence of any trends in the prevalence of driving under influence of alcohol in European countries.

3.3.2 Alcohol – DUI revealed by police sobriety checks

Results of police sobriety test provide useful information in particular on trends within a country in case tests have been repeated in the same manner over time. For more than a decade, the European Traffic Policy Network (TISPOL)[8] has been collecting data from yearly police checks on the prevalence of alcohol and drugs in road traffic conducted police forces in European countries.

These "Alcohol & Drugs" checks are organised in June and December each year and usually last one week. Drivers are stopped for random checks in the participating countries. The results of TISPOL checks are presented in Table 3.4.

Table 3.4 Alcohol offences detected – results of police checks coordinated by TISPOL in 2007-2019

Date	Number of countries	Number of motorists controlled	Alcohol offences detected	%
2007		872110	13461	1.54
2008.06.08-02	?	860174	14684	1.71
2008.12.14-08	24	1009926	14185	1.40
2009.06.08-02	21	690383	11448	1.66
2009.12.13-07	20	863204	32497	3.76
2010.06.13-07	21	422181	7699	1.82
2010.12.19-13	27	796812	12030	1.51
2012.12.16-12	29	1203095	13236	1.10
2013.06.13-09**	30	832745	14163	1.70
2013.12.15-09	31	1140346	15278	1.34
2014.06.08-02	30	1168631	18391	1.57
2015.06.07-01	28	1124163	17006	1.51
2015.12.13-07	27	1134924	15791	1.39
2016 (x2) *		> 2000000	30874	
2017.06.11-05	23	945447	12586	1.33

8 In 2019 TISPOL changed its name to Roadpol (European Roads Policing Network).

Date	Number of countries	Number of motorists controlled	Alcohol offences detected	%
2017.12.17-11	16	796725	6810	0.85
2018.06.10-04	24	1040812	13657	1.31
2018.12.16-10	23	806384	8330	1.03
2019.06.09-03	20	1028646	15797	1.54
2019.12.15-09	18	1057467	12725	1.20

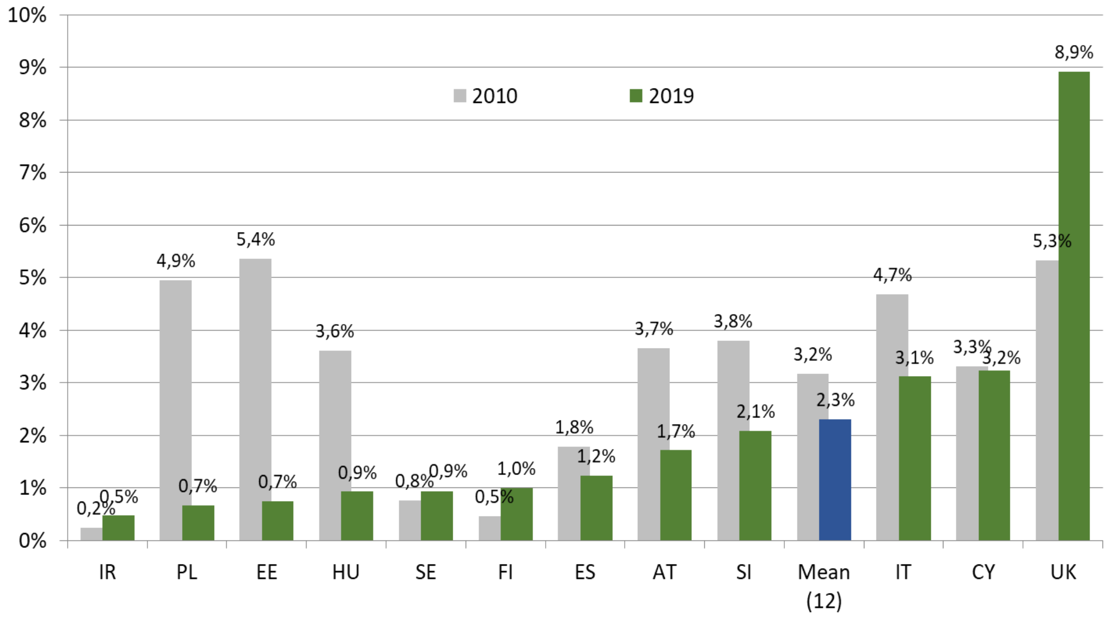
Source: TISPOL 2007-2019.

The results of the TISPOL controls shows the percentage of drivers exceeding the legal limit has been between 1% and 2%. This is lower than the average (3.48%) found in the DRUID study. Over the years a slight downward trend can be observed in the percentage of drivers committing an alcohol offence in these TISPOL data (see also Percentage of drivers over the legal BAC-limit in EU countries 2008-2019

Figure A2.1).

Data from the police checks were also collected from national experts when working on this report. For 12 out of 30 analysed countries data could be retrieved on both on the number of alcohol checks and the number of impaired drivers. Figure 3.4 and Table A2.1 show the annual percentage of drivers exceeding the legal limits across these countries. Countries in the table are set according to the percentage of tested drivers who were found to have alcohol blood concentration level exceeding the legal limit in 2019.

Figure 3.4 Percentage of tested drivers with alcohol concentration level above the legal limit in 12 European countries



Source: National expert panel (see annex 1).

Police sobriety checks carried out in 12 European countries in 2019 found approximately 2.1% of drivers were under influence of alcohol. The highest share of DUI was revealed in the United Kingdom (BAC 0.8 g/L) - 8.9%, the lowest in Ireland (BAC 0.5 g/L) - 0.5%.

Although this data gives a view of the development in time, it is less suitable for the assessment of the prevalence of alcohol in driving population. Most of these tests are not random but are purposely carried out at particular times (e.g. weekend nights) and in particular spots (e.g. in the vicinity of bars and discos) were the likelihood of finding DUI offenders is considered higher.

Furthermore, these figures are difficult to interpret since the roadside checks are not comparable between the countries on aspects such as randomness, the place and time of the road checks, and on the relative ease for (alcohol impaired) drivers to avoid the alcohol checks. Also, the legal limit differs between the countries.

3.3.3 Alcohol – DUI revealed in public surveys

Another method to assess prevalence of alcohol among road users, is using public surveys. In recent years, two surveys (ESRA1 and ESRA2) have been conducted in Europe, which also include questions about alcohol in road traffic. The ESRA survey (E-Survey of Road users' Attitudes) is an online panel survey, which aim is to collect and analyse comparable data on road safety performance, in particular road safety culture and behaviour of road users.

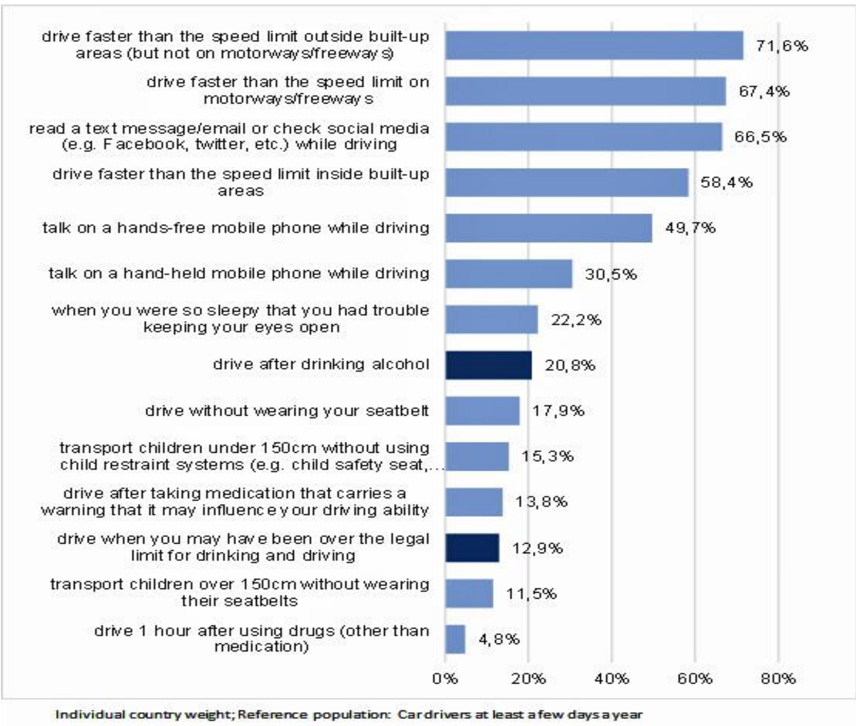
ESRA is based on a common questionnaire, which is translated into the languages of the participating countries. In most European countries, around 1,000 people participated in the survey, which was set as a minimum target. In Austria, Belgium and Germany, the national partner decided to increase the samples size to 2,000 respondents, while in Iceland and Luxemburg the sample size was around 500 participants. National results were weighted for gender and age distribution within a country. The geographical spread of the sample across the country was at least monitored (soft quota). The results are considered reliable and comparable between countries.

The survey themes include self-declared behaviour, attitudes and opinions on unsafe traffic behaviour, enforcement experiences and support for policy measures. The survey addresses different road safety topics (e.g. driving under the influence of alcohol, drugs and medicines, speeding, distraction) and targets car occupants, powered-two-wheelers, cyclists and pedestrians (Meesmann, U. et al., 2019). So far, two editions of ESRA studies have been carried out:

- ESRA1 in 2015-2017 – 38 countries (including 19 from Europe), almost 40 000 respondents;
- ESRA2 in 2018-2019 – 32 countries (including 20 from Europe), more than 35 000 respondents.

In the last ESRA survey (2018) car drivers in Europe have been asked to state how often they had engaged in risky and dangerous behaviours over different periods. The questionnaire presented 14 different behaviours (e.g. speeding, driving under the influence of alcohol, in a state of high fatigue or making a phone call while driving). It also included questions about 'driving after alcohol' and 'driving when driver may have been over the legal limit for drinking and driving'. Figure 3.5 shows the answers pattern.

Figure 3.5 Self-declared risky behaviour (% of car drivers admitting that did it at least once in the past 30 days)



Source: ESRA2, 2018.

Drink driving is not as common a traffic offence as speeding or using the mobile phone while driving, but the fact that one in five drivers declared they had been driving at least once in the previous 30 days after drinking alcohol, is alarming. The data collected in the ESRA survey indicate that, despite many efforts, the problem of alcohol in road traffic has not been yet resolved.

Overall, 22% of respondents declared that they had been driving after drinking alcohol over the last 12 months. A slightly smaller percentage (20.8%) had behaved in this way over the last 30 days[9]. Finally, 13% of respondents admitted that they had been driving (at least once) when alcohol concentration in their body could have exceeded the legal limit.

Table 3.5 presents the results of the ESRA survey 2018 concerning the frequency of driving a car after drinking alcohol.

Table 3.5 Driving a car after drinking alcohol (at least once) by country, 2018

ESRA2	Over the last 12 months drive a car after drinking alcohol	Over the last 30 days drive a car after drinking alcohol	Over the last 30 days drive a car when you may have been over the legal limit for drinking and driving
	At least once	At least once	At least once
Belgium	35.0%	33.1%	24.1%
France	29.8%	28.9%	22.3%
Switzerland	39.2%	33.6%	21.6%
Greece	34.0%	27.7%	19.3%
Spain	26.9%	24.7%	17.1%
Slovenia	29.1%	27.4%	16.6%
Austria	32.9%	30.6%	14.8%
Portugal	35.0%	33.9%	14.1%
Italy	19.5%	20.2%	13.7%
Czechia	9.0%	7.2%	11.9%
Denmark	26.9%	26.6%	11.6%
Ireland	16.3%	12.2%	10.7%
Netherlands	22.3%	21.1%	9.1%
Germany	21.2%	18.2%	8.9%
United Kingdom	19.7%	17.9%	8.8%
Sweden	7.8%	7.6%	7.0%
Poland	7.2%	6.8%	6.4%
Finland	9.5%	9.3%	4.1%
Hungary	4.5%	5.4%	3.9%
Mean (19)	22.4%	20.8%	12.9%

Source: ESRA2, 2019.

The frequency of driving after alcohol consumption varies from country to country. For example, in the last 30 days, the blood alcohol limit has been exceeded in Hungary (BAC level 0.0 g/L) by only 3.9% of respondents, and in Belgium (BAC limit 0.5 g/L) by 24%. Countries in which the established legal BAC limit is lower than 0.5 g/l have in general a lower prevalence of alcohol-impaired drivers in the general driving population. It is worth adding at this point that 97% of respondents were aware of the inappropriateness of driving after having consuming alcohol, and 68% believed that alcohol is a frequent cause of road accidents.

It is worth recalling at this point that during the first edition of the ESRA study in 2015, 31% of car drivers revealed they had driven after drinking alcohol in the last 12 months and 12% admitted they had driven when they may had been over the legal alcohol limit at least once in the last 30 days. So the percentage of drivers who often drive after alcohol use has fallen slightly.

[9] Use of alcohol in the past 30 days is defined as frequent drinking.

3.3.4 Alcohol consumption in the general population

Alcohol consumption in the general population may be used as a surrogate measure for alcohol use in traffic, under the assumption that higher alcohol consumption would, in general, lead to higher alcohol use in traffic (Spit, Houwing, Hagenzieker, Mathijssen, & Modijefsky, 2014). Establishing a direct relationship, however, may be difficult, since the use of alcohol in traffic is also influenced by other factors, such as the legal alcohol limit and enforcement activities.

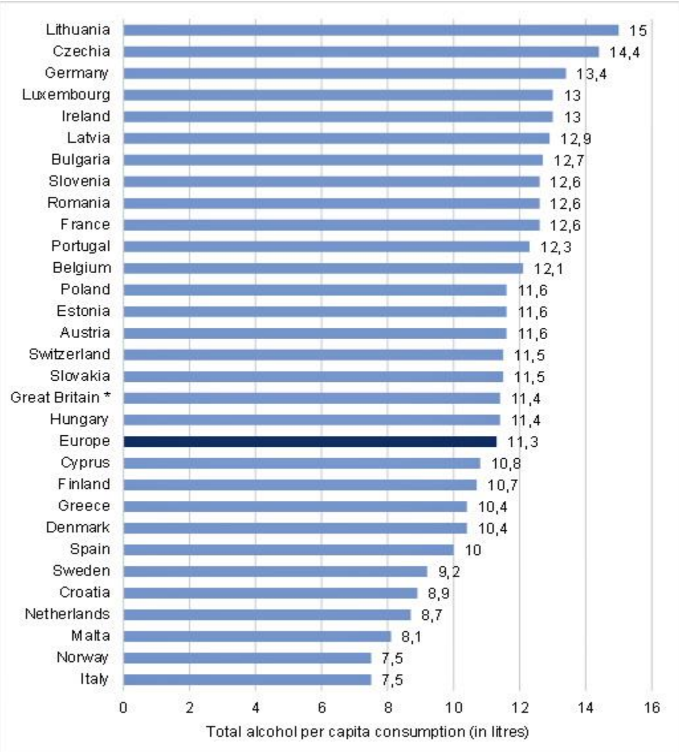
According to the World Health Organisation (2019) alcohol consumption per capita in the WHO European Region, including the European Union (EU), is the highest in the world, even though its per capita consumption has decreased by more than 10% since 2010. Recently published data covering 2016 (WHO, 2018, 2019) showed that:

- The average European citizen (aged 15+) drank 11.3 litres of pure alcohol per year (including 9.9 recorded alcohol and 1.4 litres unrecorded). In practice, this means that every adult in Europe was drinking 170 grams of pure alcohol every week;
- Men consumed 18.3 litres of pure alcohol and women 4.7 litres. Gender differences were most significant in the Mediterranean and eastern European countries;
- Most alcohol was drunk by women aged 20-24 and men aged 35-49;
- In the past 12 months (current drinkers) 72% of the surveyed population had drunk alcohol (61.4% women and 83.3% men). In all WHO regions, females are less often current drinkers than males. When women drink, they drink less than men (WHO, 2018);
- the prevalence of heavy episodic drinking (60+ grams of alcohol on at least one occasion during past 30 days) was 30.4% (14.4% among women; 47.4% among men).

In addition, research has shown that as the per capita consumption in a population increases the consumption of the heaviest drinkers also rises, as does the prevalence of heavy drinkers and the rate of alcohol-related harm (for example coronary heart disease, breast cancer, tuberculosis, liver cirrhosis and road traffic accidents) (Babor et al., 2003).

Figure 3.6 provides information on pure alcohol consumption per capita in 30 European countries.

Figure 3.6 Total (recorded and unrecorded) pure alcohol consumption per capita (15+ years) in 2016



* United Kingdom of Great Britain and Northern Ireland.
Source: WHO[10] (Data retrieved from 2020).

[10] https://www.who.int/data/gho/data/indicators/indicator-details/GHO/total-(recorded-unrecorded)-alcohol-per-capita-(15-)-consumption.

From 2010 to 2016, alcohol consumption in the population of European citizens fell by only 1.5% (from 11.5 to 11.3 litres), which, according to WHO, is a statistically insignificant result. In the analysed period, 17 countries recorded a decrease in alcohol consumption, and 13 countries recorded an increase. Within this period, a slight decrease in alcohol consumption was also recorded among people aged 15-19 (from 7.2 litres to 7.0 litres of pure alcohol) and among 20-24 years old (from 12 litres to 11.7 litres of pure alcohol). The gender gap in consumption widened due to a more significant decline for women (-6.2%) than men (-2.8%) in the proportion of drinking within the past year. Finally, the prevalence of current drinkers (last 12 months) decreased from 75.3% to 72.0%, and the prevalence of heavy episodic drinking decreased from 34.1% to 30.4%.

The WHO data indicates that on average in European countries progress in reducing alcohol consumption has been plodding, and it would be more appropriate to speak of stagnation of this process. Table 3.6 summarises data on alcohol consumption per capita since 2000. The data over a period of 16 years (2000, 2005, 2010, 2015 and 2016) was selected for the compilation. Comparing the alcohol consumption between 2000 and 2015 (due to incomplete data for 2016) provides insights in the growth, decrease or stagnation of alcohol consumption across Europe. The countries are arranged according to the size of changes in alcohol consumption from 2000 to 2015.

Table 3.6 Alcohol consumption (in litres of pure alcohol) recorded per capita (15+), from 2000 to 2016, and % change in 2015 compared to 2000 (Updated May 2018)

Country	2000	2005	2010	2015	2016	% change compared to 2000 (100%)
Spain	11.84	11.92	9.78	8.26	8.58	-30.2
Croatia	14.06	11.58	12.11	9.89	10.32	-29.7
Greece	9.16	10.03	8.99	6.64	6.52	-27.5
Italy	9.78	7.41	6.95	7.14	7.08	-27.0
Ireland	13.87	1.42	11.63	10.93	11.46	-21.2
Netherlands	10.06	9.69	9.32	8.03	-	-20.2
Denmark	11.68	11.27	10.24	9.38	9.55	-19.7
Portugal	13.08	13.34	12.23	10.54	10.66	-19.4
Switzerland	11.26	10.15	10.01	9.62	9.43	-14.6
Austria	13.2	12.4	12.1	11.4	-	-13.6
France	13.63	12.6	12.33	11.87	11.74	-12.9
Hungary	12.23	12.94	10.75	10.9	-	-10.9
Slovenia	12.8	11.19	10.1	11.49	10.51	-10.2
Luxembourg	13.14	12.02	11.72	11.83	11.22	-10.0
United Kingdom	10.82	11.37	10.22	9.82	9.81	-9.2
Czechia	13.98	13.26	12.65	12.82	12.99	-8.3
Belgium	11.25	12.21	10.27	10.36	-	-7.9
Germany	12.91	12.04	11.35	11.99	10.9	-7.1
Slovakia	11.06	10.83	10.55	10.78	10.14	-2.5
Finland	8.59	9.95	9.72	8.51	8.43	-0.9
Cyprus	9.56	11.41	11.32	9.55	-	-0.1
Romania	10.16	9.95	10.79	10.4	-	2.4
Norway	5.67	6.37	6.59	5.97	6.03	5.3
Bulgaria	10.08	10.53	10.83	11.3	11.49	12.1
Sweden	6.2	6.5	7.31	7.16	7.18	15.5
Poland	8.4	9.5	10.04	10.48	10.43	24.8
Malta	5.88	6.55	7.52	7.75	8.02	31.8
Lithuania	9.87	9.87	13.61	14.42	13.61	46.1
Latvia	7.13	9.92	9.83	10.82	11.19	51.8
Estonia	7.9	14.7	14.97	16.64	15.35	110.6
Mean (30)	10.6	10.4	10.5	10.2	9.7	-0.10

Source: WHO[11].

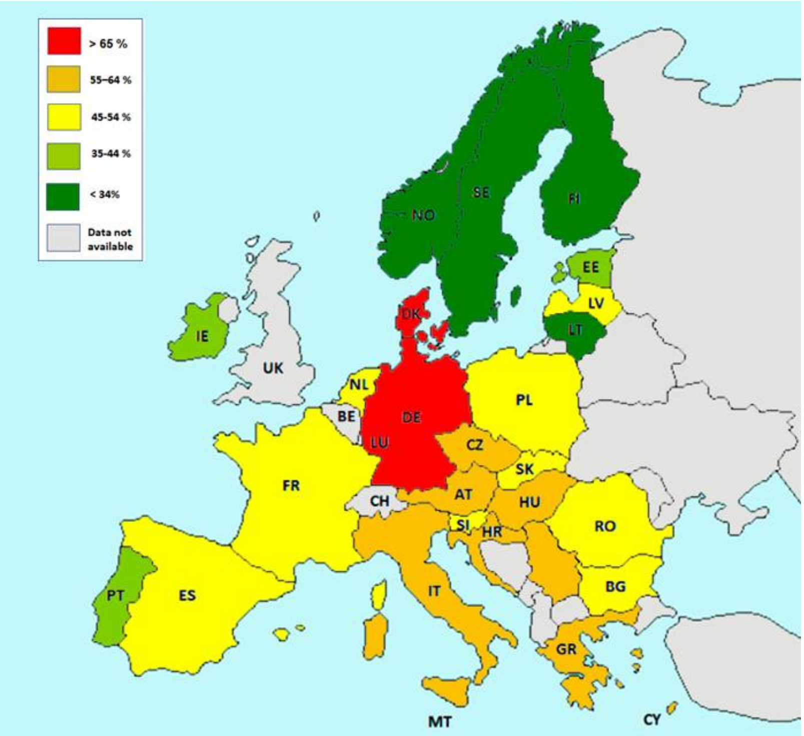
[11] https://apps.who.int/gho/data/node.main-euro.A1039?lang=en&showonly=GISAH.

According to WHO (2018) forecasts for Europe, alcohol consumption per capita will remain unchanged until 2025.

Table 3.6 shows that the effects of measures aimed at reducing alcohol consumption in the population have varied between European countries. Spain and Croatia (30% reduction in alcohol consumption over 2000-2015), Greece (-27.5%) and Italy (-27%) have shown the largest reductions in alcohol consumption. On the other hand, alcohol consumption has increased in Estonia (111%), Latvia (52%), Lithuania (46%), Malta (32%) and Poland (25%).

The European School Survey Project on Alcohol and Other Drugs (ESPAD) shows that in many European countries more than half of 15-16 year olds drink occasionally. Figure 3.7 frequency of drinking over the last 30 days by this group in 2019.

Figure 3.7 Percentage of young people drinking alcohol in the last 30 days in 2019 by country



Source: ESPAD Group, 2020.

Students who reported alcohol use in the last 30 days drank alcohol on 5.6 occasions on average. Among this group, students from Germany and Cyprus consumed alcohol on 8.0 and 7.5 occasions, respectively, and students from Sweden, Finland, Lithuania, Iceland, Estonia, Latvia and Norway drank alcohol on fewer than four occasions on average.

Despite alcohol consumption remaining very popular, temporal trends between 1995 and 2019 indicate a slow but steady general decrease in both lifetime and last-30-day use of alcohol (see Table 3.7). Still, changes in the prevalence of current use of alcohol in adolescents vary significantly from country to country. The most significant reductions were recorded in Lithuania, Sweden and Ireland. In these countries, the percentage of young people declaring to have drunk more alcohol in the last month has dropped by more than 30%. On the other hand, several countries (Spain, Denmark and Cyprus) have seen an increase in the number of young people drinking alcohol.

Table 3.7 Alcohol consumption among 15-16 year old students in 30 countries 1995-2019 (percentage)

Measure (% of population)	1995	1999	2003	2007	2011	2015	2019
Lifetime alcohol use	88	89	91	89	87	82	80
Current alcohol use (last 30 days)	55	58	63	60	58	48	48

Source: ESPAD Group, 2020.

Overall, the prevalence of alcohol in the general population as well as among people aged 15-16 years old remains high. While average decline in total alcohol consumption in the general population is statistically insignificant, that of 15-16 year olds is not. Furthermore, there are great differences between countries, with significant decline in total consumption in some countries and increases in others.

3.4 *Alcohol-related road fatalities in the EU, EFTA and UK*

As concluded in section 3.2, driving under the influence of alcohol significantly increases the risks accident involvement. In section 3.3 trends in the prevalence of alcohol in European traffic have been reviewed. This section reviews the impact by looking at alcohol-related road fatalities in Europe.

Information on alcohol-related fatalities on European roads is mainly based on official statistics that are available at the national level. In addition to these statistics, two additional sources have been reviewed: results from epidemiological studies on substance use among injured and killed road users and estimates from national experts.

3.4.1 Alcohol-related road fatalities in official statistics

According to the official data[12], alcohol was involved in at least 2,798 deaths across 29 European countries in 2018. For EU Member States, the total number of alcohol-related fatalities was 2,728. However, it is noted no statistics were available for Ireland, Italy and Malta. For Ireland, data for 2016 have been included, while for Italy data from police records have been included. For Malta no data are available as it does not collect data on alcohol-related traffic accidents.

Furthermore, it should be noted there is a widespread consensus that the actual number of alcohol-related road deaths in many countries is higher than the officially-reported numbers. In addition, there are differences in national definitions of road deaths attributed to alcohol.

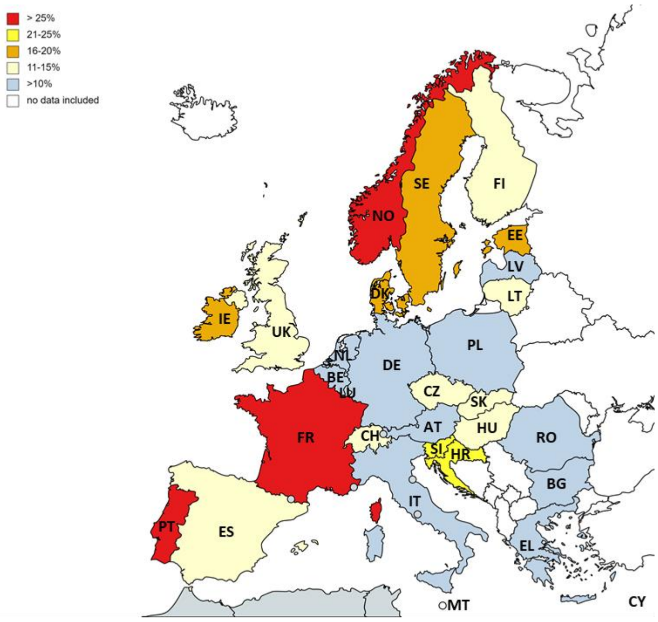
Despite efforts to harmonise these national definitions, not all European countries apply the same definition of "road death attributed to alcohol" (Eksler, V. et al., 2009; Vissers, Houwing, & Wegman, 2017). Based on a review in (Calinescu, T. et al., 2018) it appears approximately half of the European countries reviewed declare that they have introduced a modified definition proposed by the SafetyNet consortium: "*Any death occurring [within 30 days] as a result of a fatal road crash in which any active participant was found with a blood alcohol concentration level above the legal limit*"[13]. However, even in countries that state the use of this SafetyNet definition, it is not applied consistently in practice. As a result, accidents caused by drunken cyclist and/or pedestrians are not included in the statistics in several countries. Also, not all countries systematically test road users that have been involved in a road collision that resulted in death or serious injury for alcohol (Vissers, L. et al., 2017; Calinescu, T. et al., 2018). In various countries there are legal constraints prohibiting testing unconscious road users and post-mortem alcohol tests. Even when tests are performed by medical authorities in the hospital or on the spot, data might not be shared and recorded in accident statistics. In some countries, only drivers of vehicles are tested and sometimes only when there is a suspicion by the police of DUI as accident causation factor. Altogether, these practices also lead to underreporting and make direct comparison of data between countries less useful. This also applies to the fact that countries do not apply the same legal limits.

While taking into account the above-mentioned limitations in the official statistics on alcohol-related fatalities, Figure 3.8 shows the percentage of road deaths related to alcohol in the total number of road traffic deaths in individual countries.

---

[12] These data have been verified and supplemented by experts from European countries.
[13] Annex 2 provides definitions of alcohol-related fatalities in individual countries.

Figure 3.8 Share of alcohol-related road fatalities in total road fatalities in 2018.



Source: DG Move 2020; Calinescu, T. (2018); La Lievre, P. (2019); data collected by ITS from national expert panel (see annex 1).[14].

The average percentage of alcohol-related deaths in the total number of deaths in road accidents in 2018 for the 29 analysed countries, was 14.3%. The differences between countries are large. In Bulgaria (BAC 0.5 g/L) official statistics record only 1% of all road fatalities is related to alcohol. Norway (BAC 0.2 g/L), Cyprus and France (BAC 0.5 g/L) recorded the highest figures (37%, 31% and 30% respectively).

Table 3.8 provides an overview of the share of alcohol-related deaths in road traffic in European countries. The data is presented for 2010 and 2015-2018. The countries are divided into two groups (BAC < 0.5 g/L and BAC ≥ 0.5 g/L) and arranged according to values in 2018 (the last year for which comparable data could be retrieved for almost all countries).

Table 3.8 Share of alcohol-related deaths in the total number of deaths in road accidents

Country	BAC (g/L)	2010	2015	2016	2017	2018
Romania	0.0	8,2%	9,2%	8,4%	7,6%	7,1%
Poland	0.2	9,0%	10,8%	10,1%	9,6%	9,3%
Hungary	0.0	8,2%	12,4%	12,7%	11,0%	10,3%
Czechia	0.0	13,5%	9,8%	9,5%	9,2%	10,8%
Lithuania	0.4	10,7%	7,0%	9,4%	9,4%	12,7%
Slovakia	0.0	7,4%	11,3%	14,5%	10,5%	13,5%
Sweden	0.2	17,3%	23,6%	24,8%	20,9%	16,4%
Estonia	0.2	12,7%	23,9%	11,3%	27,1%	19,4%
Norway	0.2	19,0%	18,8%	21,5%	18,9%	37,0%
Mean (9)		11,8%	14,1%	13,6%	13,8%	15,2%
Bulgaria	0.5	3,2%	1,4%	1,0%	0,6%	1,0%
Italy	0.5		4,4%	4,8%	4,2%	4,6%
Belgium	0.5	5,5%	4,8%	6,0%	6,1%	5,0%
Netherlands	0.5	3,4%	1,7%	1,7%	2,4%	5,3%
Greece	0.5	7,0%	9,0%	11,9%	7,3%	6,6%
Latvia	0.5	10,1%	9,6%	10,8%	8,8%	7,4%
Germany	0.5	9,4%	7,4%	7,0%	7,3%	7,5%

14 Malta is not included in the chart (no data), and the indicators for Great Britain and Spain are calculated based on 2017 data.

Country	BAC (g/L)	2010	2015	2016	2017	2018
Austria	0.5	5,8%	5,8%	5,1%	8,0%	8,1%
Luxembourg	0.5	34,4%	27,8%	12,5%	16,0%	8,3%
Switzerland	0.5	19,3%	15,0%	17,1%	16,5%	12,9%
Spain	0.5	10,7%	10,9%	13,9%	15,1%	14,7%
Finland	0.5	23,5%	21,1%	23,3%	22,6%	15,5%
Ireland	0.5	45,3%	17,9%			
Denmark	0.5	25,1%	15,2%	14,2%	20,6%	18,3%
Croatia	0.5	35,7%	33,0%	32,2%	27,8%	22,7%
Slovenia	0.5	35,5%	30,8%	31,5%	30,8%	24,2%
Portugal	0.5	25,8%	25,6%	28,8%	29,3%	26,8%
France	0.5	30,8%	30,5%	29,1%	30,1%	30,3%
Cyprus	0.5	43,3%	21,1%	17,4%	20,8%	30,6%
Great Britain	0.8	12,6%	11,1%	12,4%	13,5%	13,1%
Mean (20)		20,3%	15,2%	14,9%	15,8%	13,8%
Mean (29)		17,6%	14,9%	14,5%	15,1%	14,3%

3.4.2 Results from epidemiological studies on substance use in injured and killed drivers

Another source for assessing the alcohol-related road toll are epidemiological studies that have been conducted in various European countries. A short overview of the results of studies carried out over the last decade is given below:

During DRUID study prevalence of alcohol was also checked in drivers who were injured and/or killed in traffic accidents. The study was carried out in Belgium, Denmark, the Netherlands, Italy, Lithuania (injured drivers), Norway, Sweden, Portugal (killed drivers) and Finland (injured and killed drivers). For some countries samples from injured and/or killed drivers were collected in the same periods and geographical areas as for the roadside surveys. Samples were tested for the presence of the same substances analysed in the roadside surveys, and the results serve as reference data for the relative risk estimation (odds ratio calculation) of alcohol and other psychoactive substances.

Table 3.9 Percentage of drivers positive for alcohol

Toxicological finding	Killed drivers				Seriously injured drivers					
	FI	NO	PT	SE	BE	DK	FI	IT	LT	NL
Alcohol (≥0.1 g/L)	31.4	25.4	44.9	19.0	42.5	19.7	32.1	23.1	17.7	29.6
Alcohol (≥0.5 g/L)	29.3	23.8	35.1	16.3	38.2	17.8	30.2	20.6	16.1	28.0

Source: Verstraete et al., 2011.

Among the positives, 87.3% had a blood alcohol concentration equal to or above 0.5 g/L, and 70% were severely intoxicated, with BAC ≥1.2 g/L. For killed drivers alcohol was mostly found in mature drivers group, whereas for seriously injured drivers in the younger age groups of males. The shares of drivers involved in accidents with serious or fatal injuries found in the DRUID-study are higher than those recorded in statistics as presented in **Table 3.9**, with exception of those for Norway. Although it could suggest the share of DUI involvement in road fatalities has reduced over time, it is likely the systematic testing carried out in the DRUID-study at least also reveals underreporting in the statistics.

A similar picture emerges from national studies reviewing alcohol involvement in road fatalities. While periods reviewed, definitions and methodologies applied in these studies may vary, these studies all found a higher share of drivers positive for alcohol among road fatalities. Most studies also found a reduction in the share of fatalities with drivers tested positive for alcohol.

A Swedish retrospective 4-year study (2008-2011) has evaluated the concentrations of alcohol and other drugs in blood samples from drivers killed in road-traffic crashes (Ahlner et al., 2013). Blood samples were taken from 895 people. In 504 drivers (56%), the results of the toxicological analysis were negative. In 21% of fatalities, blood-alcohol concentration (BAC) was above the statutory limit for driving (0.2 g/L), although the median BAC was appreciably higher (1.72 g/L).

Valen, et al. (2019) reviewed Norwegian road traffic crash registries and forensic toxicology databases for car and van drivers and motorcycle riders fatally injured in road traffic crashes in Norway during 2005-2015. Almost 800 cases were included in this study (n = 772). Drug and alcohol concentrations corresponding to 0.5 g/kg alcohol in blood were used as the lower limits for categorising drivers/riders as impaired; 0.2 g/kg was the upper limit for being categorised as sober. Substances found in concentrations above the impairment limits were mainly alcohol (20%), medicinal drugs (10%: benzodiazepines, opioids, z-hypnotics), stimulants (5%: amphetamines, methylphenidate, and cocaine), and cannabis (4%: THC). The drug/alcohol-impaired drivers had compared to the sober drivers more often been speeding (68% versus 32%), not used a seatbelt (69% versus 30%), and been driving without a valid driver license (26% versus 1%).

Over the five-year period 2013-2017, Finnish investigation teams investigated a total of 921 fatal motor vehicle collisions. In 24% (222) of the cases the driver's BAC was 0.5g/l or above. Out of the 252 people who lost their lives in those collisions, 188 (75%) were the drink-drivers themselves, 54 (21%) were passengers of the vehicle driven by the drunk driver, six were occupants of other vehicle and four pedestrians (Calinescu, T. et al., 2018). Over the years, the number of alcohol-related road fatalities has decreased and with it its share in overall road fatalities. In 2018, 33 people died in collisions involving a driver, a rider or a pedestrian with a BAC above 0.5 g/l compared to 77 in 2010.

A French study (Martin et al., 2017) has estimated the relative risks of responsibility for a fatal accident linked to driving under the influence of cannabis or alcohol, the prevalence of these substances among drivers and the corresponding attributable risk ratios, and compared the results to a similar study carried out in France between 2001 and 2003. Some 2,870 fatal accidents from Metropolitan France during 2011 were analysed and 300 characteristics encoded to provide a database of 4,059 drivers. Information on alcohol and four groups of illicit drugs derived from tests for positivity and potential confirmation through blood analysis. The proportion of persons driving under the influence of alcohol was estimated at 2.1% (95% CI: 1.4±2.8). Drivers under the influence of alcohol were 17.8 times (12.1±26.1) more likely to be responsible for a fatal accident, and the proportion of fatal accidents, which would be prevented if no drivers ever exceeded the legal limit for alcohol is estimated at 27.7% (26.0%-29.4%). The study also showed the overall number of deaths from traffic accidents has dropped sharply in the 10-11 year period, and the number of victims attributable to alcohol has declined proportionally.

Meesmann, Vanhoe, & Opdenakker (2017) estimate that some 24% of hospitalised traffic casualties in Belgium tested positive for BAC above the legal limit. The authors assume that this is an underestimate of the effective number of annual road crash victims who test positive for alcohol, because the hospital data, which served as the basis for this calculation, is in itself a slight underestimate of the total number of road crash victims. However, the underestimation of this group of victims is less significant in the hospital data than in the official accident statistics, which are based on the registration of traffic victims by the police.

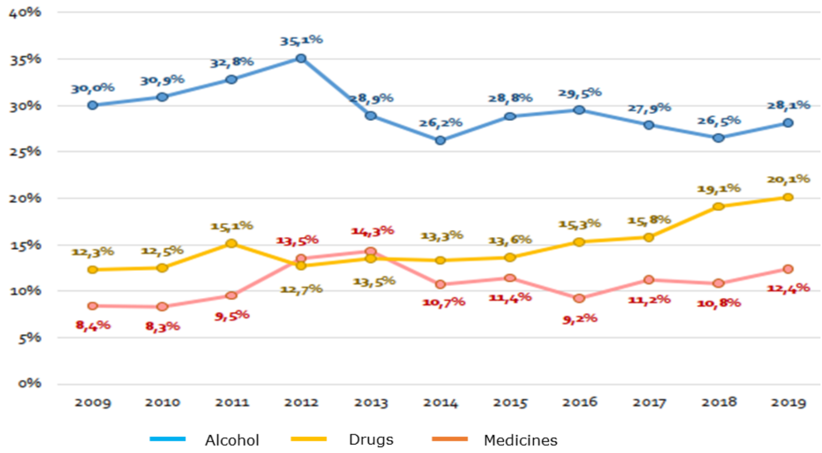
Barone, et al.(2019) investigate the prevalence of alcohol and drugs in Italian drivers involved in road traffic crashes between 2011 and 2018. Toxicological analyses were performed on whole blood samples of 7593 injured drivers. Some 16.2% of the samples tested positive for alcohol, 2.5% for cocaine, followed by opiates (2.0%), cannabinoids (1.5%), and amphetamines (0.5%). The overall prevalence of alcohol and drugs was lower than what was reported in previous epidemiological studies of the DRUID project.

Blood samples from drivers involved in RTAs in Padova province from 2014 to 2017 were analysed for the presence of alcohol and drugs by Favretto, et al. (2018). Four thousand four hundred forty-three blood samples were analysed: 23.7% were positive for alcohol and 19.9% for psychoactive drugs, with prevalence of polydrug and combined alcohol-drug abuse of 4.5% and 6%, respectively.

Another Italian study aimed to assess the prevalence of a large set of psychoactive substances (n=53) in Italian drivers involved in a road traffic crash and predefined population subgroups (Pelletti et al., 2019). The blood samples were taken from 1026 drivers involved in a road traffic crash in the area of Bologna, Italy. The research was carried out between January 2017 and March 2018. The prevalence of alcohol was 17.3%.

A review of toxicological testing of road fatalities over the last ten years (from 2009 to 2019) in Spain (INTCF, 2019) has found positive results in alcohol registers a progressive downward trend since 2012, except the last year in which a slight increase of 1.6% (see blue line in Figure 3.9). The share of fatalities tested positive for alcohol ranged between 26%-35%.

Figure 3.9 Percentage of fatally injured drivers tested positive for alcohol and drugs in Spain



Source: INTCF (2019).

In a retrospective study consisting of 80 forensic autopsies of victims of road traffic accidents, performed at the Institute of Legal Medicine – Tîrgu Mureș, Romania during a two years period, between January 1st, 2016 to December 31st, 2017, Carașca, Hogea, & Hădăreanu (2019) found overall 13.8% tested positive for alcohol. Alcohol consumption among the victims was more frequently in pedestrians (20.68%), cyclists (20%) and drivers (14.81%), with official measured alcohol values between 0.8 mg‰ to 1.4mg‰ for the involve drivers and up to values of 2.4 mg‰ for pedestrians.

Papalimperi, et al.(2019) studied 1,841 toxicological investigation reports from the Department of Forensic Medicine and Toxicology of the University of Athens of victims of fatal road accidents over a 7-year period (2011-2017). The victims included car drivers, motorcyclists, passengers and pedestrians. Alcohol was detected in 40.7% (n=749) of the victims, of which 464 had consumed alcohol alone, while the rest had consumed alcohol in combination with at least one psychoactive drug. Within the group of car and motorcycle drivers 44% of the drivers were found to be positive for alcohol use. According to previous studies conducted in Greece, during the period between 1995–1997 and 1998–2004, drivers involved in alcohol-related road traffic accidents were 37% and 41%, respectively.

In a forensic autopsy study in Bulgaria, Kiryakova, et al.(2018) examined all drivers killed in road accidents and investigated in the Department of Forensic medicine and deontology, Sofia, Bulgaria over the period 2011-2017. In total, 520 cases were examined. In 81 cases the chemical analysis showed the presence of alcohol and/or illicit drugs. Almost 60 percent of the drivers who had consumed alcohol had a BAC of more than 150 mg/ml.

In Ireland, RSA has reviewed closed coronial files for road accident fatalities that occurred in 2013-2017 (Road Safety Authority, 2020). There was a toxicology result available for 600 of the 705 fatalities (85.1%) captured in the 2013-2017 coronial data. Focussing on driver fatalities, 494 drivers were killed in road accidents on Irish roads. Coronial data are available for 419 of these driver fatalities (84.8% coverage) with a toxicology result available for 379 of the 419 driver fatalities (90.5%) captured in the coronial data. Of the 379 driver fatalities with a toxicology result available, 35.6% (n = 135) had a positive toxicology for alcohol. These fatalities were typically male, and under the age of 45. The majority had a high BAC (e.g. seven in ten had a BAC >150mg/ml). Seven in ten of the driver fatalities with a positive toxicology for alcohol died in single vehicle collisions. They primarily took place in the late evening/early hours of the morning, and over the weekend.

3.4.3 Assessment of the share of alcohol-related road fatalities in Europe

A main tasks of this study is to assess the present European share of road fatalities due to drink-driving. Various studies carried out over the past decade have estimated around 25% of all road deaths can be related to driving under the influence of alcohol (ETSC, 2010, COWI, 2014; WHO, 2015; Jeanne Breen Consulting et al., 2018; EC, 2018; Calinescu, T. et al., 2018). The average share found for European countries based on official statistics is approximately 15%. However, as also described in the previous section, this is likely to be an underestimate. Hence, in order to provide a more realistic estimate, a similar approach has been applied as was used in Spit, Houwing, Hagenzieker, Mathijssen, & Modijefsky (2014).

By combining the results from the national statistics with the results from epidemiological studies and expert estimates, a first impression can be derived of the quality of the official recorded shares of alcohol-related road fatalities. This does not constitute a structural assessment of the quality of the data, which is outside the scope of this study, however, if the results of official statistics are in line with the experts' estimates and/or the results of the epidemiological studies, we consider the official statistics as reliable.

For countries for which data epidemiological studies and/or expert opinions is available, but the results strongly deviate from the official statistics, the results of the epidemiological studies and/or expert opinions are considered leading for the estimated share of alcohol-related road fatalities. To reflect the higher level of uncertainty concerning this data, a bandwidth has been used in this study of +5 per cent points and -5 per cent points for data from epidemiological studies and/or national expert estimates. The bandwidth is chosen for practical reasons and based on a doubling of the bandwidth that is commonly used by national experts (5%).

For example, in Bulgaria (BAC 0.5 g/L) only 1% of all road fatalities is related to alcohol according to official statistics. In this country, a modified definition of SafetyNet is used ("*Deaths occurring as a result of a road traffic accident in which the blame for the traffic accident was found with blood alcohol level above 0.5 g/L*"), but this change cannot be the only explanation for such a low value of this indicator. Underreporting is suspected. The results of an epidemiological study (Kiryakova, et al., 2018) found 13% of drivers who died in a traffic accident were under influence of alcohol. This share is used for the estimate with a bandwidth of 5 per cent points.

Table 3.10 Additional information share of road fatalities with alcohol involvement

Country	BAC (g/L)	Statistics 2018	Epidemiological studies*	Expert estimate/ comment	Updated estimate
Austria	0.5	8.1%		Killed and unconscious road users are not tested for alcohol, unless required by the prosecutor.	18%-38%
Belgium	0.5	5.0%	24% (injuries)	Alcohol tests are rarely done for killed and seriously injured people.	19%-29%
Bulgaria	0.5	1.0%	13%	Only fatalities were the culpable drivers had a BAC > 0.5 g/l	8%-18%
Croatia	0.5	22.7%		Alcohol tests are done systematically for fatalities	22.70%
Cyprus	0.5	30.6%		Alcohol tests are done systematically for fatalities	30.60%
Czechia	0.0	10.8%		Killed and unconscious road users are not tested for alcohol, unless required by the prosecutor	16%-26%
Denmark	0.5	21.0%		Official statistics are regarded as reliable data	21.00%
Estonia	0.2	19.4%		All active participants of a serious road collision are tested	19.40%
Finland	0.5	15.5%		Official statistics are regarded as reliable data	15.50%
France	0.5	30.3%	26.0%-29.4%	Official statistics are regarded as reliable data	30.30%
Germany	0.5	7.5%		Only alive suspected drivers are tested.	11-31%
Great Britain	0.8	13.1%		Official statistics are regarded as reliable data	13.10%
Greece	0.5	6.6%	40.7%	No systematic tests	35.7%-45.7%
Hungary	0.0	10.3%		Drivers are almost always tested for alcohol, pedestrians and cyclists only in problematic cases	16%-26%
Ireland	0.5	n/a	35.6%	Alcohol tests are done systematically for fatalities	35.6%

Country	BAC (g/L)	Statistics 2018	Epidemiological studies*	Expert estimate/ comment	Updated estimate
Italy	0.5	4.6%	16.2%-17.3%; 23.7%	Alcohol tests are done only when alcohol is considered to be the main contributory factor. Drivers or other killed persons on the spot might not be tested. Data are not published	15%-25%
Latvia	0.5	7.4%			16%-26%
Lithuania	0.4	12.7%			16%-26%
Luxembourg	0.5	8.3%		Tests are done in case of injuries and fatalities	8.30%
Malta	0.5	n/a		No statistics are collected	20%-40%
Netherlands	0.4	5.3%		No systematic testing for fatalities. Estimated rates 12%-23%, 20%-25%	20-30%
Norway	0.2	37.0%	20% (prior 2017)	Alcohol tests are done systematically for fatalities since 2016/2017	37.00%
Poland	0.2	12.9%		Official statistics are regarded as reliable data	12.90%
Portugal	0.5	26.8%		Official statistics are regarded as reliable data	26.8%
Romania	0.0	7.1%	13.8%	Killed people tested for alcohol. Testing might only occur when the Police suspects the presence of alcohol (legal limit is 0.0 g/l)	8.8%-18.8%
Slovakia	0.0	13.5%		Alcohol tests are done only when alcohol is considered to be the main contributory factor of the fatal collision	16%-26%
Slovenia	0.5	24.2%		Alcohol tests done systematically for active participants of a road collision	24.20%
Spain	0.5	14.7%	28.1%	Killed drivers and cyclists are always tested by coroners.	28.1%
Sweden	0.2	16.4%	21%	Alcohol tests are done systematically for fatalities	16%-26%
Mean (29)		14.3%			

*Epidemiological studies per country are described in the sections above the table

For countries for which no data is available from other sources than the national statistics, it is assumed that these statistics are sufficiently reliable in case the recorded share falls within the same range as the shares (i.e. 15-40%) recorded for the countries identified in the first steps.

Based on the inventory of the data in Table 3.9, we regard the recorded data on alcohol fatalities from Estonia (19.4% in 2018), Finland (15.5% in 2018), Denmark (21% in 2018), Croatia (22.7% in 2018), Slovenia (24.2% in 2018) and Cyprus (30.6% in 2018) as being reliable as well. Also for Luxemburg the national statistic is considered reliable, although it recorded a low share (8.3%). However, it applies the SafetyNet recommended definition of alcohol-related road deaths and systematically tests for road users for alcohol when involved in injury and fatal accidents. Both the total absolute numbers of traffic fatalities and alcohol-related fatalities are low compared to other European countries. This increases the possibility of large fluctuations of the share of alcohol fatalities between the years. For example, while the share of alcohol-related fatalities was 8.3% in 2018, it was 16.0% in 2017 and 40.9% in 2019. Due to the relatively low number of traffic fatalities the impact on the estimated European share of alcohol-related fatalities is negligible.

In a next step, we use data on the prevalence of alcohol in traffic to assess the alcohol-related fatalities in countries for which results obtained are thought to show a relatively strong bias. We compare prevalence data of these countries, with neighbouring countries that already were included in the assessment. Based on this comparison we create estimates for the final countries. These estimates are probably less reliable and will therefore be surrounded by a larger bandwidth of +10% and -10%.

For Austria, prevalence of alcohol in traffic based on TISPOL findings, prevalence is almost double compared to Finland, 60% higher compared to France and 60% higher compared to Sweden. Applying these ratio’s on the share of alcohol-related traffic fatalities would put Austria in the range of 27-37%. Looking at findings on drink-driving from the ESRA 2 Survey (Achermann Stürmer, Meesmann, & Berbatovci, 2019) Austria compares with alcohol prevalence rates found in Belgium, France and Portugal. Estimates of the share of alcohol-related traffic fatalities in these countries ranges from 19-29%. Based on these ranges, the share of alcohol-related traffic fatalities is estimated 18-38%.

Prevalence of alcohol in traffic from TISPOL findings places prevalence in Hungary at a similar level as Sweden and 25% higher than in Finland. Applying these ratio’s on the share of alcohol-related traffic fatalities provides an estimate of a 16-26% share for Hungary. Looking at findings from the ESRA2 survey, Hungary also compares to Sweden and Finland. Hence, the share of alcohol-related traffic fatalities is estimated 16-26%.

For Czechia no comparison can be made based on TISPOL findings. Looking at findings from the ESRA2 survey, Czechia also compares to Sweden, Finland and Hungary. Based on this comparison, the share of alcohol-related traffic fatalities is estimated 16-26%. This is a similar bandwidth found in a study in 2014, although we do note official statistics record a 3 percent point drop in the share of alcohol-related traffic fatalities in the years considered in this study (2018) and the study in 2014 (2010).

Also for Germany only a comparison could be made based on findings from the ESRA2 survey. Here, Germany compares most to DUI prevalence rates found it UK, Italy and, to a lesser extent, The Netherlands. These countries have estimated shares between 13%-30%, with an average of 21%. Based on this the estimate for Germany is 11-31%.

For Latvia, Lithuania and Slovakia, neither TISPOL nor ESRA survey data are available. As the share of alcohol-related traffic fatalities based on official statistics in Latvia compares to that of Germany and so does the overall alcohol consumption per capita, the same estimate has been adopted. In similar fashion, Lithuania is compared to Czechia, resulting in an estimated share of 16%-26%. In turn, Slovakia is compared to Hungary and Sweden, which also results in an estimated share of 16%-26% alcohol-related traffic fatalities.

For Malta no estimates of alcohol-related road fatalities are available. To include estimates for these countries surrogate data for drink-driving fatalities might provide an indication of the share of drink-driving fatalities. The estimate for Malta is based on a comparison for the surrogate data with countries from the same European region. Malta is compared with Greece, Cyprus and Italy. With an average of 30% alcohol-related traffic fatalities, the estimated share for Malta becomes 20%-40%.

Based on the review presented, Table 3.11 provides the national estimates of the share of road fatalities with involvement of alcohol. For each country the share is estimated with an upper and a lower limit.

Table 3.11 Estimated road fatalities with alcohol involvement, 2018

Country	Estimated % alcohol fatalities (low)	Estimated % alcohol fatalities (high)	Fatalities national statistics	Fatalities Estimated (low)	Fatalities Estimated (high)
AT	18	38	33	74	155
BE	19	29	30	115	175
BG	8	18	6	49	79
CY	31	31	15	15	15
CZ	16	26	71	105	171
DE	11	31	244	360	1015
DK	21	21	32	37	37
EE	19	19	13	13	13
EL	36	46	29	250	320
ES	28	28	232	507	507

Country	Estimated % alcohol fatalities (low)	Estimated % alcohol fatalities (high)	Fatalities national statistics	Fatalities Estimated (low)	Fatalities Estimated (high)
FI	16	16	33	37	37
FR	30	30	985	985	985
HR	23	23	72	72	72
HU	16	26	65	101	165
IE	37	37	38	51	51
IT	15	25	58	500	834
LT	16	26	22	28	45
LU	08	08	3	3	3
LV	16	26	11	24	38
MT	20	40	n/a	4	7
NL	20	30	36	136	203
NO	37	37	40	40	40
PL	13	13	370	370	370
PT	27	27	133	181	181
RO	09	19	118	164	351
SE	16	26	26	52	84
SI	24	24	22	22	22
SK	16	26	31	37	60
UK	13	13	240	241	241
CH	13	16	30	30	37
Total EU 27			2.728	4.291	5.997
Total 30 European countries			3.038	4.602	6.315

In order to combine these national estimates presented in Table 3.11 into an estimate of European share of road fatalities with involvement of alcohol, the sums of the low and high estimate of alcohol-related road fatalities of all countries are divided by the total number of road fatalities. This provides a share of road fatalities with involvement of alcohol in the EU 27 of 18-26% and 18-25% for the 30 European countries (see Table 3.12).

Table 3.12 Estimated share of road fatalities with alcohol involvement in Europe, 2018

	Total number of road fatalities	% alcohol fatalities (low)	% alcohol fatalities (high)
EU 27	23,366	18%	26%
Total 30 European countries	25,546	18%	25%

The ranges found in this study are just below those found by Spit, Houwing, Hagenzieker, Mathijssen, & Modijefsky (2014), who estimated a share of 20-28% of road fatalities with involvement of alcohol in the EU 27[15] for 2011. Also, the EU average estimated in the current study is just below the estimate of 25% that has been used in official EU documents for the past years. Given the bandwidth applied in this study, the estimate that 25% of all road fatalities are related to alcohol, is still acceptable and should not be discarded.

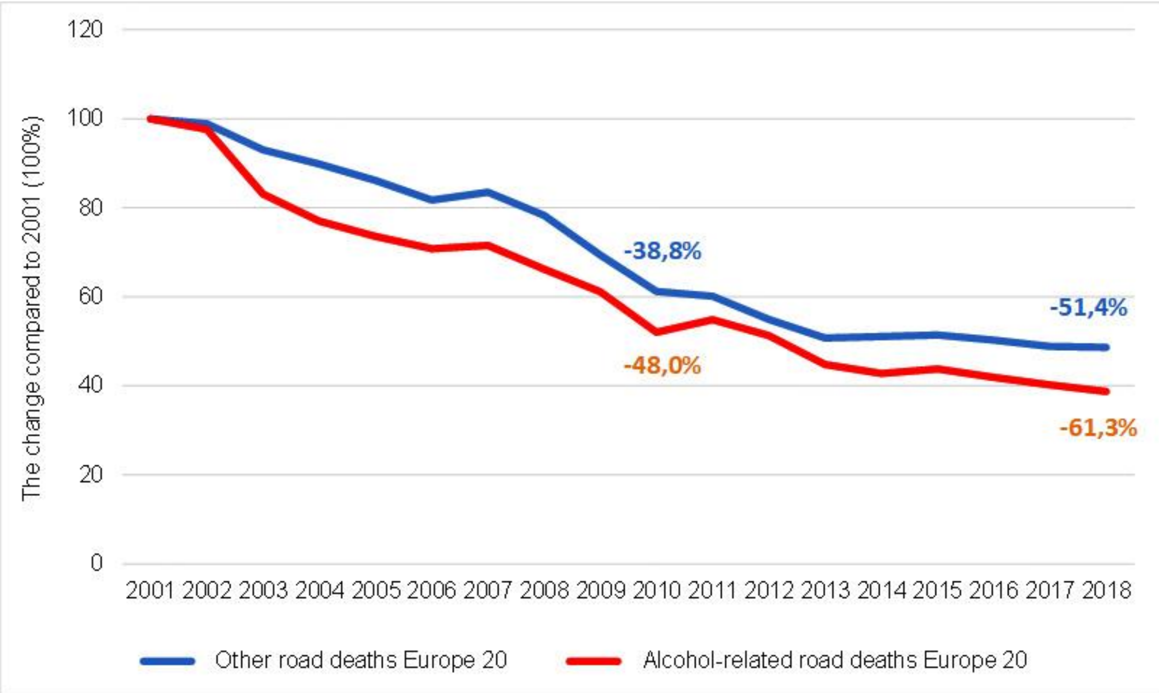
It is noted that there are differences between countries in how the share of road fatalities with alcohol involvement has developed in time. Looking at the national statistics, in over two-third of the countries the share did not significantly reduce. This does not mean there was no progress in reducing the number of road fatalities with alcohol involved. In many countries, these fatalities have reduced, but the reduction kept track with an overall reduction in road fatalities. In other countries, there has been a significant reduction in the share of alcohol-related fatalities. For example, Croatia, Latvia, Slovenia have seen a drop in the share of road fatalities with alcohol involved as result of a series of measures, including increased police checks, stricter penalties and information campaigns. In contrast, Lithuania and Norway experienced an increase in the share of alcohol-related fatalities. In the case of Norway, this can largely be explained by a change in the

[15] It is noted that in the study by Spit, et al. (2014) the EU27 figure included data for UK and not for Croatia, while the current study does the opposite.

registration of alcohol-related fatalities. In 2016, Norway started conducting toxicological testing of all drivers involved in fatal traffic accidents. This practice resulted in an increase in the registration of alcohol-related fatalities. Norway is the only country in which improvements have been found in the registration of alcohol involvement in road fatalities and thus also in the share of road fatalities with involvement of alcohol.

Looking at the trend in the absolute number of road fatalities with involvement of alcohol, it has already been mentioned countries have seen a reduction of these fatalities between 2010 and 2018. More than half of the European countries has a significant reduction in alcohol-related fatalities. According to ETSC studies (Calinescu, T. et al., 2018), in EU25, alcohol-related road fatalities reduced by 46% between 2006 and 2016, while road fatalities contributed to others causes (e.g. speeding, distracted driving, weather conditions) went down by 40% over the same period. These calculations could suggest that alcohol prevention policies have proved to be more effective than policies targeting other traffic risks. However, there are many indications there is much more to it such a conclusion. Figure 3.10 shows relative changes in officially recorded road fatalities with alcohol involvement and other road fatalities in the period from 2001 to 2018 (2001=100%). The graph presents data from 20 out of 30 European countries, for which complete data was available[16].

Figure 3.10 Relative changes in officially recorded road deaths attributed to alcohol and other road deaths in the period from 2001 to 2018 (2001=100%)



Source: DG Move Road safety evolution (December 2018); Podda, F. (2012); Calinescu, T. (2018); La Lievre, P. (2019); data from National expert panel (see annex 1).

In the analysed period, the number of people who have died in a road accidents involving alcohol has fallen by 61%. This is undoubtedly a positive result. At the same time, it is also clear the reduction in the number of deaths related to alcohol was larger in the first nine years of the analysed period. In the second period (2011-2018), the progress was significantly slower, especially in the last three to four years. Determining the causes of this trend requires further examination of the effectiveness of measures undertaken in individual countries. The next part of the report presents data on selected preventive actions taken at EU and national level.

[16] Data from Belgium (no data for 2013-2014, 2017-2018), Croatia (2001-2002), Ireland (2001-2002), Italy (2009-2014), Malta (no data), the Netherlands (2017-2018), Norway (2001-2005), Spain (2018), United Kingdom (2018) are not included in the calculation.

3.5 *Alcohol in traffic - legal framework, enforcement and sanctions*

The effectiveness of a prevention policy depends on convincing road users not to participate in road traffic after drinking alcohol. Appropriate legislation on drinking and driving, which is consistently enforced and well understood by the public is critical in controlling drink driving. The elements aimed to discourage DUI within these legal frameworks are the instatement of legal maximum Blood Alcohol Concentration (BAC) limits and penalties for non-compliance with this limit. Enforcement of compliance with these limits and education, communication and awareness campaigns about the regulations and the importance of compliance with the regulations complement the policies to prevent and control drink driving.

This section describes the legal frameworks in the EU Member States and other European countries for driving under the influence of alcohol (e.g. BAC limits).

3.5.1 Drink driving legal limit

Current limits

Within the EU, legislating BAC limits, enforcement and penalties for non-compliance is a Member State competence. The European Commission may coordinate the activities, identify and disseminate best practices and increase exchange of information. In 2001 the European Commission adopted its Recommendation (2001/115/EC) on the maximum permitted blood alcohol content (BAC) for drivers of motorised vehicles and invited all Member States to adopt the following:

- a lower legal maximum blood alcohol content (BAC) limit of 0.5 g/L, or lower, for drivers and riders of all motorised vehicles;
- a lower legal maximum blood alcohol content (BAC) of 0.2 mg/ml, or lower, for inexperienced drivers, riders of two-wheeled motor vehicles, drivers of large vehicles and drivers of vehicles carrying dangerous goods;
- Random Breath Testing to prevent drivers from drinking to the extent that every driver has a realistic statistical probability of being tested to the current best practice standard of at least once every three years.

The rationale for the lower BAC limit was based on research findings showing that that reductions in BAC limits, supported by effective enforcement and publicity, can reduce inappropriate drinking and driving at all BAC levels. It was estimated that at least a 10 % reduction in all fatalities in accidents involving inappropriate drinking and driving could be achieved by introduction of a package of measures incorporating national enforcement and publicity based around reduced BAC limits, and that greater reductions are possible from more extensive enforcement[17].

At the time of the Recommendation (2001/115/EC) there already was ample evidence from countries which had previously introduced or lowered their BAC limit to 0.5 g/L that this limit can reduce drink-driving and associated accidents. A scientific review by Fell & Voas (2006) includes reference to a number of studies on experience in some EU Member States and Australia.

Table 3.13 Studies of the effects of lowering the illegal BAC limit to .05 in Europe

Study	Results
Noordzij (1994)	"Decline in Drinking and Driving in the Netherlands." Percentage of drivers with BACs >.05 from roadside surveys decreased from more than 15%in the years before the.05 limit to 2% in the first year and then levelled off at 12% for 10 years after the law change.
Mercier-Guyon (1998)	"Lowering the BAC Limit to 0.05: Results of the French Experience." Alcohol-related traffic crash fatalities decreased from 100 before the limit was lowered to 64 in 1997 right after the law change in the French Province where the study was conducted.
Bartl and Esberger (2000)	"Effects of Lowering the Legal BAC Limit in Austria." Found 9.4% decrease in alcohol-related crashes. "Lowering the legal BAC-limit from.08%to.05% in combination with intense police enforcement and reporting in the media leads to a positive short-term effect."

Source: Fell & Voas (2006).

[17] COM(2000) 125 final: Priorities In EU Road Safety; Progress Report And Ranking Of Actions.

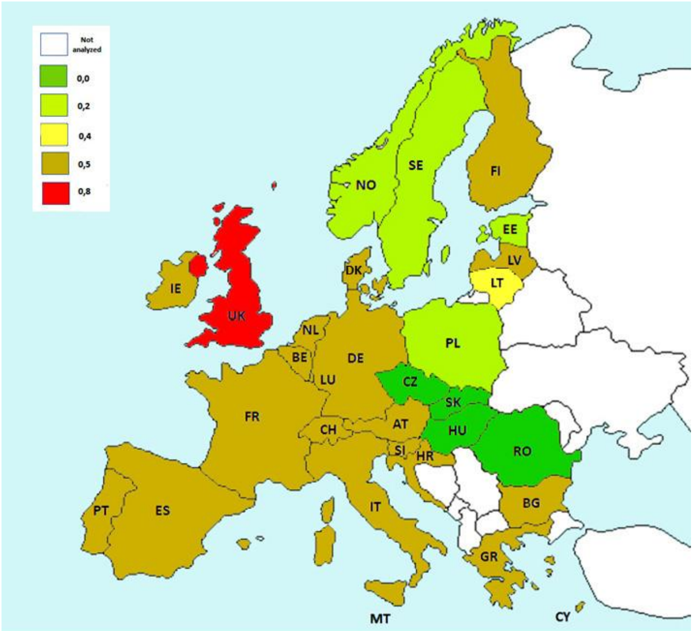
The body of evidence in this respect has increased ever since, although a lot is based on experiences in Anglo-Saxon countries. In a meta-analysis of qualifying international studies to estimate the range and distribution of the most likely effect size from a reduction to 0.05 BAC or lower in the US, (Fell & Scherer, 2017) provide strong evidence on the relationship between lowering the BAC limit for driving and the general deterrent effect on alcohol-related accidents. The study found a 5% decline in non-fatal alcohol-related accidents, a 9.2% decline in fatal alcohol-related accidents from lowering the BAC to 0.8 g/L, and an 11.1% decline in fatal alcohol-related accidents from lowering the BAC to 0.5 g/L or lower.

Using data from 28 European countries from the period 1999–2012, while controlling for several explanatory economic, demographic and geographical attributes, Castillo-Manzano et al. (2017) demonstrated the effectiveness of a limitation of the BAC limit to 0.5 g/L in Europe. In another study, analysing the experience of 15 EU countries based on data from the European panel-based data (CARE) for the period 1991-2003, Albalate (2006) showed that lowering legal BAC limits to 0.5 g/L has been an effective solution to prevent road casualties, leading to a decrease in fatalities by 8.2% to 11.5%. However, this study concluded it has been primarily effective in preventing casualties in certain groups. The study found that the greatest benefits were observed in the group of men (especially in urban areas) and among all drivers aged 20-49. There were no significant reductions in deaths or injuries among the population as a whole when other concurrent policies and infrastructure quality were taken into account (the study took account of a large number of factors which could have affected the results, including related policies and enforcement: minimum legal driving age, points-based licensing and random checks). The study also found it takes at least two years to observe the real effects of introducing lower alcohol limits. Furthermore, the study concludes lowering BAC levels does not have a global impact, unless this regulation is enforced in practice by random alcohol checks on the road. Thus, when these two measures go together fatality rates can decline substantially.

Related to this latter finding, Haghpanahan, et al.(2019) come to a similar conclusion in a study of effects of the introcuction of lower alcohol limits in Scotland in the first two years after the introduction. The study did not observe changes in the number of road traffic accidents with alcohol involvement in the two years after lowering the driving BAC limit from 0.8 g/L to 0.5 g/L in December 2014. The study pointed at a lack of enforcement as a reason for the lack of effect. Still, this change in BAC limit had a small impact (less than 1%) on reduction in per-capita alcohol consumption from on-trade alcohol sales. Taking account of the time lag of two years or more in the effectiveness of lowering BAC-limits found in (Albalate, 2006), it would be interesting to see in the case of Scotland, if a lack of effect contunues to be observed once a longer period after the introduction of the lower BAC-limit can be studied.

At the time when the European Commission introduced its recommendations, out of 15 Member States only four had BAC > 0.5 g/L (Ireland, Italy, Luxembourg and the UK). After the enlargement of the European Union by another ten countries in 2004, Cyprus and Malta joined the group of countries with BAC level > 0.5 g/L. Information on current standard BAC level across Europe is presented in Figure 3.11 Standard BAC legal limits (g/L) across Europe Figure 3.11.

Figure 3.11 Standard BAC legal limits (g/L) across Europe



Source: ETSC[18]; data from National expert panel (see annex 1).

The process of harmonising legislation on BAC level for all drivers has taken many years. The last country to introduce the BAC 0.5 g/L was Malta. This country introduced new regulations 17 years after the publication of the European Commission's recommendation. A little earlier, Ireland (2011) and Luxembourg (2007) did so as well. Table 3.14 provides information on the year of introducing the current blood alcohol limit for all drivers in each country.

Table 3.14 Year of introducing the standard BAC legal level (g/L) by country

BAC limit (g/L)	Country
0.0	Czechia (1953), Slovakia (1953), Hungary (2008), Romania (?)
0.2	Poland (1960), Sweden (1990), Estonia (2001), Norway (2001)
0.4	Lithuania (2000?)
0.5	Slovenia (1950), Finland (1977), Portugal (1983), Latvia (1992), Belgium (1994), Netherlands (1994), France (1995), Austria (1998), Denmark (1998), Germany (1998), Bulgaria (1999), Greece (1999), Spain (1999), Italy (2002), Switzerland (2005), Cyprus (2006), Luxembourg (2007), Ireland (2011), Malta (2018), Croatia (?),
0.8	United Kingdom (1967)19

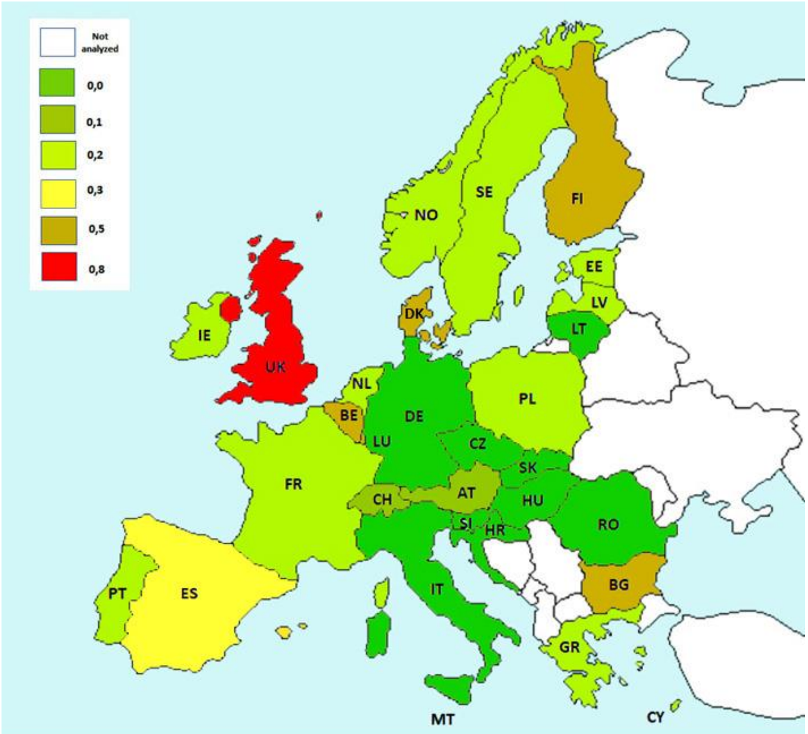
Source: literature review; information from National expert panel (see annex 1).

Currently 27 EU countries, as well as Switzerland and Norway, have implemented a legal BAC limit of 0.5 g/L or less. The United Kingdom still has the highest standard limit of 0.8 g/L, though Scotland has set a limit of 0.5 g/L.

As mentioned earlier, the European Commission proposed lower legal maximum blood alcohol content (BAC) of 0.2 g/L for inexperienced, also referred to as novice drivers. These are drivers who have held a driving license for less than 5 years (>2 years in some countries), although often reference in also made to young drivers (up to a certain age, often up to 25 years). As mentioned in section 3.2, several studies have shown that with the same BAC level, the risk of road accidents for young drivers is at least three times higher than for middle-aged drivers (DACOTA, 2012). It is assumed that lowering the BAC level will reduce the consumption of alcohol among young and inexperienced drivers, reduce the number of drunken drivers in road traffic and reduce the number of accidents, deaths and alcohol-related injuries. Figure 3.12 shows the current alcohol limits for novice drivers in the analysed European countries.

18 https://etsc.eu/blood-alcohol-content-bac-drink-driving-limits-across-europe/.
19 Scotland introduced 0,5 g/L BAC level in 2014.

Figure 3.12 Inexperienced drivers' BAC legal limit (g/L) across Europe



Source: Information from National expert panel (see annex 1).

Currently, 24 of the 30 European countries analysed apply lower BAC for inexperienced drivers. For such persons, the legal alcohol limit was reduced to 0.0-0.3 g/L. Table 3.15 shows the year of introducing the BAC level for inexperienced drivers.

Table 3.15 Inexperienced drivers BAC legal limits (g/L) across Europe

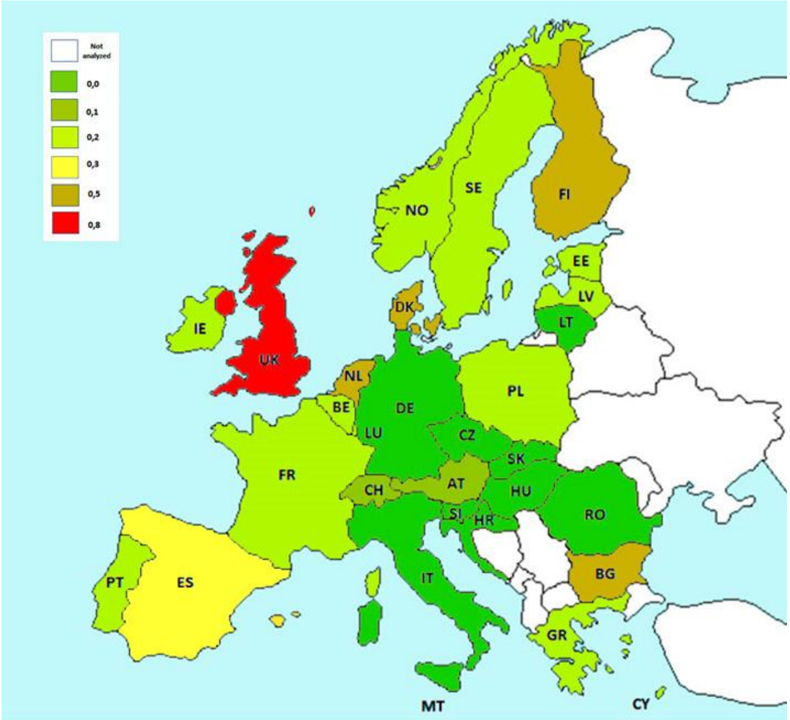
BAC limit (g/L)	Country
0.0	Czechia (1953), Slovakia (1953), Germany (2007), Croatia (2008?), Italy (2010), Lithuania (2015), Hungary (?), Romania (?), Slovenia (?)
0.1	Austria (1992), Switzerland (2014)
0.2	Poland (1960), Sweden (1990), Latvia (1998), Estonia (2001), Norway (2001), Greece (2002), Netherlands (2006), Luxembourg (2007), Ireland (2011), Cyprus (2012), France (2015), Malta (2018), Portugal (?)
0.3	Spain (1999)
0.5	Finland (1977), Belgium (1994), Denmark (1998), Bulgaria (1999), Scotland (2014)
0.8	United Kingdom (1967)

Source: Literature review; information from National expert panel (see annex 1).

At least 14 countries have introduced lower BAC level for novice drivers after the publication of the European Commission recommendations, but, as in case of the BAC level for all drivers, the process of implementing the European Commission's proposals has been stretched over time. Belgium, Bulgaria, Denmark and Finland decided not to introduce lower BAC limits for inexperienced drivers and remained with the 0.5 g/L limit. The lower maximum alcohol level for young novice drivers during the first few months after passing their driving test is now discussed in the United Kingdom. In this country the zero-alcohol limit is a part of a wider proposal – the introduction of a 'graduated licencing' scheme.

Lower legal BAC limits were also introduced for commercial transport drivers as a way of minimising the potential risks of being impaired by alcohol when driving large vehicles, or those transporting dangerous goods or multiple passengers. The prevalence of drink-driving amongst commercial transport drivers is lower than among drivers of private cars. Surveys from the US, Canada and Europe have shown the low prevalence of alcohol among drivers of heavy vehicles – less than 1% (Assum, T. 2009; Eksler, V. et al., 2009; data from TISPOL). But alcohol-related road accidents with commercial transport vehicles usually result in more serious injuries and greater material damage. Figure 3.13 shows the current BAC limits for professional drivers. It is worth recalling at this point that BAC limits in different countries cover different groups of professional drivers.

Figure 3.13 Professional drivers BAC legal limit (g/L) across Europe



Source: Information from experts.

Currently 25 of the 30 analysed countries have lower BAC limits for professional drivers (0.0-0.3 g/L). Table 3.16 provides information on the year of implementation of these solutions.

Table 3.16 Professional drivers' BAC legal limit (g/L) across Europe

BAC limit (g/L)	Country
0.0	Czechia (1953), Slovakia (1953), Croatia (2008), Germany (2007), Italy (2010), Lithuania (2015), Hungary (?), Romania (?), Slovenia (?)
0.1	Austria (1997), Switzerland (2014)
0.2	Poland (1960), Sweden (1990), Estonia (2001), Norway (2001), Portugal (2001), Greece (2002), Luxembourg (2007), Ireland (2011), Cyprus (2012), Latvia (2014), Belgium (2015), France (2015; bus drivers), Malta (2018; bus and coach drivers)
0.3	Spain (1999)
0.5	Netherlands (1974), Finland (1977), Denmark (1998), Bulgaria (1999), Scotland (2014),
0.8	United Kingdom (1967)

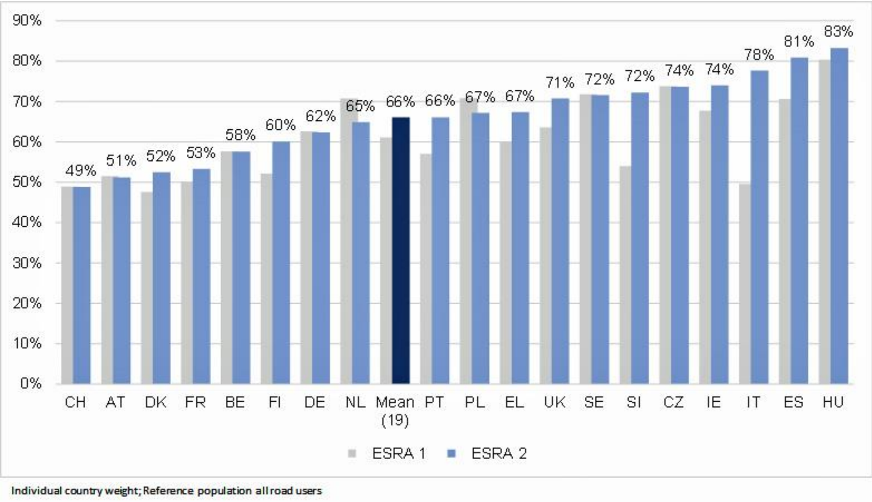
Source: Literature review; information from National expert panel (see annex 1).

Most EU Member States now have a lower BAC limit for professional drivers of 0.3 g/L or below. Bulgaria, Denmark, Finland, the Netherlands and Scotland have a limit of 0.5 g/L, and the UK, excluding Scotland has a limit of 0.8 g/L.

BAC-limits below 0.5

In recent years there have been repeated calls to further lower the current alcohol limits. Various road safety organisations like the European Transport Safety Council have been calling for the introduction of (near to) zero alcohol limits in the EU in order to improve road safety and reduce the number traffic casualties. A proposal to introduce a legal BAC level closer to 0.2 g/l for all drivers was included in the document published by WHO Regional Office for Europe "European action plan to reduce the harmful use of alcohol 2012–2020" (2011). Also, at Member State level there have been proposals to set the BAC-limit at 0.2 g/l or lower, most recently (2020) in Belgium where the parliament considered bills to either impose a zero-limit for every driver or to impose a zero-limit for novice drivers (the bills were rejected). In addition, surveys show public support for introducing lower BAC limits. For example, ESRA2 (2018) shows that 66% of respondents from 19 European countries are in favour of lower BAC limits for all drivers. This support has increased by five percentage points since 2015. Figure 3.14 shows the support for the introduction of Zero-tolerance law in each country.

Figure 3.14 Percentage of respondents supporting the Zero tolerance for alcohol (0.0 ‰) proposal for all drivers



Source: ESRA1 (2015) & ESRA2 (2018).

The ESRA2 survey revealed that the highest number of respondents who support Zero tolerance for alcohol for all drivers are in Hungary (83%), Spain (81%), Italy (78%) and Ireland (74%). In turn, in Switzerland, Austria, Denmark or France, the support is lower, and it oscillates around 50%. Between the lowest and the highest approval rates, the difference is of 34 percentage points. It seems that the level of support for introducing a lower BAC- limit for all drivers does not depend on the share of severe accidents involving DUI. In the three years period between the two ESRA surveys, support for the solution has increased primarily in Italy (28% more people support the solution), Slovenia (+18%) and Spain (+10%), and decreased in the Netherlands (-5%) and Poland (-4%). Finally, in countries that have already implemented lower BAC limits (0.2 g/L or less), support for this solution is higher.

The proposal to introduce Zero tolerance law for novice drivers (licence obtained less than two years) has even greater support from European road users. Nearly 80% of the respondents surveyed support this solution and this support has remained practically unchanged since 2015. The highest number of respondents who support Zero tolerance for alcohol for novice drivers are found in Slovenia (92%), Spain (89%), Hungary (88%) and Czechia (86%). The question of whether to support a law prohibiting novice drivers from consuming alcohol reveals wider disparities among European countries. Italy stands out with a particularly low approval rate of 54%, followed by Denmark and Finland with a rate of 69%. The difference between the lowest and highest rates is therefore almost 40 percentage points. The general ban on alcohol for novice drivers is widely supported in some European countries, such as Hungary, Spain, Italy or Serbia (support rate above 75%) and considerably less in other countries such as France, Denmark or Austria where just over half of the population supports it, and would be even rejected in Switzerland (49%). Between the lowest and the highest approval rates, the difference is of 34 percentage points.

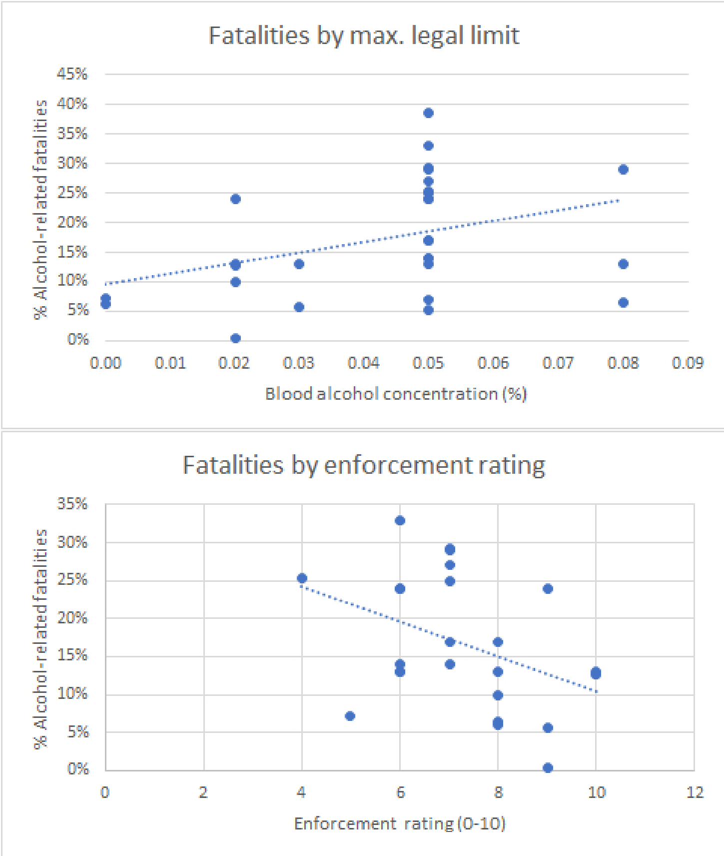
Apart from public support, key considerations observed in debates on whether or not to lower BAC-limits to 0.2 g/L or less focus on the effect of BAC-levels on driving abilities and of BAC-limits on road safety (i.e. accidents and casualties).

Section 3.1 of this report provides a review of the impact BAC-levels on driving abilities. It is concluded there is clear scientific evidence that driving skills are impaired at a BAC of 0.5 g/L and many of these skills are increasingly impaired with an increasing BAC level. In addition, some driving faculties can already be impaired at lower BAC-levels.

Furthermore, in section 3.2 of this report, the relation between BAC-levels and crash risk is reviewed. There is clear evidence from international, again mainly Anglo-Saxon, scientific studies that shows how relative crash risk increases for drivers with BAC-levels between 0.2-0.5 g/L (see also **Table 3.1**). At the same time, the crash risk for the general driving population decreases between BAC-levels 0.0-0.2 g/L (Blomberg, Pech, Moskowitz, Burns, & Fiorentino, 2009; Compton & Berning, 2015). However, Zador et al (2000) show how this risk can vary between groups. Except for those in the 16–20 age group, the relative risk of receiving a fatal injury is lower for drivers with a positive BAC under 0.2 g/L than for drivers with 0.0 g/L. When comparing the 16–20 age group however, the comparable relative risk was substantially increased even at this low positive BAC, by 55% among men and 35% among women.

The question what impact BAC-limits have on road safety is more complex. As mentioned earlier in this section, several studies have demonstrated the positive impact of lowering BAC levels to 0.5 g/L. However, looking at evidence and arguments for the effect of a lower BAC level, a mixed view emerges.

Figure 3.15 Correlation BAC-limits, enforcement levels and road fatalities



Source: WHO.

Based on their analysis of data from 28 European countries, Castillo-Manzano, et al. (2017) conclude that setting BAC-limits at zero does not seem to be a panacea for drink-driving, since the countries with the strictest limits do not achieve better road safety outcomes. Similarly, a WHO study based on data collected world-wide, finds a weak correlation (R2=0.14) between alcohol-related road fatalities and BAC limits. There several countries with BAC-levels at 0.5 g/L, which have far lower fatality levels alcohol-related road fatalities than some countries which have a BAC limit of 0.2 g/L or lower. Also, there are significant differences in performance between countries with the same low BAC-limit. Finally, not all countries saw the introduction of a low BAC-limit coincide with a reduction in alcohol-related road fatalities, or vice versa.

There are few scientific studies providing sound evidence on the impact of lowering BAC limits to values below 0.5 g/L, especially for European countries. For Europe, data could be retrieved from studies in Sweden, Norway and Serbia:

- In Sweden, the BAC-limit was lowered from 0.5 to 0.2 g/L in 1990 was associated with 8-10% reduction in all fatal accidents (Norström, 1997; Lindgren, 1999; Borschos, B. 2000). Single-vehicle road accidents accounted for the greatest decrease (by 11%) when compared to the total reduction of all road accidents (i.e. 7.5%) (Fell et al., 2006);
- In Norway, the BAC-limit was lowered from 0.5 to 0.2 g/L in 2001. It did not cause a reduction in the accident numbers, but self-reports showed there has been a reduction in drink-driving and an increase in perceived social disapproval of drinking before driving (Assum, 2002; Assum, 2010);
- In Serbia, the lowering of the BAC-limit from 0.5 to 0.3 g/L in 2009 did not affect the involvement of DUI drivers in road accidents (except for the short period immediately after the introduction of the new BAC level) and their severity. Moreover, the results of the study reveal that the share of DUI drivers in accidents has increased after the introduction of a more stringent BAC limit (Smailovic et al., 2020).

In addition to the European findings, an evaluation of changes in the Road Traffic Act of *Japan* in 2002, which included lowering the legal BAC limit for driving lowered from 0.5 mg/L to 0.03 mg/L and drastic increases of the penalties for DUI offences, found statistically significant decreases in alcohol-related crashes, alcohol-related injuries and single vehicle night time crashes among 16-19 year old drivers. In comparison, the rates of total crashes, injuries and pedestrian fatalities showed no statistically significant decline or increase in the period following the introduction of the BAC law (Desapriya, Shimizu, Pike, & Smith, 2007). Other international studies add evidence on the impact of BAC-limits below 0.5 mg/L, although these lower limits relate to young and/or inexperienced drivers (see Table 3.17).

Table 3.17 International experience on effects of lowering legal BAC limit

Study	
Fell, Scherer, Thomas, & Voas (2016)	Study to determine which minimum legal drinking age 21 laws currently have an effect on underage drinking-and-driving fatal crashes in the US. Found laws on use alcohol and lose your license (-7.9%), zero tolerance 0.02% blood alcohol concentration limit for underage drivers (-2.9%) were associated with significant decreases in fatal crash ratios of underage drinking drivers
New Zealand Ministry of Transport (2012)	Study into the effect of lowering of the BAC limit in 2010 from 0.03% to zero for drivers ages under 20, found 46% reduction in offending drivers under 20 years with 0.03%≤BAC≤0.08% in first two years after change and 43% reduction in offending drivers under 20 years with BACs≥0.08 in first two years after change.
Shults, et al. (2001)	Systematic review, including findings from four US-based studies and two Australian studies concluded that there was sufficient evidence that lower BAC laws were effective in reducing alcohol-related crashes among young or inexperienced drivers. The studies reported studies reductions in fatal crashes ranging from 9% - 24%.
Voas, Tippetts, & Fell (2003)	Study of the effect of laws raising the minimum legal drinking age (MLDA) and establishing zero tolerance (from 0.08% to 0.02% blood alcohol concentration (BAC) limit for drivers younger than age 21 years) on alcohol-related highway deaths among drivers younger than age 21 years. After accounting for differences among the 50 states in various background factors, changes in economic and demographic factors within states over time, and the effects of other related laws, results indicated substantial reductions in alcohol-positive involvement in fatal crashes (24.4% reduction in BACs>0 drivers younger than 21 involved in fatal crashes) were associated with the two youth-specific laws.
Zwerling & Jones (1999)	Reviewed six studies on the introduction of lower BAC-limits in States in Australia and the US. The greatest reduction (22%) was reported for night-time, single vehicle fatalities in those states with zero BAC laws. In states with 0.02% BAC laws, the reduction averaged 17%.

The above-mention international research show that lowering the alcohol limit *for novice drivers* results in less driving under the influence of alcohol, fewer accidents and fatalities. Also, evidence from research of European experiences is only partially in line with these findings. For example:

- In 1992 in Austria the BAC limit for the group of novice drivers had been lowered from 0.8 to 0.1 g/L. An accident analysis after five years of observation indicated a reduction of drink driving injuries in the group of novice drivers by 30.9% in contrast to a reduction of only 5.9% in the group of experienced drivers. The accident reduction may be explained not only as a consequence of the legal alterations, but also as a consequence of intensive support in the media, persistent police enforcement and the introduction of mandatory psychological driver improvement courses for drunk drivers (Bartl & Esberger, 2000);
- In January 2006, the Netherlands introduced a lower BAC limit (0.2 g/L) for novice drivers (less than five years of experience) (SWOV, 2018). Data on alcohol use in weekend nights showed that in the period 2002-2010, the alcohol use among young drivers did not decline stronger than among older drivers. Nor was there a decline in the number of alcohol-related traffic casualties among young people in the first two years after the introduction of the reduced limit (SWOV, 2018).

Overall, the evidence from literature suggests that lowering BAC limits to 0.2 g/L or lower can have a positive effect, reducing the number of accidents and fatalities. The direct impact on accidents with drivers with a BAC between 0.2 g/L - 0.5 g/L is likely to be limited (Schultze, H. et al., 2012), but it could also l the number of drivers in higher BAC categories, although it is often assumed drivers with BAC ≥ 1.0 g/L are not affected (Leung, 2013), (Allsop, 2015), (Moreau et al., 2020).

Moreover, the extent of the actual impact depends on a variety of factors, including the probability of getting caught, the severity of penalties, public awareness and understanding of BAC limits and the social acceptability of drink-driving (Assum, 2010), (Killoran, et al., 2010), (Haghpanahan, et al., 2019), (Castillo-Manzano, et al., 2017), (Moreau et al., 2020). Without conserted efforts in these areas, the impact of lowering the BAC-limit from 0.5 g/L to 0.2g/L or lower, could have very limited impact. Consideration should be given to time and other resources available to make this effort. When these resources are (too) limited to promote and enforce a new, low BAC-level, it is feared the measure does not resort any effect or can even be counterproductive.

The next part of the report presents available data on drink-driving enforcement in 30 European countries.

3.5.2 Drink driving enforcement

It is generally accepted that traffic law enforcement influences driving behaviour through two processes: general deterrence and specific deterrence (Zaal, 1994) (Mäkinen, et al., 2003). General deterrence can be defined as the impact of the threat of legal punishment on the public at large. Specific deterrence can be seen as the impact of the actual legal punishment on those who are apprehended (DGMOVE). Thus, general deterrence results from the perception of the public that traffic laws are enforced and that there is a risk of detection and punishment when traffic laws are violated. Specific deterrence results from actual experiences with detection, prosecution, and punishment of offenders.

Deterrence, thus effectiveness of enforcement is higher if police controls take place regularly over a long time period; are unpredictable and difficult to avoid; focus on traffic offences that have a direct, proven relationship with collisions or their severity; and are accompanied by sufficient publicity (Zaal, D. 1994; Mäkinen et al., 2003; Adminaite, D. et al., 2016).

Table 3.18 shows number of roadside police alcohol checks per 1000 inhabitants in the last ten years for 13 countries which could provide data.

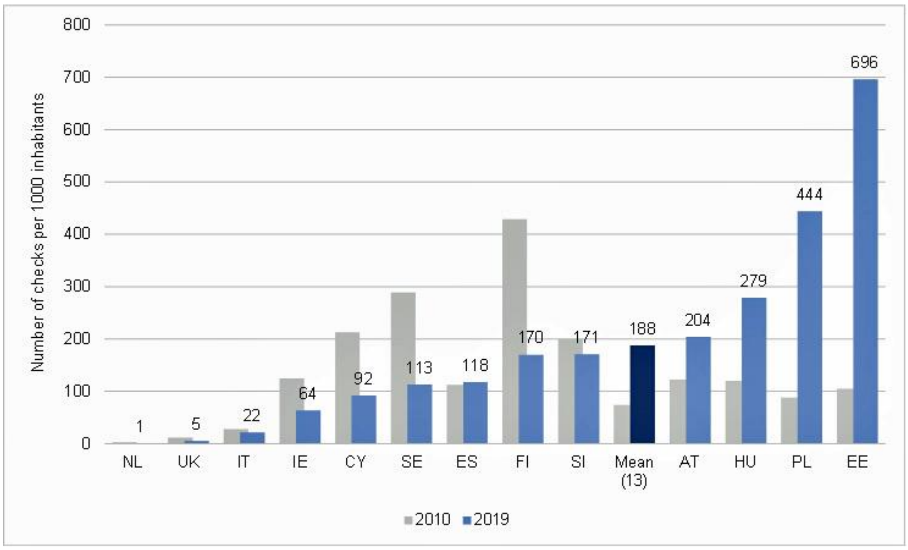
Table 3.18 The number of roadside police alcohol checks per 1000 inhabitants in 2010-2019

	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
Austria	123	169	195	209	214	189	192	196	197	204
Cyprus	213	205	176	146	138	135	105	120	102	92
Estonia	105		356	470	572	677	656	513	584	696
Finland	429	214	171	145	279	268	272	264	249	170
Hungary	120	118	125	121	124	135	174	241	298	279
Ireland	125	119	103	97	87	71	72	73	65	64
Italy	28	31	30	29	26	25	24	23	22	22
The Netherlands	3	3	3	2	2	2	2	1	1	1
Poland	88	149	194	234	405	466	473	470	434	444
Slovenia	200	188	161	184	186	156	142	191	171	200
Spain	113	136	138	138	136	124	109	111	118	141
Sweden	289	293	259	235	209	146	121	114	113	127
UK	12	11	11	11	9	8	7	5	5	
Mean (13)	142	126	148	155	184	185	181	179	182	188
France	168	172	168	160	164	152				
Lithuania	42	83	53	55	52	48				
Greece	164	158	156	163	166					
Portugal	107	111	133	149						
Norway	367									
No data: Belgium, Bulgaria, Croatia, Czechia, Denmark, Germany, Latvia, Luxembourg, Malta, Romania, Slovakia, Switzerland										

Source: ETSC, 2010; Podda, F. 2012; Adminaite, D. et al., 2016; Adminaite, D. 2018; data from National expert panel (see annex 1).

While the total number of police sobriety checks increased significantly between 2010 and 2019, this progress in Europe is mainly due to a very clear increase in the intensity of police activities in Estonia, Hungary and Poland (Figure 3.16). In five Member States, the number of police sobriety checks decreased in 5 countries (Ireland, Cyprus, Sweden, Finland, Slovenia).

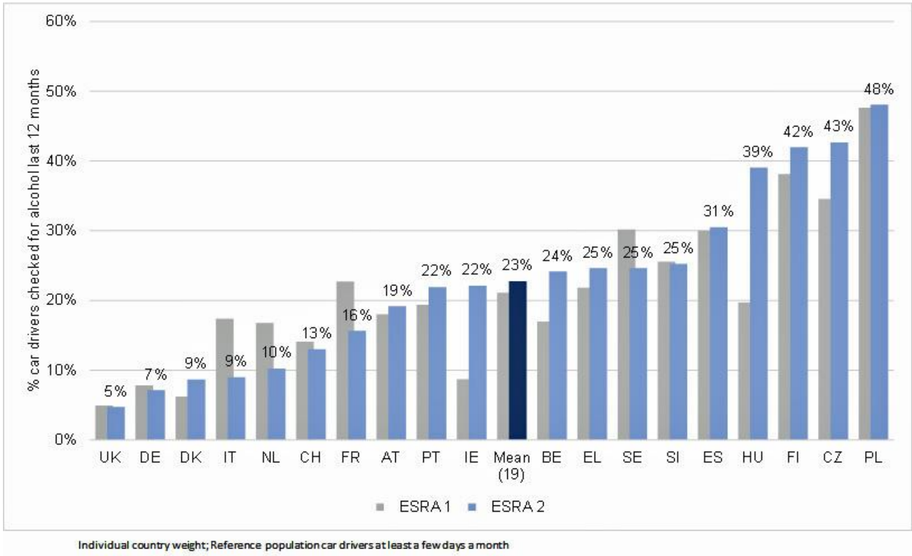
Figure 3.16 Number of alcohol checks per 1000 inhabitants in 2010 and 2019 in selected countries[20]



Source: ETSC, 2010; Podda, F., 2012; Adminaite, D. et al., 2016; Adminaite, D. 2018; Eurostat 2020; data from National expert panel (see annex 1).

For those countries that witnessed an increase in the number of sobriety checks, this appears to be reflected in responses in public surveys (ESRA studies). The car drivers were asked whether the police had checked them for alcohol in the last 12 months. The figure below shows the percentage of responses 'At least once' to the same question in 2015 and 2018.

Figure 3.17 Percentage of respondents indicating they had been checked for alcohol at least once during the last 12 months by the police in 2015 and 2018



Source: ESRA1 (2015) & ESRA2 (2018).

Figure 3.17 shows that in 2018, 23% of respondents had at least once undergone sobriety check during the last 12 months. It also shows there are significant differences between countries. Where the share of drivers who have experienced an sobriety check during the last twelve months in Finland, Czechia and Poland was above the 40%, this share was below 10% in UK, Germany, Denmark and Italy. Similar large differences can be found in the trend in the shares. While in Hungary, Ireland, Belgium and Czechia shares have increased significantly, car drivers in France, the Netherlands, Italy and Sweden indicate that the number of sobriety checks in their countries has fallen.

[20] The indicator for the UK was calculated on the basis of 2018 data.

The ESRA2 study also a positive relation between the (number of) checks and drivers' experience or perception of the likelihood of being checked. In countries where sobriety checks were more frequent (indicator: number of alcohol checks per 1 000 inhabitants), a larger share of drivers indeed indicated having experienced a sobriety check, and drivers who experience a check in the last 12 months, assessed the probability higher of another sobriety check.

The latter result is important, because the subjective risk of apprehension is considered a key factor affecting road users' behaviour. Various studies at national level found that higher numbers of alcohol checks, especially random ones, are associated with lower rates of alcohol-related crashes (Macaluso, et al., 2017) (see Table 3.19).

Table 3.19 Relationship between police sobriety checks and accidents

Author(s); Year; Country	Sampling frame	Method	Outcome indicator	Main Result
Cestac J., Kraïem S., Assailly J.P; 2016; France	Questionnaires of 10,023 car drivers from 15 European countries regarding alcohol consumption and driving behaviours were collected; the number of roadside alcohol breath tests in 2008 were recorded by the European Transport Safety Council	Multilevel modelling	Self-reported drunk drivers [slope]	The number of breath tests is negatively linked to drunk driving, showing that this measure is efficient in preventing drunk driving. However, the effect is small in comparison with cultural and individual-level factors.
Elvik R., Høye A., Vaa T., Sørensen M.; 2009; Norway	meta-analysis of 5 studies to examine effects of introducing random breath test laws on fatal crashes in America.	Meta-analysis; before after	Fatal accidents [percent accident reduction]	The results show a nonsignificant reduction. No difference has been found between the effects on fatal accidents involving alcohol and on the total number of fatal accidents
Erke A., Goldenbeld C., Vaa T.; 2009; USA, Canada, Australia, UK, France, Sweden, New Zealand	40 studies were combined in a meta-analysis to estimate the effectiveness of DUI checkpoints in reducing all type of crashes. 116 effect estimates has been obtained or computed from these studies.	Log-odds method; meta-analysis (random effects); test of heterogeneity; trim and fill analysis	Alcohol-related accidents [% accident reduction]	The result of the study is that overall we have a reduction of total crashes due to DUI checkpoints: the reduction is lower if the publication bias is considered.
Ferris J., Mazerolle L., King M., Bates L., Bennett S., Devaney M.; 2013; Australia	The dataset of breath tests is provided by the Traffic Analysis Unit of the states of Queensland and Western Australia state for approx. 10 years. Crash data consist of police attended accidents (July 2004-June 2009)	Join-point regression model; linear-log OLS regression	Alcohol-related crashes [absolute difference]	Results show an inverse correlation between alcohol-related (RBT) crashes and random breath tests: an increase in the number of RBT leads to a decrease in alcohol-related crashes.
Romano E., Scherer M., Fell J.,Taylor E.; 2015; USA	Annual fatal crashes from 1982 to 2010 are provided by NHTSA's Fatality Analysis Reporting system (NHTSA, 2013b) for 51 jurisdictions in the USA.	Structural equation modelling techniques with Analysis of Moment-Based Structures	Ratio of the number of alcohol-related fatal crashes among drivers aged 15 to 20	The analysis carried out demonstrated that the decrease in alcohol-related teen's crashes is associated with the introduction of 0.08 BAC law, zero tolerance law, seat

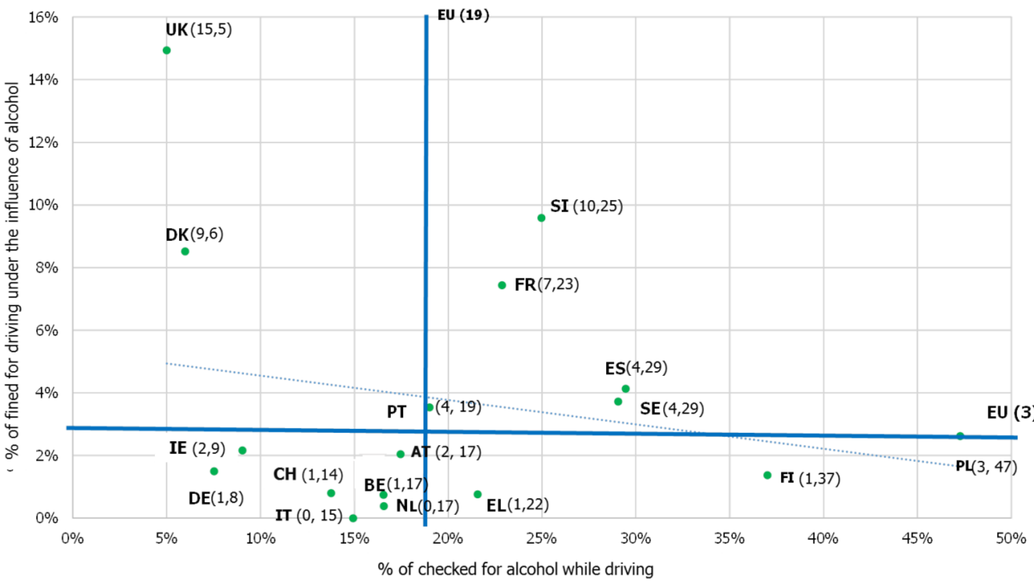
Author(s); Year; Country	Sampling frame	Method	Outcome indicator	Main Result
			years divided by the number of nonalcohol-related fatal crashes among drivers of the same age group [slope]	belt laws DUI checkpoints and other laws addressing the problem of alcohol among drivers (20 are analysed). On the other hand, fatal alcohol-related crashes increase when keg registration laws increase

Source: (Macaluso, Theofilatos, Botteghi, & Ziakopoulos, 2017).

Studies exploring this association at an individual level found results contradicting the findings reported in above-mentioned studies. Based on data of consecutive ESRA surveys, Butler (2016) and Achermann et al. (2019) found that people who underwent more alcohol checks and considered it more likely to be checked in the future, still reported to have driven more often under the influence of alcohol. In addition, Figure 3.18 relates the share of drivers checked for alcohol and the share of drivers fined for DUI alcohol. The figure shows that the majority of the countries, irrespective of alcohol check intensity, reveal about 1-4% of those drinking and driving. Similar results were also obtained during the TISPOL checks described earlier.

Little explanation for this counterintuitive findings has been provided in the studies. Perhaps it is an indication that for regulars drinkers, police controls do not provide a strong enough deterrent to prevent drink-driving. However, more research would be required to help interpret these findings.

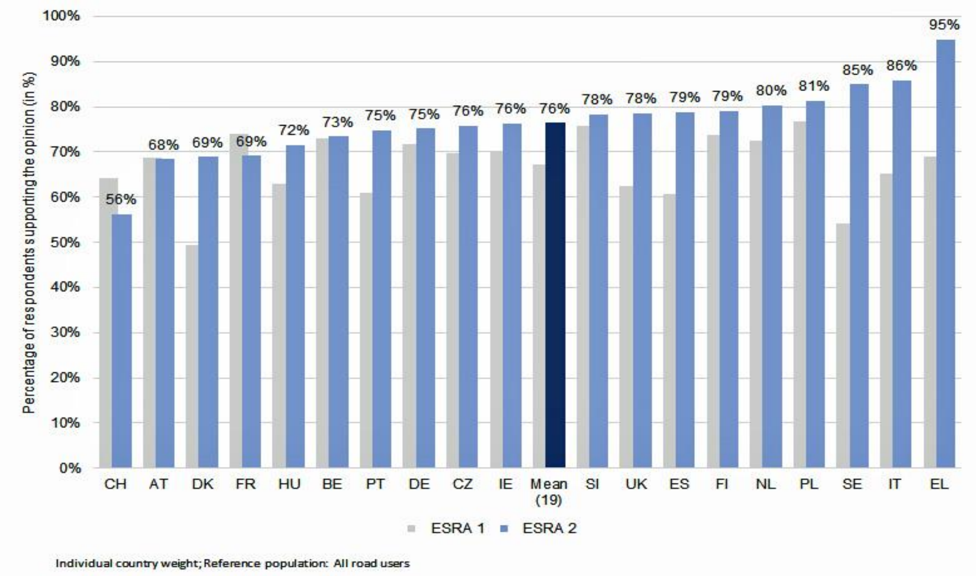
Figure 3.18 Share of car drivers checked for alcohol and drivers fined for DUI alcohol in 2015



Source: Butler (2015) and information from National expert panel (see annex 1).

The ESRA1 and ESRA2 surveys also provide information on the opinions of road users on the enforcement of traffic rules for driving under the influence of alcohol. Road users were asked whether they consider that the traffic rules are sufficiently enforced. Figure 3.19 clearly shows road users think the enforcement of DUI regulations should increase; 76% of respondents think police enforcement of road traffic rules on drink-driving is not sufficient. Also, the share of road users with this opinion has increased in almost all countries. There is no clear correlation between the share of road users who think DUI enforcement should increase and the number of road fatalities with alcohol involvement in countries. Countries with both relatively high and low fatality numbers can be found at both ends of the chart. A similar observation can be made for the relation with the level of police enforcement experience by road users. For example, countries where road users experience few sobriety checks (e.g. the Netherlands or Italy) are among the countries where the largest shares of road users think DUI enforcement should be increased, but so are countries where the situation is opposite (e.g. Finland and Poland) and the number of police checks per 1000 inhabitants is high compared to other countries.

Figure 3.19 Percentage of road users supporting the opinion that traffic rules for driving or riding under the influence of alcohol are not being checked sufficiently



Source: ESRA 1 (2015) & ESRA 2 (2018).

Random breath testing

At the end of this part of the report, brief consideration is given to the approaches, which can be adopted to carry out sobriety checks, in particular the Random Breath Testing procedure.

Traditionally Random Breath Testing is defined as "a test given by the police to drivers chosen by chance to measure the amount of alcohol the drivers have. It means that any driver can be stopped by the police at any time to test the breath for alcohol consumption" (WHO). Sometimes you can also find an elaborate definition of RBT (Faulks, I. J. et al., 2009): "*Random breath testing is a comprehensive set of drink-drive countermeasures, including specific drink-driving laws, use of breathalyser technologies at the roadside and as evidentiary instruments, specific operational traffic policing methods (random breath testing and the highly visible "booze buses"), integrated with public advertising that alerts the community to the risks associated with drink driving and emphasises the high probability of detection for driving while impaired by alcohol, and school-based education targeting young people in the immediate pre-driving phase and providing for a discussion of driving while impaired*". With this understanding of RTB, it operates as an enforcement tool both to apprehend offenders and to deter potential offenders (Faulks, I. J. and Irwin, I. D. 2007).

The European Commission recommends the application of random breath testing with an alcohol screening device as a leading principle for surveillance of drink-driving (Commission, 2001). According to the EC, the Member States should try to ensure that random breath testing was "carried out regularly in places where and at times when non-compliance occurs regularly and where this brings about an increased risk of accidents, and ensure that officers carrying out random breath testing checks use evidential breath test devices whenever they suspect drink-driving".

Data from ETSC, WHO and experts indicate that currently in almost all European countries there is a possibility of randomly stopping a car driver for inspection. The exceptions are Luxembourg, Malta, United Kingdom and Ireland. The latter country allows a driver to be stopped at random, but only if she/he drives through a designated intoxication checkpoint. It is somewhat surprising that the random stopping of a car driver by the police does not yet mean that she/he will be randomly subjected to a sobriety test. In Lithuania, Latvia, Slovenia and the United Kingdom, such a sobriety test can only be carried out if the police officer suspects that she/he has consumed alcohol before driving or is drunk.

Evaluations of police operations have confirmed that random breath testing is a cost-effective road safety measure (Fauls & Irwin, 2009). For example, according to Racioppi (Racioppi et al. 2005, in: (Anderson, et al. 2012)), each Euro invested in prevention carried out through random breath-testing allows €36 to be saved. The key to the success of RBT lies within complying with the following: highly visible and intensive police enforcement, with about one motorist in three being breath tested at any time or place during a calendar year, together with extensive publicity, particularly in the early stages of implementation. However, it is worth noting that the level of intensity of police checks described in the previous sentence (1:3) is based on calculations carried out in Australia in the 1980s and 1990s. The European Commission in its 2001 recommendation proposed that every driver should be tested at least once every three years. Data from the ESRA-surveys (Figure 3.17) indicate on average 23% of drivers have been checked by police at least once, but the levels vary greatly between countries. This suggest that in many countries recommended enforcement levels are not made yet.[21] However, according to Ferris, J. et al. (2013), there are no clear results that indicate an optimal level of random breath testing.

3.5.3 Drink driving sanctions

If people are found guilty of DUI alcohol, they can be fined, banned from driving or even imprisoned. A variety of legal sanctions are applied to drivers who are convicted of DUI:

- fines;
- having driving licence suspended or revoked;
- penalty points;
- remedial programmes (assessment, mandatory treatment or rehabilitation);
- vehicle sanctions (vehicle impoundment or immobilisation, alcohol ignition interlocks);
- various forms of restriction of confinement.

The severity of the punishment depends on the alcohol concentration in the body of the road user. Still, it could also be modified by e.g. belonging to a specific group of road users (e.g. novice or young drivers, professional drivers, cyclists, etc.), behaviour during roadside checks (e.g. refusal to undergo a sobriety check), number of previously committed traffic offences (including those related to alcohol) and previous involvement in a road accident, as well as weekly, monthly or annual income etc. Each country defines these factors differently and gives them a different weight. Finally, many European countries have introduced stricter penalties for people with high BAC levels. Various countries apply this BAC threshold to distinguish between an administrative offence and a criminal offence. Driving with high BAC involves a high risk of getting involved in a road accident. It is also assumed that many high-BAC drivers are habitual impaired driving offenders, even though they may not have records of previous arrests and convictions (Richard, Ch. M. et al., 2018). Table 3.20 summarises the available information on this subject.

Table 3.20 Offences vs crime in different European countries

Country	Standard BAC level (g/L)	Offence (g/L)	Crime (g/L)
Hungary	0.0	0.0-0.5	>0.5
Romania	0.0	0.0-0.8	>0.8
Slovakia	0.0	0.0-0.48	≥ 0.48
Poland	0.2	0.2-0.5	>0.5
Estonia	0.2	0.2-1.5	>1.5
Lithuania	0.4	0.4-1.5	>1.5
France	0.5	0.5-0.8	>0.8
Italy	0.5	0.5-0.8	>0.8
Germany	0.5	0.5-1.1	>1.1
Slovenia	0.5	0.5-1.1	>1.1
Bulgaria	0.5	0.5-1.2	>1.2
Finland	0.5	0.5-1.2	>1.2

[21] It is noted that theoretically even countries where a low share of drivers have been checked by police, the level recommended by the Commission could have been reached as drivers could have been checked several times in one year.

Portugal	0.5	0.5-1.2	>1.2
Spain	0.5	0.5-1.2	>1.2
Only offence: Czechia, Norway, Sweden, Austria, Belgium, Croatia, Cyprus, Denmark, Greece, Ireland, Latvia, Luxembourg, Malta, The Netherlands, Switzerland, United Kingdom			

Source: Information from National expert panel (see annex 1).

In many countries DUI alcohol laws are complex. They are difficult to understand, enforce, prosecute, and adjudicate with many inconsistencies and unintended consequences. As a result, no tool can be used to analyse the similarities and differences among the legal systems of different countries. A good illustration of these problems is the juxtaposition of two very common penalties for driving after drinking alcohol: driving license suspension and monetary fines. Table 3.21 provides information on the level of penalties at the lowest prosecuted BAC limits.

Table 3.21 Driving license suspension and monetary fines at the lowest prosecuted BAC limits in European countries

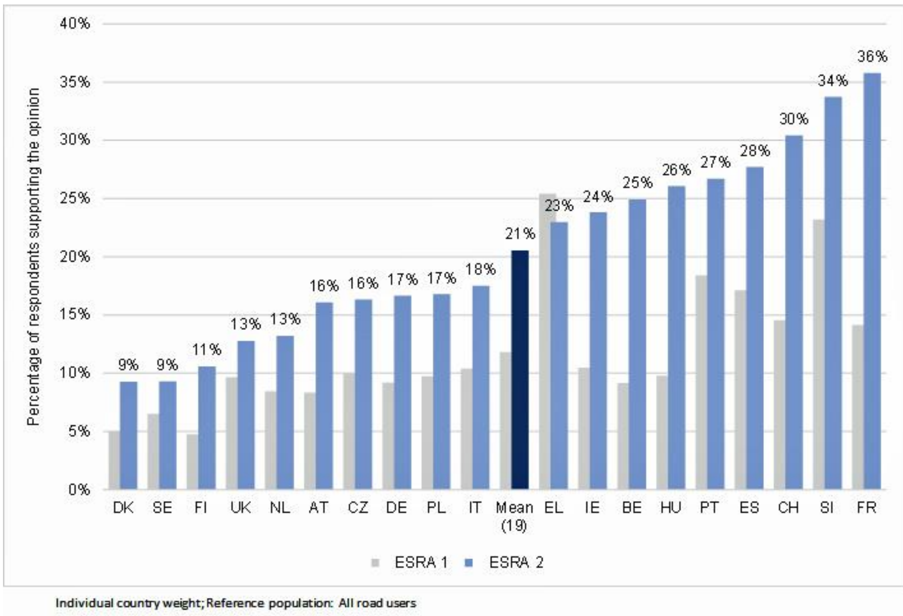
	Standard BAC level g/L	The lowest prosecuted BAC limits	Driving licence suspension/ revoked	Fines (in euros)
CZ	0.0	0.0-0.3	From 6 months to 1 year	100-800
HU	0.0	0.0-0.5	No	Up to 285
RO	0.0	0.0-0.8	Up to 90 days	Up to 170
SK	0.0	0.0+	From 1 to 5 years	200-1000
EE	0.2	0.2-0.49	Up to 6 months	400
NO	0.2	0.2-0.5	Up to 6 months	Fine adjusted to the driver's earnings (max. 1.5 times the monthly earnings)
PL	0.2	0.2-0.5	From 6 months to 3 years	Up to 1135
SE	0.2	0.2-0.49	1 year	40 rates
LT	0.4	0.4-1.5	12-18 months	800 - 1100
LV	0.5	0.2-0.5	3 months	215 - 430
CH	0.5	0.5-0.69		Min 550
AT	0.5	0.5-0.79	No	From 300 to 3000
BE	0.5	0.5-0.8	3 hours	125 on the spot. If case is taken to court – up to 2,500 euros.
BG	0.5	0.5-0.8	6 months	255
CY	0.5	0.5-0.81	No. If case is taken to court - up to 3 months	125 on the spot. If case is taken to court – up to 1,500 euros.
FR	0.5	0.5-0.8	Up to 3 years	From 135
EL	0.5	0.5-0.8	No	200
IE	0.5	0.5-0.8	3 months	200
IT	0.5	0.5-0.8	3-6 months	544-2174
NL	0.5	0.54-0.8	No	300
PT	0.5	0.5-0.8	From 1 month to 1 year	250-1250
SI	0.5	0.51-0.8	Possibly, but no details	600
HR	0.5	0.5-1.0	n/a	140-275
ES	0.5	0.5-1.0	no	500
DE	0.5	0.5-1.1	Up to 1 months	500
DK	0.5	0.5-1.2	conditionally suspended	Net monthly income x BAC level
FI	0.5	0.5-1.2	From 1 month to 5 years	A fine depending on income (unit fines).
LU	0.5	0.5-1.2	From 8 days to 1 year	25-500
UK	0.8	0.8-1.37	12-16 months	180 or 150% of weekly earnings
No data: Malta				

Source: Information from National expert panel (see annex 1).

Suppose the various penalties are an effective tool to stop road users from driving after drinking alcohol. In that case, the rules must be designed in a way that a person without a legal background can understand, memorize and most importantly accept them (GRSP, 2007). There are many indications that this is not the case. E.g. the Eurobarometer survey (2010) found that across the European Union, awareness of the current legal BAC limit in individual countries is fairly low. Only slightly over a quarter of respondents (27%) were able to give a correct answer. More than one third (36%) gave an incorrect answer, while an equal number (37%) said they wouldn't know. It is therefore difficult to assume that these people are familiar with much more complicated rules governing the system of penalties for drink driving. Simplification of the DUI alcohol legislation and communication/education campaigns at national level could help increase awareness and understanding of the legislation in force.

At the end of this part of the report, it is worth returning for a moment to public opinion surveys. In the ESRA surveys, respondents were asked to assess the severity of penalties for drink driving. The results are shown in Figure 3.20.

Figure 3.20 Percentage of respondents supporting the opinion that penalties for driving or riding under the influence of alcohol are too severe



Source: ESRA 1 (2015) & ESRA 2 (2018).

Between 2015 and 2018, there has been a clear increase in the number of respondents who support the opinion that penalties for drink driving are too severe. This trend is present in all countries (except Greece), but is particularly evident in France, Hungary, Switzerland and Belgium. These results could suggest that in the future, an often chosen method of dealing with the problem of alcohol in road traffic, namely increasing the severity of penalties for such offence/crime, may meet with social resistance.

Over the last three decades, considerable research has been conducted on the effectiveness of different countermeasures for DUI alcohol. The primary concern has been to establish their effect on alcohol-related accidents and fatalities and drink driving recidivism. Attention has also been given to the effect of sanctions on the behaviour of the general driving community. Summarising the results of these studies is not an easy task. The results are not always consistent, the research is carried out according to different methodologies, and even if they concern the same solution, this solution can be implemented and used in different ways.

Despite these inconveniences, there are some proposals for sets of preventive solutions which have been effective in reducing the risk associated with the presence of alcohol in road traffic. Below there are two such sets of solutions. The first one dates from 2003-2006 and was prepared by Anderson & Baumberg (2006). They summarised the results of research on the effectiveness and efficiency of several selected preventive solutions.

Table 3.22 Effectiveness rating for drink driving countermeasures

	Effectiveness[22]	Cost efficiency[23]
Lowered BAC levels	High	Low
Random breath testing (RBT)	High	Moderate
License suspension	High	Very high
Alcohol locks	Moderate	Low
Low BAC for youth	Moderate	Relatively high
Graduated licensing	Limited	Relatively high
Server training and civil liability	Limited	Relative high
Designated drivers and ride services	Lack of effectiveness	Moderate
School based education courses	Insufficient evidence/Rather lack of effectiveness	Relatively high
Community programmes	Limited	Relatively high

Source: Anderson, P. et al., 2006.

The second set was prepared as part of the Australian Drink Driving Policy Framework (Howard, Harris, & McIntyre, 2020). According to the study, the effort should be focused primarily on the following activities[24]:

- Revising how licence sanctions are applied: Having immediate licence suspension at the roadside, ensuring licence bans apply to all offenders over the legal limit and removing sentencing options or policies which can result in licence bans for drink driving offences not being systematically applied (including work or restricted licences) will help strengthen the deterrent effect and deliver road safety benefits. Initiatives to assist and support offenders to separate driving from drinking should also be implemented as close to the offending as possible;
- Highly visible and randomised enforcement, combined with covert operations, to improve deterrence: The benefits of highly visible randomised enforcement will require ongoing and increasing efforts. Maintaining a focus on visible and randomised enforcement as a priority rather than specific or targeted enforcement will be required to keep the rate of drink driving at current levels. Increasing the number of random breath tests and hours of testing is likely to have a positive impact on the extent of drink driving. Education of all levels of police and key policy makers is needed to explain general deterrence, why random breath testing programs are important and what best practice enforcement is.

3.6 *Conclusions*

Below main findings of the chapter are presented.

- On average, adults in Europe drink 170 grams of pure alcohol every week. In recent years the consumption of alcohol in the general population in Europe has not declined;
- Alcohol is a psychoactive substance that impairs a variety of faculties and skills, which are required for driving a vehicle. There is scientific evidence that shows these skills are generally impaired at BACs of 0.05%. Some driving skills are already impaired at BACs as low as 0.01 or 0.02%. Furthermore, it is well established in the research that crash risk increases almost exponentially with increasing BAC;
- National statistics show that on average 1-4% of the general driving population in Europe drives with BAC levels above the legal limit. However, national statistics are based on research with differing study approaches. User surveys with a uniform approach found at least 22% of road users in Europe drive after consuming alcohol, while at least 13% have driven when they may have been over the legal limit;
- Official statistics show there were approximately 2,750 fatalities in alcohol-related accidents in the EU27 in 2018. This number has been declining over the past decade in

[22] The scientific evidence demonstrating whether a particular strategy is effective in reducing alcohol consumption, alcohol-related problems or their costs to society.

[23] Relative monetary cost to the state to implement, operate and sustain this strategy, regardless of effectiveness.

[24] It is noted the study makes additional recommendations such as expanding the use of interlock programs, a lower BAC for youth, working with the alcohol and other drug (AOD) sectors to manage alcohol dependent drivers, supporting measures to reduce societal use of alcohol.

similar trend as the overall road fatality number, although fatalities related to alcohol have declined at a higher pace, with a CARG of 4.4% between 2008 and 2018 compared to a CARG of 3.6% for total fatalities. In the last 2-3 years the decline of fatalities with alcohol involvement has stagnated;

- There is a widespread believe national statistics in most countries underreport the number of road fatalities with alcohol involvement. Not all countries use the same definition for alcohol-related road fatalities (e.g. definition by the European project SafetyNet). In addition, not all active road users involved in a road collision that resulted in road death or serious injury are systematically tested for alcohol. Epidemiologic studies using toxicology reports of traffic fatalities find higher shares of fatalities with alcohol involvement (above the legal limit) than what is expected based on national statistics. Based on national statistics, the share of alcohol-related fatalities in total road fatalities was 15% in the EU27 in 2018. It is estimated the actual share lays between 18% - 26%. This bandwidth is slightly lower compared to findings of a European Commission funded study, which estimated the share of road fatalities with involvement of alcohol in the EU27 for 2011 at 20-28%;
- Since the publication of the EU Recommendation (2001/115/EC) BAC limits in the EU have further harmonised. At least 8 countries have introduced a lower BAC level for divers and 14 for novice and professional drivers after publication of the Recommendation;
- Currently, EU Member States, as well as Switzerland and Norway, have a legal BAC limit of 0.5 g/L or lower. The United Kingdom still has a standard limit of 0.8 g/L, though Scotland has set a limit of 0.5 g/L. Furthermore, 24 of the analysed 30 European countries apply lower BAC (0.0-0.3 g/L) for inexperienced drivers. In addition, most European countries have a BAC limit for professional drivers of 0.3 g/L or lower. Exceptions are Bulgaria, Denmark, Finland, the Netherlands and Scotland which have a limit of 0.5 g/L, and the UK, excluding Scotland, where a limit of 0.8 g/L applies;
- Research (Albalate, 2006) (Castillo-Manzano, et al. 2017) has shown lowering BAC limits to 0.5 g/L has been effective in reducing road fatalities in the European countries, but it is stressed the effectiveness is also determined by (increased) enforcement of and awareness raising on these limits;
- There is limited evidence to support that lowering the BAC-limit from 0.5 g/L to 0.2 g/L or lower results in large reductions in road fatalities. There is little correlation between the zero BAC limits and the road safety performance of countries. In Europe, evaluations found positive effects from the measure in Sweden, but no impacts in Norway and Serbia. International studies amongst others from Australia, Japan, New Zealand and the US did find positive effects, although these low/zero BAC limits were mainly for young/novice drivers and BACs came down from a higher level (often 0.8 g/L). Differences in social perceptions and awareness related to risks and acceptability of drinking and driving and of enforcement, are all believed to result in differences in of drink-driving and accidents with alcohol involvement;
- Public surveys show consistent high support for the introduction of a (near) zero BAC limit for young or novice drivers;
- Available date (13 countries) shows the number of police sobriety checks per 1000 inhabitants increased by 25% in Europe between 2010 and 2019. This increase largely occurred until 2014 and has remained at a similar level since. It should also be noted there are large differences between countries, with several countries actually reducing enforcement intensity. European surveys (19 countries) show 76% of respondents consider that the police enforcement of drink-driving traffic rules is not sufficient;
- A wide variety of legal sanctions for drink driving is applied in European countries and there are large differences between countries in the choice of sanctions and how these are applied. There are many indications that the majority of drivers are not aware of penalties level that they are facing for driving above the legal alcohol limit.

4 Drug use and road safety

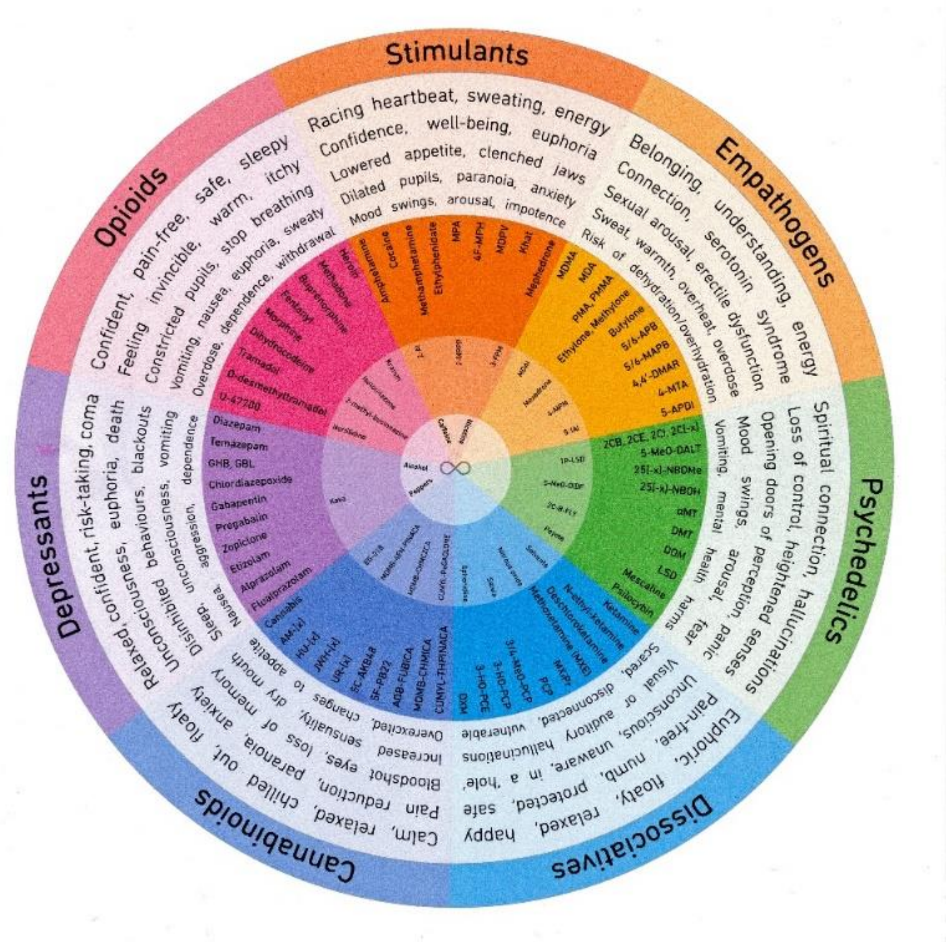
This current chapter reviews problems related to the use of psychoactive substances other than alcohol in road traffic and its impact on road safety.

As mentioned in chapter 2, all substances which affect perception, consciousness, cognition, mood and emotions are considered psychoactive substances. In common parlance, alcohol, tobacco and caffeine are differentiated other kinds of psychoactive substances, also referred to as 'drugs'. Furthermore, 'drugs' and 'medicines' are often used interchangeably as most medicines contain psychoactive substances. Equally common seems to be the reference to 'drugs' when referring to psychoactive substances without proven medicinal effects and non-medicinal use of substances that have.

Also in road safety research, impacts from alcohol on the one hand and medicines and other drugs on the other are also considered separately. Compared to alcohol, research on drugs use in relation to road use is still limited. A complication is that there exist thousands of psychoactive drugs. One common factor is that their production, distribution, sale or non-medical use of many psychoactive drugs is either controlled or prohibited outside legally sanctioned channels by law. However, their use and impact on the human body and driving skills may vary between drugs and individuals.

In order to provide overview in the array of drugs, a classification model that can be used is the 'Drug Wheel' presented in Figure 4.1. It groups together different types of drugs based on the effect they have on the human body. Road safety research, enforcement and in some cases legislation, focusses on a few specific drugs, in particular those known to be consumed most within the general population. Figure 4.1 attempts to help place these drugs within a category and give an impression of their effects on humans.

Figure 4.1 Categorisation of drugs using the Drugs Wheel



Source: The Drugs Wheel by Mark Adley based on a work at www.thedrugswheel.com.

4.1 *Effect of drug use on driving performance*

Like alcohol, drugs can affect mental and physiological functions, causing impairment of these functions, including those required for driving a vehicle. Whereas the effect of alcohol on driving skills is widely researched and documented, research on the impacts of drugs on driving abilities is less numerous. Findings on the impacts of drugs on driving skills for which scientific evidence could be retrieved, is discussed below:

Cannabis

Most publications on the impact of drugs on driving skills are on cannabis and its psychoactive constituent, delta-9-tetrahydrocannabinol (THC). In addition to research focussing on accident or fatality risks (see next section), the impact of cannabis use on driving has been examined based on experimental (laboratory) studies of the effects of cannabis on skills relevant to driving; on driving performance in driving simulators and on effects of cannabis use on real on-road driving, usually on closed courses.

A recent and the most comprehensive review of the effects of cannabis on driving performance and behaviour, based on data from such studies, has been conducted by Simmons (2020). The study reviewed considered 120 eligible studies of which 81 were ultimately included in a meta-analysis. Within this body of literature, the study found clear evidence that cannabis impairs lateral control (i.e., increases in lateral position variability, possibly increases in lane excursions) and causes reductions in speed relative to baseline driving. In addition, in combination cannabis and alcohol cause larger impairment of driving skills than either in isolation.

Table 4.1 Effects of cannabis on driving performance and behaviour relative to baseline, compared to the effects of alcohol

Measure	Results
Lateral Position Variability	Lateral position variability increases with increasing BAC levels. Cannabis increases lateral position variability to a similar, greater or lesser extent than BAC levels up to 0.03% (depending on the pre-post correlation used), but it increases lateral position variability to a lesser extent than BAC levels of 0.07% and higher.
Lane Excursions	Cannabis increases lane excursions to a lesser extent than BAC levels ranging from 0.04% to 0.06%, and to an even lesser extent than BAC levels ranging from 0.07% to 0.09%. However, there is not enough data to compare cannabis to BAC levels up to 0.03%, or from 0.10% to 0.12%.
Speed	Cannabis decreases speed relative to all BAC levels. Up to a BAC level of 0.09%, greater differences in speed between cannabis and alcohol are observed with increasing BAC levels.
Speed Variability	Based on limited data, cannabis is not associated with an increase in speed variability. However, speed variability increases with increasing BAC levels starting at a BAC of 0.04%. Thus, cannabis affects speed variability to a similar or lesser extent than BAC levels up to 0.03%.

Source: Simmons (2020).

In contrast, there was no compelling evidence that cannabis reliably changes rates of hazard RT, headway, headway variability, time out of lane, speed variability, speed exceedances or time speeding. At the same time Simmons adds an important reservation: although there is no compelling evidence, this does not necessarily mean these other measures are wholly unaffected by cannabis or that the effect on lateral control and speed are more strongly affected by cannabis. Very few studies have studied the influence of cannabis on these measures and reported data necessary for effect size computation. Consequently, the meta-analyses conducted to assess the influence of cannabis on these measures lack precision (Simmons, 2020).

While most studies primarily focused on the effects of acute intoxication, (Dahlgren, et al., 2020) assessed the potential impact of cannabis use on driving performance using a customized driving simulator in non-intoxicated, heavy, recreational cannabis users and healthy controls (HCs) without a history of cannabis use. The study found chronic, heavy, recreational cannabis use was associated with worse driving performance in non-intoxicated drivers, with increased accidents, speed, and lateral movement, and reduced rule-following. In addition, earlier onset of use was associated with greater impairment.

An additional finding related to driving tasks at the strategic level comes from Valen, et al.(2019). This study using data from fatally injured in road traffic crashes in Norway during 2005-2015, found impairment from cannabis was associated with driving without having a valid driver licence.

Benzodiazepines

Benzodiazepines are used primarily for rapid relief of anxiety and for muscle relaxation, sedation and anticonvulsant effects. They are widely prescribed drugs for the treatment of anxiety, insomnia, seizures, alcohol withdrawal, and many other disorders. Depending on the metabolic pathway, benzodiazepines are divided into three groups (Verstraete & Legrand, 2014):

- short-acting: triazolam and midazolam: The short-acting benzodiazepines generally do not produce a 'hangover' effect if taken at bedtime. If the drug is stopped after a prolonged period of use, withdrawal symptoms occur; these can be quite severe.

Study	Findings
Greenblatt et al. (2005)	Use of triazolam 0.375 mg is highly correlated with impairment measured by Digit Symbol Substitution Test (DSST). DSST is a valid and sensitive measure of cognitive dysfunction impacted by many domains. Performance on the DSST correlates with real-world functional outcomes (e.g., the ability to accomplish everyday tasks)
Simpson and Rush (2002)	Triazolam (0.125 or 0.250 mg) and temazepam (15 or 30 mg) each produced some impairment. Triazolam–alcohol and temazepam–alcohol combinations resulted in clear impairment, even with low amounts of alcohol.
(Deits, Ng Boyle, & Morrison, 2011)	Based on driver performance of 18 commercial bus operators in a simulated environment while under the influence of Triazolam. The study shows that those drivers under influence of the drug had higher steering entropy and greater difficulty staying close to the intended travel lane when compared to those who were not under the influence of the drug.
(Miyata, et al., 2015)	Triazolam may affect road-tracking performance, visual attention and/or psychomotor speed measured by Trail-Making Test part A, and body balance in acute dosing. In the driving simulations, triazolam increased the number of subjects who slid off the road. It increased the standard deviation of lateral position compared to a placebo at 1 h post-dosing and significantly increased the time to complete aTrail-Making Test compared to placebo at 1 and 4 h post-dosing. Triazolam significantly increased subjective sleepiness compared to placebo at 1 h post-dosing.

- Medium-acting: alprazolam, bromazepam, brotizolam, clotiazepam, loprazolam, lorazepam, lormetazepam, oxazepam and temazepam; Studies found various medium-acting benzodiazepines could severely and impair cognitive and psychomotor abilities and driving.

Study	Findings
(Clarkson, Gordon, & Logan, 2004)	Review of positive lorazepam drug-impaired driving cases submitted to the Washington State Toxicology Laboratory between January 1998 and December 2003, where lorazepam was the only drug detected. The review indicates that lorazepam is capable of causing significant impairment to driving and psychomotor abilities, independent of the concentration detected.
(Verster, Veldhuijzen, Patat, Olivier, & Volkerts, 2006)	Researched benzodiazepines (with the recommended dosages in brackets used) were nitrazepam (5 mg), flurazepam (15 mg), flunitrazepam (2 mg), loprazolam (1 mg), lormetazepam (1mg), oxazepam (50mg) and temazepam (20 mg). Ten studies, published from 1984 to 2002 (207 subjects), were included in the meta-analyses. Primary outcome measure of the driving test was the Standard Deviation of Lateral Position. The ability to drive was examined after taking for one or more two nights). The morning after ingestion (10-11 hours after ingestion), there was a significant worsening of the driving skills found for the recommended dosage of the different benzodiazepines.
(Leufkens, Vermeeren, Smink, van Ruitenbeek, & Ramaekers, 2007)	Subjects performed a standardized driving test on a primary highway in normal traffic. Cognitive and psychomotor tests were assessed 1, 2.5, and 5.5 h post-dose. Memory functioning was measured only 1 h after administration. Both formulations severely impaired driving performance between 4 and 5 h after administration. The magnitude of impairment in the driving test observed with alprazolam XR was about half that observed with alprazolam IR. Laboratory test results were in line with the driving data. The acute impairing effects of alprazolam XR 1 mg on driving and psychomotor functions were generally less, as compared to its immediate-release equivalent, but still of sufficient magnitude to increase the risk of becoming involved in traffic accidents.

Study	Findings
(Vermeeren, Leufkens, & Verster, 2009)	Review of the results of ten experimental studies investigating the effects of anxiolytics on driving performance using over-the-road tests. Diazepam, lorazepam, oxazepam, clorazepate, alprazolam, alpidem, suriclone had moderate to severely impairing effects on driving in the doses studied. Impairment was clearly dose dependent, and increased on average with increasing blood concentrations. However, most studies analysing correlations between drug concentrations in plasma and effects on driving performance found low and non-significant correlations, indicating that prediction of impairment from blood concentrations is problematic. Furthermore, tolerance was found to develop only very slowly, and impairing effects did not seem to be counteracted by improvement in anxiety symptoms. Finally, subjects seemed relatively unaware of the effects of the drugs. Awareness of these effects was only seen with severe objective impairment, indicating that patients should be warned explicitly about the risks associated with using these drugs by their physicians or pharmacists.
(Schulze et al., 2012)	Alprazolam (0.5 mg) produced significant driving impairment in patients as well as in healthy control subjects.

- Long-acting benzodiazepines: clobazam, clonazepam, clorazepate, cloxazolam, diazepam, ethyl loflazepate, flunitrazepam, flurazepam, nitrazepam, nordazepam, prazepam and tetrazepam. Some of these can cause impairment of cognitive and psychomotor abilities and driving over a prolonged period of time, comparable to an alcohol concentration of <0.5 g / l up to 0.8 g/l depending on the dosses at time-lapse.

(BIVV, 1999)	Literature review shows that the responsiveness and the psychomotor performance is reduced after a single dose flunitrazepam 1 mg and 2 mg. In acute (day 1) and sub-chronic (day 7) administration of 2 mg flunitrazepam were the real driving test decreased driving performance observed (increased SDLP equal to an alcohol concentration of 0.5- 0.8 g / l).
(Vermeeren, 2004)	Flunitrazepam 2 mg has moderate residual effects 8 to 12 hours after ingestion, lasting for the duration of the last all day. The residual effects of flunitrazepam 1 mg are still in the morning present, but disappear faster than when ingested of 2 mg. Contrary to these results, a meta-analysis showed that flunitrazepam 1 mg shows no or little residual effects. A number of studies emphasize the residual effects of flurazepam 2 mg on the ability to drive that are similar to a blood alcohol concentration of 0.5 g / l that lasts up to 16 hours detectable after ingestion. The residual effects of nitrazepam 10 mg are moderate to severe and can be observed during the remainder of the day. The residual effects of nitrazepam 5 mg are quite small after> 8 hours after ingestion. The residual effects of nitrazepam 10 mg on driving performance measured in the morning and afternoon are equivalent to BACs of 0.5 - 0.8 g / l and are observable for 8 days of consecutive treatment. The meta-analysis confirms that nitrazepam 10 mg before night worsens performance throughout the day and experts consider these effects to be severe, diminishing to moderate effects.
(Verster, Veldhuijzen, & Volkerts, 2004)	In studies with a driving test, after use of 5 mg nitrazepam for the night does not affect the demonstrated driving skills. When using 10 mg of nitrazepam for the night (for 2 nights) became a significant one deterioration in driving ability comparable with a BAC between 0.5 and 0.8 ‰. After 4 nights and after 7 nights, no significant deterioration was found. It was striking, that in the afternoon test (16-17 hours after intake) the driving ability had deteriorated more than in the morning test (10-11 hours after ingestion). In a study with a driving test in a driving simulator on the morning after using 5 mg nitrazepam before the night was a significant decrease in the reaction speed. For limited impairment by lormetazepam was found comparable to an alcohol concentration of <0.5 g / l up to 0.8 g/l depending on the dosses (1 or 2 mg) at time-lapse.
ICTADS (2007)	Review effects of nitrazepam: Serious or potentially dangerous influence on the driving skills. This is comparable to an alcohol concentration of > 0.8 g / l (> 0.8 ‰).
(Rapoport, Lanctot, & Streiner, 2009)	Meta-analysis of five on-road experimental studies to determine differences in SDLP between benzodiazepine users and controls with a reported pooled estimate of standardized mean difference (SMD) between groups of 0.80 (p = 0.0004) at a ≤5-mg dose equivalent of diazepam [6]. The SMD further increased to 3.07 standard deviations at a ≥10-mg diazepam dose equivalent, thus implying a dose-dependent loss of vehicle control in users compared with controls

(Jongen, Vuurman, Ramaekers, & Vermeeren, 2018)	Effects of oxazepam and diazepam: mean SDLP changes of + 1.83, + 3.03, and + 7.57 cm for oxazepam 10 mg, oxazepam 30 mg, and diazepam 10 mg,, respectively, indicating ΔSDLP comparable to a BAC of < 0.5, 0.5–0.8, and > 0.8 g/L, respectively.

The International Council on Alcohol, Drugs and Traffic Safety (ICADTS) compared medications with an equivalent BAC for their effect on driving ability. While drugs affect people differently, especially in combination with other drugs or alcohol, this can be used as a guide to understand the equivalent level of impairment.

Table 4.2 Medical drugs: Estimated BAC equivalent

Drug Class	Generic name	Estimated BAC equivalent
Antihistamines	Chlorpheniramine	0.08%
	Promethazine	0.08%
Antidepressants	Sertraline	0.05–0.08%
	Escitalopram	0.0–0.08%
	Amitriptyline	0.08%
	Doxepin	0.08%
Hypnotics	Temazepam	0.08%
	Nitrazepam	0.08%
	Diazepam	0.08%
	Oxazepam	0.08%
Tranquillisers	Olanzapine	0.08%
	Haloperidol	0.08%

Source: ICADTS (2007).

z-Hypnotics

Z-drugs zolpidem, zopiclone, and zaleplon are hypnotics which came on the market in the 1990’s as an improvement to traditional benzodiazepines in the management of insomnia. Z-drugs have also been the subject of experimental studies to determine their impact on driving performance, although less so than benzodiazepines. Studies have found in particular zopiclone impair driving skills up until 12 hours after use.

(Staner, et al., 2005)	The study found that a single administration of zopiclone 7.5 mg, but not zolpidem 10 mg, shows effects on driving tests the following day (8-10 hours after dosing). The same observation can be seen with repeated administration.
Verster et al. (2006)	In their meta-analysis of 10 experimental studies, found that the recommended dose of Zopiclone 7.5 mg also impaired driving in the morning (ES=0.89; CI=0.54 to 1.23). Zaleplon (10 and 20 mg) and zolpidem (10 mg) did not affect driving performance the morning after dosing. Following middle-of-the-night administration, significantly impaired driving performance was found for zopiclone 7.5 mg (ES=1.51, CI=0.85 to 2.17), zolpidem 10 mg (ES=0.66, CI=0.13 to 1.19) and zolpidem 20 mg (ES=1.16, CI=0.60 to 1.72). Zaleplon (10 and 20 mg) did not affect driving performance.
(Leufkens & Vermeeren, 2014)	The study provided a pooled analysis in 4 studies using similar procedures. It found that zopiclone 7.5 mg causes moderate to severe impairment in driving performance. Results show that zopiclone 7.5 mg has significant and clinically relevant performance-impairing effects on driving in the morning, until 11 hours after bedtime ingestion. The effects did not differ between male and female subjects and did not increase with age, at least until 75 years. The effects of zopiclone 7.5 mg are comparable to the effects of a mean blood alcohol concentration between 0.5 and 0.8 mg/mL, which has been associated with a 2- to 3-fold increase in the risk of becoming involved in a traffic accident.
(Roth, Eklov, Drake, & Verster, 2014)	Meta-analysis determining the user's driving ability the day after drug administration. The primary outcome measure for the driving task in all included studies was the Standard Deviation of Lateral Position (SDLP). Analyses indicate that the half-life, dose of the hypnotic, as well as time between treatment and driving, as measured by SDLP, all significantly impact

	the ability to drive a car after taking hypnotic drugs. Overall, significant impairment was found when morning testing (i.e., 10-11 h after initiating sleep) was compared to afternoon testing (i.e., 16-17 h after initiating sleep; P =.0001). Twice the standard dose also showed significant impairment (P =.0001) relative to the standard dose. The time of the test, morning versus afternoon, also had an impact on individual drugs. Middle of the night administration of zolpidem and zopiclone caused significant impairment the following morning, though no such impairment was seen with zaleplon.
(Van der Sluiszen, et al., 2021)	Study assessed driving performance and neurocognitive skills of long-term users of sedating antidepressants, amitriptyline and mirtazapine - users treated less than 3 years (n = 20) did show a significant and clinically relevant increase in SDLP.

GHB

Only few studies have been found regarding driving under influence of GHB. Based on a review of epidemiological studies (Centola, Giorgetti, Zaami, & Giorgetti, 2018) found GHB causes cognitive and psychomotor impairment and risky driving behaviour. The effects of GHB on cognitive, psychomotor and driving performance are dose-related in experimental studies. In real cases of driving under the influence of GHB, severe impairment is observed with a wide range of blood GHB levels are found. Another recent study (Liakoni, et al., 2018) found significantly more weaving and erratic driving, as measured by speed deviation ($p = 0.002$) and lane position deviation ($p = 0.004$), with GHB at 1 h post dosing compared to placebo conditions. Also significant differences were seen in for the life-threatening outcome collisions ($p < 0.001$) and off-road accidents ($p = 0.018$). Driving was not faster and also no significant impairment was found in the GHB group at 3 and 6 h post dose.

Opioids

Both morphine and heroin are central nervous system depressants. The effects of morphine or heroin depend on the dose, way of intake and organism tolerance. Both drugs can cause similar effects. These include euphoria, drowsiness, mental clouding, inability to concentrate, distractibility, lethargy, apathy, tremors, slower reaction time, and reduced consciousness.

Studies reviewing the impacts of opioids on driving skills have found the impact very limited. An evidence-based review (Fishbain, Cutler, Rosomoff, & Steele Rosomoff, 2003) indicated the following:

- There is moderate, generally consistent evidence for no impairment of psychomotor abilities of opioid-maintained patients;
- There is inconclusive evidence on multiple studies for no impairment on cognitive function of opioid- maintained patients;
- There is strong consistent evidence on multiple studies for no impairment of psychomotor abilities immediately after being given doses of opioids;
- There is strong, consistent evidence for no greater incidence in motor vehicle violations/motor vehicle accidents versus comparable controls of opioid-maintained patients; and
- There is consistent evidence for no impairment as measured in driving simulators off/on road driving of opioid-maintained patients.

A meta-analysis of the experimental studies performed as part of the DRUID project (Strand, Fjeld, Marianne, & Morland, 2011), also found limited effects, concluding that:

- Administration of a single dose of morphine of up to 5 mg appears to cause very few effects in traffic-relevant performance tasks. At higher doses, performance of various tasks is impaired, but with no clear dose–effect relationship except on the DSST;
- In drug-naive, healthy subjects, single doses of methadone of up to 10 mg impaired performance on three out of five tests;
- In opioid users and methadone-maintained patients acute effects of a single doses of methadone are less pronounced. Dose-related impairment of performance was only found in 10 out of 50 tests with methadone doses of up to 120 mg.

A more recent systematic review (Ferreira, Boland, Phillips , Lam, & Currow, 2018) also did not identify impaired simulated driving performance when people take regular therapeutic opioid agonists for symptom control.

Still, the commonly held concept that "chronic pain patients on stable opioids are safe to drive" cannot be generalized to all such patients in everyday practice, but may be applicable only to a subset who meet certain criteria (Mailis-Gagnon, Lakha, Furlan, & Nicholson, 2012). In their review of 35 studies, Mailis-Gagnon et al. (2012) found the amount and dose of opioids varied largely in many studies. In addition, little more than a third of studies could be classified as ‘high quality’, as many failed to report on confounders, such as co-prescriptions with psychotropic effects.

Based on their review of available evidence, Vindenes et al.(2012) proposed that, for the purpose of imposing sanctions:

- cut-off values for morphine in blood of 9, 24 and 61 μg/l should be considered equivalent to BAC-levels of 0.2, 0.5 and 1.2 g/l, respectively;
- a cut-off value for methadone in blood of 25 ng/ml should be considered equivalent to a BAC-level of 0.2 g/l.

Stimulants and Empathogens (amphetamine, methamphetamine, MDMA and cocaine)

Experimental research has shown that 3,4-methylenedioxymethamphetamine (MDMA) can improve some psychomotor driving skills when administered during the day. Among others (Ramaekers, Kuypers, & Samyn, 2006) concluded MDMA and methylphenidate significantly decreased SDLP in the road-tracking tests in driving tests conducted between 3 and 5 hours post-drug administration, which indicates these may improve road-tracking performance. At the same time, the study also found MDMA intoxication decreased performance in the car-following test as indicated by a significant rise in the 'overshoot' of the subjects' response to speed decelerations of the leading vehicle.

Based on a literature review, (Vindenes, et al., 2011) also found that at low doses of amphetamine and methamphetamine improvement of psychomotor effects have been shown, and reduced SDLP has been shown after administration of 75–100 mg MDMA. The stimulant effects are seen after ingestion of single doses, and especially in sleep-deprived individuals. Repeated administrations may, on the other hand, lead to a reduction in the endogenous level of neurotransmitters, followed by impairment characterized by drowsiness and inattention which may take several days to normalize.

In addition, it is assumed in practice MDMA is taken during the night, and driving may likely occur early in the morning after a night of "raving" and sleep loss (Bosker, et al., 2012). Bosker et al.(2012) assessed the effects of MDMA on road-tracking and car-following performance in on-the-road driving tests in normal traffic. The study finds MDMA-use resulted in increments in SDLP of high clinical relevance and comparable to those observed for alcohol at blood alcohol concentrations >0.8 mg/mL. These impairments were primarily caused by sleep loss, which arguably is sustained or aggravated by use of MDMA. It is concluded that MDMA cannot compensate for the impairing effects of sleep loss and that drivers who are under the influence of MDMA and sleep deprived are unfit to drive.

Also (Stough, Ogden, Owens, Swann, & Gibbs, 2011) found driving performance was significantly impaired by intoxication by MDMA, reducing performance on signal changes, dangerous action skidding, inappropriate braking, safe following distance, speed in the city, and overall driving score. Performance on the stopping brake measure was found to be significantly worse when under the influence of methamphetamine three hours post drug (when compared to placebo).

The desired effects of cocaine are similar to those of the amphetamines, but the onset is slower and the duration is longer. There are very few experimental studies on the impairment effect of cocaine on driving skills. Those that are, found little effect. Although previous studies found performance-enhancing effects with acute administration of cocaine, (Rush, Baker, & Wright, 1999) did not detect any impact on the DSST of a variety of doses of oral cocaine (50, 100, 200 and 300 mg). The use of cocaine can partially reverse performance decrements in sleep-deprived persons. In rested persons, some studies found no effect of the use of cocaine on psychomotor or cognitive skills (Hopper et al., 2004 cited in Marillier & Verstraete, 2019).

For stimulant drugs like amphetamines and cocaine, the available literature did not provide evidence for dose/concentration-effect relationships (Vindenes et al., 2012).

Finally, stimulants (mainly amphetamines) was associated with all three risk factors, speeding (68% versus 32%), not used a seatbelt (69% versus 30%), and been driving without a valid driver license (Valen, et al., 2019).

Psychedelics, hallucinogens and dissociatives

Psychedelics and hallucinogens are drugs that effect ones' perception by distorting sensory messages sent to the brain. Examples of psychedelics include lysergic acid diethylamide (LSD), peyote (peyote cactus), psilocybin (magic mushrooms) and methylenedioxymethamphetamine (MDMA, also known as ecstasy) and ketamine.

Psychedelics acutely cause decreases in attention, short- and long-term memory, verbal memory, visuospatial skills, executive functioning, and prediction of object movement under divided attention. Psychological effects often depend on the mood of the users and the context of use (Marillier & Verstraete, 2019).

Experimental studies found significant impairment in skills directly related to driving, such as the ability to adjust the speed of the vehicle to adapt to the driving environment, and incorrect signalling (not signalling when changing lanes, exiting highways, making turns). Driving while under the influence of hallucinogens is highly hazardous.

Dissociatives, or dissociative anaesthetics reduce pain by reducing the brain's perception of pain. Common drugs that fall under the dissociative anaesthetics category include ketamine and phencyclidine ("PCP"). Laboratory research indicates that severe cognitive and psychomotor impairments do occur with ketamine intake, including deficits in divided attention and reaction time. A review of the existing research (Giorgettia, Marcotulli, Tagliabracci, & Schifano, 2015) concluded that ketamine significantly impairs multiple cognitive and functioning domains involved in driving ability. Administration of ketamine with dexmedetomidine but not fentanyl significantly increased SDLP ($F_{1,18} = 22.60$, $P < 0.001$) and reduced SV ($F_{1,18} = 164.42$, $P < 0.001$) 2 hours after treatment. (Hayley , et al., 2019).

New psychoactive substances

New psychoactive substances (NPS) are substances of abuse, either in a pure form or a preparation, that are not controlled by the 1961 Single Convention on Narcotic Drugs or the 1971 Convention on Psychotropic Substances, but which may pose a public health threat (UNODC, 2013). In this context, the term 'new' does not necessarily refer to new inventions but to substances that have been recently become available. NPS could be further categorised within several groups of substances present in this market, i.e. synthetic cannabinoids, synthetic cathinones, phenethylamines, piperazines and plant-based substances. Also ketamine can be listed as NPS.

Little is known about the risks of most NPS (Trimbos & WODC, 2019). There is also little knowledge about the risks associated with the use of these new substances in traffic. Nevertheless, it seems reasonable to assume that they will also impair driving performance, because they have the same mechanism of action as the classical drugs (Marillier & Verstraete, 2019).

4.2 *Drugs and accident risk*

According to the DRUID study, driving under the influence of drugs can multiply the risk of an accident by a factor of 2 to 7. This is a very broad range. The actual risk increase very much depends on the type of drug, with significant variations in known impacts within the wide array of psychoactive substances. Also, the relationship between dosage and driving impairment is complex and uncertain in many cases. Furthermore, there are various drugs for which the impact is uncertain because these are not often detected. The range of substances screened for is limited and so are the intensity and history of drugs screening in most countries, also compared to alcohol. In addition, for many drugs there are large differences between individuals in the response to the same dose and differences in impairment resulting from acute versus chronic use of some drugs (Compton, B., 2015).

Until date, the European project Driving *Under the Influence of Drugs, Alcohol and Medicines* (DRUID) still provides the latest comprehensive assessment of drug driving accident risk for the EU, based on a common methodology applied across several countries within the same period. The study provided a risk estimate for driving the influence of substances, based on roadside surveys and blood analyses of approximately 3570 seriously injured drivers and 1293 killed in accidents (Verstraete, A. et al., 2011). Among the drivers involved in road accidents, delta-9-tetrahydrocannabinol (THC) and cocaine were the most frequently used illicit drugs. There was a variability among countries with the relative risk of serious injury or fatality for different substances. Table 4.3 shows the main results of the DRUID project.

Table 4.3 Relative risk level of getting seriously injured or killed for various substance groups

Substance group	Risk	Risk level
Cannabis	1-3	Slightly increased risk
Cocaine, illicit opiates, Benzodiazepines and Z-drugs, Medicinal opioids	2-10	Medium increased risk
Amphetamine, Multiple drugs	5-30	Highly increased risk
Drugs in combination with alcohol	20-200	Extremely increased risk

Source: Bernhoft, I. M., 2011.

In a meta-analysis of 66 studies Elvik (2013) found 264 estimates of the effects on accident risk of using illicit or prescribed drugs when driving. Table 4.4 shows the odds ratio[25] of accident involvement based on this analysis.

Table 4.4 Meta-analysis estimates of relative risk of accident involvement associated with drug use

Drug	Accident severity	Number of estimates	Best estimate adjusted for publication bias[26]	95% confidence interval
Amphetamine	Fatal	8	5.17	(2.56, 10.42)
	Injury	2	6.19	(3.46, 11.06)
	Property damage	1	8.67	(3.23, 23.32)
Analgesics	Injury	8	1.02	(0.89, 1.16)
Anti-asthmatics	Injury	6	1.31	(1.07, 1.59)
Anti-depressives	Injury	20	1.35	(1.11, 1.65)
	Property damage	5	1.28	(0.90, 1.80)
Anti-histamines	Injury	7	1.12	(1.02, 1.22)
Benzodiazepines	Fatal	10	2.30	(1.59, 3.32)
	Injury	51	1.17	(1.08, 1.28)
	Property damage	4	1.35	(1.04, 1.76)
Cannabis	Fatal	10	1.26	(0.88, 1.81)
	Injury	15	1.10	(0.88, 1.39)
	Property damage	17	1.26	(1.10, 1.44)
Cocaine	Fatal	4	2.96	(1.18, 7.38)
	Injury	3	1.66	(0.91, 3.02)
	Property damage	4	1.44	(0.93, 2.23)
Opiates	Fatal	7	1.68	(1.01, 2.81)
	Injury	18	1.91	(1.48, 2.45)
	Property damage	1	4.76	(2.10, 10.80)
Penicillin	Injury	5	1.12	(0.91, 1.39)
Zopiclone	Fatal	1	2.60	(0.89, 7.56)
	Injury	4	1.42	(0.87, 2.31)
	Property damage	1	4.00	(1.31, 12.21)

Source: Elvik, R. (2013).

25 Odds ratio (in short OR) defines the ratio of the chance of a given event occurring in a group to the same event occurring in another group being compared. The OR ratio is used to determine how much greater or lesser is the chance of an event occurring. If a variable (i.e. drug use) is not associated with an accident, the odds ratio of accident involvement associated with that variable will be 1.00. Odds ratios above 1.00 indicate a positive relationship, with stronger relationships reflected by higher odds ratios.

26 Estimates shown in bold are statistically significant at the 5% level.

Findings from the meta-analysis indicated for most drugs their use results in a small or moderate increase in the accident risk. Large differences exist between risk estimates found in studies assessing the risk for the same psychoactive substance. The majority of estimates indicate that the increase in risk is lower than twofold. Elvik (2013) concludes use of drugs while driving tends to have a larger effect on the risk of fatal and serious injury accidents than on the risk of less serious accidents (usually property-damage-only accidents), although it can be noted from Table 4.5 for some drugs the risk of property damage accidents is larger.

As part of the SafetyCube study, Leblud (2017) compared findings from a literature review of ten studies on the incidence of drugs in injured drivers crash-involvement and thirteen scientific articles (based on meta-analysis, case control studies, systematic review, an experimental study), with findings from the above-mentioned study by Elvik (2013). Findings from both analysis were largely in agreement, except for cannabinoids (THC).

Table 4.5 Effects of drugs on crash-involvement

Study	Amphet-amines	Benzoyl-ecgonine	Cocaine	Cannabi-noids	Opiates (illicit)	Benzodi-azepines	Medicinal opioids - analgesics	Alcohol + drugs	Drugs + drugs
Asbridge et al. 2012				+					
Bédard et al. 2007				+					
Bernhoft et al. 2012	+	+	0	+	0	+	+	+	+
Elvik 2013	+		+	0		+	0		
Gjerde et al. 2013	+			0		+			+
Gjerde et al. 2011	+			0		0			+
Gjerde et al 2015	+			0		0			+
Kuypers et al. 2012	+	0	0	+	0	0	+		+
Laumon et al. 2005	0		0						
Romano et al. 2014				0					+
Romano et al. 2011	+		0	0					
Sewell et al. 2009				+				+	

\+ means increase in crash risk; 0 means no significant effect.
Source: Leblud (2017).

Amphetamines had a significant negative effect on road safety in most studies. Additional findings from studies in the US and Australia, which found respectively no significant association between crash involvement[27] and use of stimulants, like amphetamines (Lacey, et al., 2016), nor in crash responsibility (Drummer & Yap, 2016).

Case control studies in DRUID found that **cocaine** and its metabolite benzoylecgonine may increase the risk of being involved in or responsible for an accident (Bernhoft et al., 2012; Elvik 2013). The risk increase for injuries was classified as medium, based on an adjusted OR for cocaine of 1.65 (95% CI 0.66-4.16) and for benzoylecgonine 3.88 (95% CI 1.14-10.68). For fatalities, the adjusted OR could not be calculated. The crude ORs were 22.34 (95% CI 3.66-36.53) and 6.87 (95% CI 1.49-31.76) for respectively cocaine and benzoylecgonine. Other studies, such as (Kuypers, Legrand, & Ramaekers, 2012) did not find a significant association between cocaine use and injuries, have a low statistical power and could not calculate an adjusted OR. A study (Martin, Gadegbeku, Wu, Viallon, & Laumon, 2017) published after Leblud (2017) found a low prevalence of cocaine among road casualties in France and the associated extra risks could not be assessed.

[27] It is noted the study by Lacey et al. (2016) mainly contained data on material damage accidents (66.4%) and little on fatality accidents (0.6%).

The limited epidemiological studies available provide inconclusive evidence for the accident risk associated with **opioid** use. Illicit Opiates showed a not significant negative effect on road safety (Bernhoft et al., 2012 and Kuypers et al., 2012), but these drugs seem less studied than the others. Medicinal drugs, represented by Benzodiazepines and Medicinal opioids, both showed significant negative effects on road safety in these studies.

Similarly, from a systematic review and meta-analysis of epidemiological evidence in Dassanayake, Michie, Carter, & Jones (2011) conclude benzodiazepine use was associated with a significant increase in the risk of traffic accidents and responsibility of drivers for accidents. The association was more pronounced in the younger drivers. The accident risk was markedly increased by co-ingestion of alcohol.

Based on a meta-analysis Chihuri & Li (2017) also conclude, epidemiologic evidence indicates that use of prescription opioids by drivers is associated with significantly increased risks of crash involvement and crash culpability. They found crude ORs associated with prescription opioid use ranging from 1.15 to 8.19 for the risk of crash involvement and from 0.75 to 2.78 for the risk of crash culpability. Summary ORs based on pooled data were 2.29 (95% CI: 1.51, 3.48) for crash risk and 1.47 (95% CI: 1.01, 2.13) for crash culpability.

Some studies have demonstrated a dose-relationship. Gomes, et al. (2013) found a significant association between opioid dose and road trauma in a nested case–control study of patients aged 18–64 years who received at least one publicly funded prescription for an opioid in Canada. Compared with very low opioid doses, drivers prescribed low doses had a 21% increased odds of road trauma (adjusted odds ratio, 1.21 [95% CI, 1.02-1.42]); those prescribed moderate doses, 29% increased odds (1.29 [1.06-1.57]); those prescribed high doses, 42% increased odds (1.42 [1.15-1.76]); and those prescribed very high doses, 23% increased odds (1.23 [1.02-1.49]). Interestingly, after multivariate adjustment the study did not found significant association between escalating opioid dose and odds of road trauma(adjusted odds ratio ranged between 1.00 and 1.09). A dose relation-ship was also found among patients receiving prescription opioids, concomitant treatment with gabapentin (Gomes, et al., 2017). In the dose–response analysis, moderate-dose (OR 2.05, 95% CI 1.46-2.87, $p < 0.001$; aOR 1.56, 95% CI 1.06 to 2.28, $p = 0.024$) and high-dose (OR 2.20, 95% CI 1.58 to 3.08, $p < 0.001$; aOR 1.58, 95% CI 1.09 to 2.27, $p = 0.015$) gabapentin use was associated with a nearly 60% increase in the odds of opioid-related death relative to no concomitant gabapentin use.

In contrast, the largest and most comprehensive study to address alcohol and drug crash risk in the United States through a case-control study design, did not find a significant increase in crash-risk when adjusting for gender, age, race/ethnicity, and driver alcohol concentration. Based on data from crash-involved and non-crash-involved drivers over a 20-month period in Virginia Beach, the study found an adjusted odds ratios for narcotic analgesics (e.g. fentanyl, methadone, opiates, oxycodone) were 1.17, 95% percent drugs as an overall category were.99, 95 percent CI [0.84, 1.18] and for sedatives (e.g. barbiturates, benzodiazepines, zolpidem) 1.19, 95% CI [0.86, 1.64]. Also Drummer & Yap (2016) found drivers taking opioids, benzodiazepines, or anti-depressants were not significantly over-represented in crash casualties, compared to the drug-free control group, although there was a suggestion of increased crash risk for benzodiazepines.

Studies in European countries not listed in Table 4.5 mainly suggest there is an increased risk of accident involvement when driving under influence of opioids or depressants. Ravera et al. (2011) found a significant association was found between traffic accident risk and exposure to commonly prescribed sedatives (i.e. anxiolytics) (OR 1.54; 95 % CI 1.11–2.15), based on data from the Netherlands in 2000 and 2007.

Using on data on injurious crashes in France between July 2005 to December 2011, Orriols, et al. (2016) compared benzodiazepine and z-hypnotic use among drivers responsible or not responsible for the crash. The study found that exposure to benzodiazepine anxiolytics was associated with an increased risk of being responsible for a road traffic crash during the pre-intervention period (OR = 1.42 [1.24–1.62]).

In Sweden, Nevriana, et al. (2017) found zolpidem or zopiclone use increased the risk of road traffic crashes, where increased ORs for all users were observed. In the case-control study, the highest odds were seen among newly initiated zolpidem-only users involved in single-vehicle crashes (adjusted OR 2.27; 95% confidence interval [CI] 1.21-4.24), followed by frequent combined zolpidem and zopiclone users [adjusted OR 2.20; CI 1.21-4.00]. In the case-crossover, newly initiated treatment with zolpidem or zopiclone showed an increased risk that was highest in the two weeks after the start of the treatment (OR 2.66; 95% CI 1.04-6.81).

Existing epidemiological research (both culpability and case-control studies) into the accident risk related to the use of cannabinoids (THC) have provided inconsistent results (Compton & Berning, 2015) (Gjerde, Strand, & Mørland, 2020) (Leblud, 2017) (Vindenes, et al., 2011). For example, half of the coded studies reviewed by Leblud (2017) (see Table 4.5) showed negative significant effects while the other half showed no significant effect.

Three large case-control studies performed in the US over the past decade, which estimated both increased risk of crash involvement (Li et al. 2013; Li and Chihuri 2019) and no increased risk of crash involvement for drivers testing positive for THC (Romano et al. 2014), have been criticised for using cases from the US Fatality Analysis Reporting System (FARS), whereas the controls were selected from roadside surveys. Limitations in the FARS dataset do not allow calculation of unbiased, reliable and valid estimates of the risk of crash involvement that results from drug use (Compton & Berning, 2015). Due to a variety of reasons drug exposure was defined differently for cases and controls, with unpredictable errors in the studies (Gjerde, Strand, & Mørland, 2020).

More carefully controlled studies, that actually measured THC use by drivers rather than relying on self-reporting, and that had a high degree of control of covariates that could bias the results, generally show low risk estimates or in a few cases no risk associated with THC use (Compton R. , 2017).

Elvik (2013) found an association between cannabis use and property damage collisions (OR 1.48; 95 % CI: 1.28–1.72), but not for fatal (OR 1.31; 95 % CI 0.91–1.88) or injury collisions (OR 1.26; 95 % CI: 0.99–1.60); In addition, associations were weakened when publication bias was considered.

A fourth (i.e. in addition to the three mentioned above) large US study (Compton & Berning, 2015) found no significant increased crash risk traceable to marijuana after controlling for drivers' age, gender, race, and presence of alcohol. When both alcohol and other drugs were consumed, alcohol alone was associated with crash risk.

Largely unnoticed is the interpretational bias caused by researchers treating culpability ORs as equivalent to crash ORs (Rogeberg, 2019). Since culpability ORs relates to culpable crashes only, the change in total crash risk will necessarily be smaller. Rogeberg (2019) concludes the magnitude of the bias can be considerable, and the misinterpretation appears widespread and persistent in the cannabis crash risk literature, including in (Asbridge et al., 2012; Gjerde and Mørland, 2016; Martin et al., 2017). Based on data from 13 published culpability studies, Rogeberg estimates an average increase in crash risk at 1.28 (1.16–1.40). The pooled increased risk of a culpable crash is estimated as 1.42 (95% credibility interval 1.11–1.75), which is similar to pooled estimates using traditional ORs (1.46, 95% CI: 1.24–1.72). The attributable risk fraction of cannabis impaired driving is estimated to lie below 2% for all but two of the included studies.

From a review of eleven epidemiological studies of the effects of cannabis on the risk of crashing that used the presence of THC in blood or oral fluid as a marker of the recent use of cannabis, identified from five published reviews (Asbridge, Hayden & Cartwright, 2012; Hartman & Huestis 2013; Hostiuc et al., 2018; Li et al., 2012; Rogeberg & Elvik, 2016), (White, 2017) (White, 2019) concluded that there is too limited evidence to suggest THC has significant impact on crash risk. Even, *if* cannabis does increase the risk of crashing, the increase is unlikely to be more than about 30%. In addition, the review found no satisfactory epidemiological evidence for a threshold concentration of THC below which there is no effect, but above which there is an effect. Also no confincing evidence was found to suggest THC exacerbates the effects of alcohol on crashing.

Based on a review of available evidence the National Transport Commission in Australia concluded in 2018 in its position paper Towards a national approach to drug driving: "We need to do more research to understand the level of driving impairment caused by drugs (both licit and illicit) and drugs mixed with alcohol or other drugs. [..] there has not been a holistic study of impairment levels associated with licit and illicit drugs and their flow-on effect on road safety risks."

Overall, the results of these studies leave room for discussion on the impact of drugs on accident risk. There is much to suggest that it will take some time before this issue is finally resolved. There is only limited robust epidemiological data on the role of various drugs on accident risk and subsequent risk on injuries and fatalities. Up-to-date data in the European context is particularly lacking. The wide variety of substances complicates development of reliable estimates of these risks. As various drugs affect driving skills differently, overall crash risk estimates may underestimate the contribution of certain drugs to specific types of crashes.

For the time being, it can only be concluded drug contribution to accident risk is lower than alcohol.

4.3 *Prevalence of drugs in traffic in the EU, Norway and UK*

4.3.1 Drugs – DUI estimates from roadside surveys

As with alcohol, the results of the DRUID (Driving under the Influence of Drugs, Alcohol and Medicines) study still provide the most comprehensive information on the prevalence of drugs in traffic in Europe. The research was conducted in 13 European countries: Denmark, Finland, Norway, Sweden, Czechia, Hungary, Poland, Lithuania, Spain, Portugal, Italy, Belgium and the Netherlands.

In all countries, roadside studies were conducted according to the same methodological guidelines and over the same period of time (from September 2008 to June 2010). During these tests traffic police randomly stopped drivers of passenger cars and vans and checked their state of sobriety. The drivers were also asked for a sample of saliva, which was then checked for other psychoactive substances in the laboratory. Before presenting these results, it is worth recalling that the DRUID study analysed the prevalence of only 23 substances (see Table 0.1 in Annex 3) known to be relatively frequent in road traffic.

Table 4.6 shows the results obtained in individual countries. The fields marked in blue indicate that the value is higher than the European average.

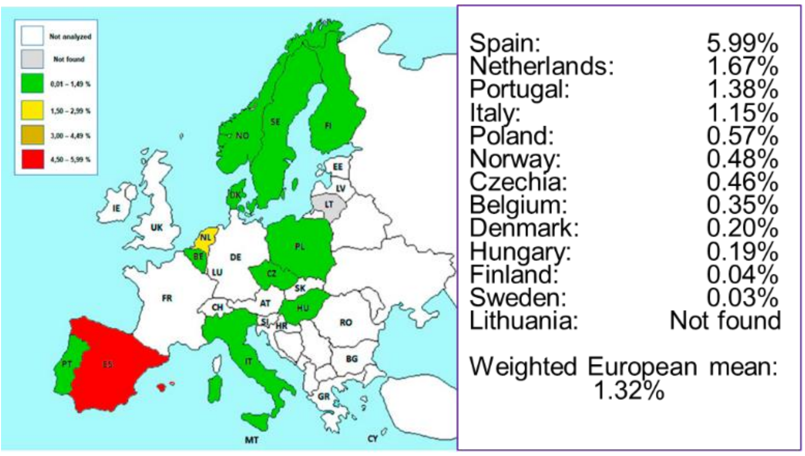
Table 4.6 The estimated prevalence of psychoactive substances (in %) in driver's population in European countries

	Negative	Amphetamine	Cocaine	THC	Illicit opiates	Benzodiazepines	Z-drugs	Medical opiates and opioids	Alcohol	Alcohol & drugs	Drugs & drugs
IT	84.99	-	1.25	1.15	0.3	0.97	-	0.53	8.59	1.01	1.22
ES	85.15	0.11	1.49	5.99	0.05	1.4	-	0.19	3.92	1.14	0.57
BE	89.35	-	0.2	0.35	0.09	2.01	0.22	0.75	6.42	0.31	0.3
PT	90.01	-	0.03	1.38	0.15	2.73	-	0.11	4.93	0.42	0.23
LT	94.49	0.22	-	-	-	1.41	-	-	3.86	0.03	-
NL	94.49	0.19	0.3	1.67	0.01	0.4	0.04	0.16	2.15	0.24	0.35
DK	95.52	0.02	-	0.2	-	0.47	0.32	0.79	2.53	0.1	0.06
NO	97.03	0.06	0.06	0.48	-	0.84	0.69	0.16	0.32	0.07	0.28
FIN	97.15	0.05	0.03	0.04	-	0.79	0.36	0.56	0.64	0.08	0.29
CZ	97.2	0.36	-	0.46	-	0.62	-	0.21	0.99	0.05	0.11
PL	97.63	0.05	-	0.57	0.09	0.14	-	0.03	1.47	-	0.02
HU	97.68	-	0.04	0.19	-	1.5	0.07	0.11	0.15	-	0.27
SE	98.66	0.07	-	0.03	-	0.19	0.31	0.63	n/a	n/a	0.12
Weighted European mean	**92.57**	**0.08**	**0.42**	**1.32**	**0.07**	**0.9**	**0.12**	**0.35**	**3.48**	**0.37**	**0.39**

Source: Houwing, S. et al., 2011.

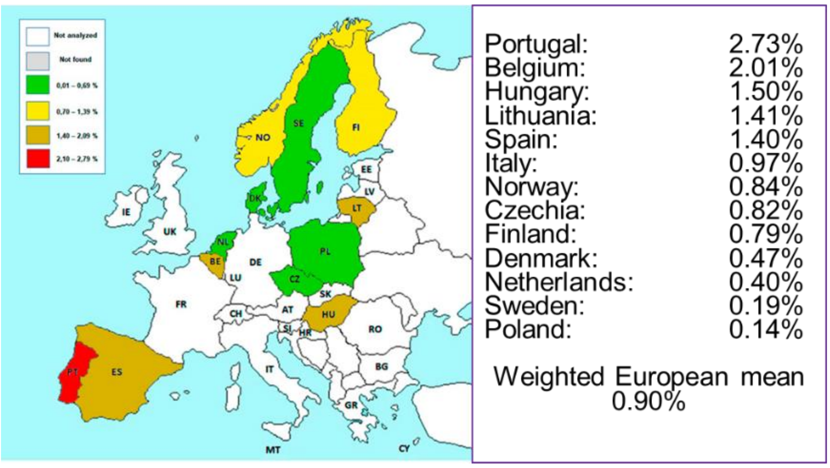
The DRUID project estimated that on average 1.9% of drivers drive with illicit drugs in their blood, 1.4% with a limited list of medicinal drugs, 0.37% with a combination of alcohol and drugs and 0.39% with different drug classes. THC was the most frequently detected drug in traffic, followed by cocaine. The least frequently detected drugs were amphetamines and illicit opiates. Large differences were observed among countries, with more alcohol and illicit drugs found in southern Europe and more medicinal drugs in northern Europe. The following figures show the prevalence of the four most common psychoactive substances revealed in DRUID studies.

Figure 4.2 The estimated European prevalence of THC (in %) in driver's population



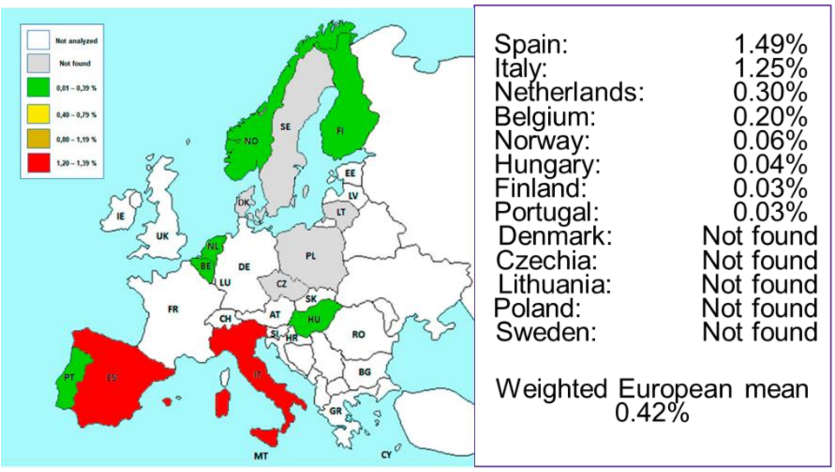
Source: Houwing, S. et al., 2011.

Figure 4.3 The estimated European prevalence of Benzodiazepines (in %) in driver's population



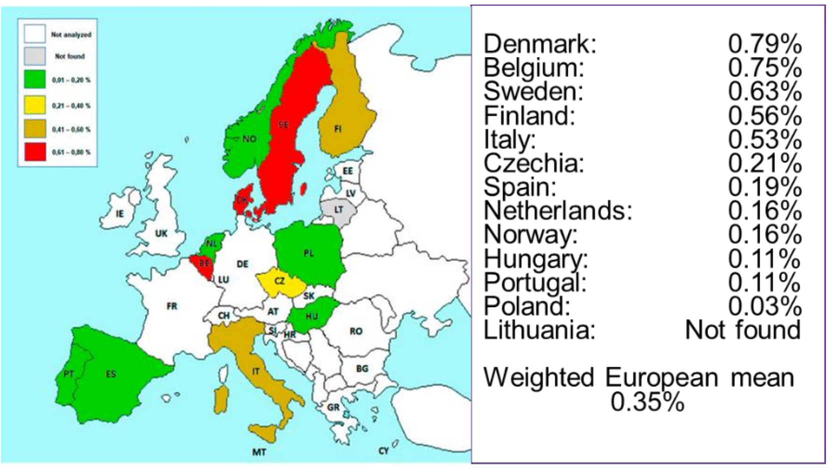
Source: Houwing, S. et al., 2011

Figure 4.4 The estimated European prevalence of COCAINE (in %) in driver's population



Source: Houwing, S. et al., 2011

Figure 4.5 The estimated European prevalence of medical opiates and opioids (in %) in driver's population



Source: Houwing, S. et al., 2011

As can be seen from figures, the prevalence of illicit drugs was higher than the prevalence of medicinal drugs in Spain, Italy, the Netherlands, Czech Republic, and Poland. Medicinal drugs were more frequently detected than illicit drugs in Northern Europe, Belgium, Portugal, Lithuania and Hungary. The prevalence of psychoactive substances exceeded the prevalence of alcohol in the Czech Republic, Spain, Finland, Hungary, the Netherlands, and Norway. In all other countries, the prevalence of alcohol was higher than the prevalence of other psychoactive substances (Houwing et al., 2011).

To date, the DRUID study is still the most recent roadside study on driving after drug use, which has been carried out simultaneously in several EU countries. Since 2010 studies on the prevalence of drugs in driving population in Europe have been carried out occasionally in individual countries. A short overview of the results of recent studies is given below:

- In **Belgium**, 558 blood samples obtained during roadside controls in Belgium (January to August 2015) after a positive Drugwipe 5S® test and 199 oral fluid (OF) samples obtained from negatively screened test pads were analysed (Wille, et al., 2017). The NPS positivity rate was 7% in blood, while it reached 11% in OF. NPS detected were: diphenidine, ketamine, 4-fluoroamphetamine, 2-amino-indane, methoxetamine, α-PVP, methiopropamine, a mix of 5-MAPB/5-EAPB, TH-PVP, mephedrone, methedrone, 4-methylethylcathinone, 5-MeO-DALT, 4-Acetoxy-DiPT, AB Fubinaca, FUB-JWH018, JWH020, trifluoromethylphenylpiperazine, and ethylphenidate. Moreover, 17% of blood samples (and 5% of OF) contained an analgesic drug, 10% (0.5%) a benzodiazepine/hypnotic, 5% (2%) an antidepressant, 2% (3%) an antipsychotic, 2% an antiepileptic drug and 1% methylphenidate. The presence of NPS in the young (and predominately male) DUID population is proven. Furthermore, a high level of poly-drug use including combinations of NPS, licit and drugs of abuse was observed.

- In **Denmark**, Simonsen, Linnet, & Rasmussen (2018) analysed blood samples from drivers under suspicion of driving under the influence of drugs and alcohol in 2015 and 2016 in the eastern part of Denmark. THC (67-69%) was the most frequently detected drug above the legal limit, followed by cocaine (27-28.5%), amphetamine (17%), and clonazepam (6-7%) in both years. Morphine (5.4%), included among the 5 most frequent drugs in 2015, was replaced by methadone (4.6%) in 2016. Few new psychoactive drugs (NPS) were detected.

- A study in **Hungary** analysed 1252 suspected drivers in 2014 and 2015 and found impairment was proven in 39.2% (2014) and 35.7% (2015) of all drivers tested, based on the legal criteria of Hungary (Institórisa, et al., 2017). Cannabis was most detected (34%), followed by amphetamine (25%), stimulant designer drugs (14%), alprazolam (8%), cocaine (6%), synthetic cannabinoids (6%) and clonazepam (3%). The presence of both alcohol and at least one drug in samples was found in about 10% of the cases, both years. The ratio of multi-drug use was 33.0% in 2014 and 41.3% in 2015.

- From September 2014 to October 2015, research was carried out in Finnmark (**Norway**) of the prevalence of alcohol and potentially impairing drugs among the general driving population Gjulem Jarnt et al., 2017). A total of 3228 drivers were asked to participate in the study. The refusal rate was 6.2 per cent. Psychoactive medicinal drugs were detected in 2.5 per cent and illicit drugs in 1.6 per cent of the samples. The most commonly found substances were the sleeping agent zopiclone (1.1%), tetrahydrocannabinol (THC) (1.1%) and the analgesic agent codeine (0.6%). There were large differences between age groups and genders concerning illicit drugs and psychoactive medicinal drugs. Illicit drugs were more frequently in samples from young male drivers, while psychoactive medicinal drugs were more frequently in samples from elderly female drivers. The total prevalence of drugs among the general driving population in Finnmark was low and similar to previous Norwegian roadside surveys.

- From April 2016 to April 2017, research was carried out in the southeastern part of Norway of the prevalence of alcohol and potentially impairing drugs among the general driving population (Furuhaugen et al., 2018). Five thousand five hundred fifty-six drivers of cars, vans, motorcycles, and mopeds took part in the study. The weighted prevalence of medicinal drugs and illicit drugs were 3.0% and 1.7%, respectively; those numbers included more drugs than the 2008-2009 survey and are therefore not comparable. The most prevalent illicit and medicinal drugs were tetrahydrocannabinol (1.3%) and zopiclone (1.4%). The prevalence of benzodiazepines and amphetamines were significantly lower than detected in the 2008-2009 survey. Only one sample tested positive for a new psychoactive substance.

- In 2015, a study on the prevalence of alcohol and illicit drugs use in a representative nationwide sample of the general population of drivers was carried out in **Spain** (Domingo-Salvany, A., 2017). Two thousand seven hundred forty-four people attended the survey. Drugs more frequently testing positive were 7.8% were positive for cannabis (7.8%), cocaine (3.5%), amphetamine-like stimulants/designer drugs (1.5%), and opiates/methadone (0.5%). More than one substance was detected in 4% of the subjects. The proportion of positive results for drugs decreased with age and was more likely among men and on urban roads. Cannabis was more likely to be detected at younger ages, and cocaine was associated with night driving. The consumption of illegal drugs seems to have increased. Compared to the previous edition in 2013, positive cases screened at roadside for drugs increased from 8.0% [7.0–8.9] to 10.7% [9.5–11.8]; $p < 0.001$).

- Herrera-Gómez, García-Mingo, & Álvarez (2020) assessed data on Spanish drivers with confirmed drug-positive results recorded by the Spanish National Traffic Agency between 2011 and 2016, accounting for 179,645 tests and 65,244 confirmed drug-positive tests. They found benzodiazepines were confirmed in 4.3% of all positive roadside drug tests. In most of those cases (97.1%), other substances were also detected, particularly cocaine (75.3%) and cannabis (64.0%). The frequency of benzodiazepine-positive drivers (OR, 1.094; 95% CI, 1.088–1.100) increased with age, while the frequency of drivers who tested positive for benzodiazepines in conjunction with other substances, compared with drivers who tested positive for benzodiazepines alone, decreased with age (OR, 0.903; 95% CI, 0.825–0.988). Nordiazepam (54.8%) and alprazolam (46.9%) were the most common benzodiazepines detected.

4.3.2 Drugs – DUI revealed by police sobriety checks

When assessing the prevalence of drugs in the driving population, the results of police checks are often examined. Since 2008 the European Traffic Police Network (TISPOL)[28] has been organising joint police checks in Europe. Operation "Alcohol & Drugs" checks are organised in June and December each year and usually last one week. Drivers are stopped for random checks, during which they are checked for alcohol and drugs presence. Operation "Alcohol & Drugs" enables comparison of results between different countries, as police checks are organised in all countries at the same time and according to the same guidelines. The results of TISPOL drug checks are presented in Table 4.7.

[28] In 2019 TISPOL changed its name to Roadpol (European Roads Policing Network).

Table 4.7 Drug offences detected – results of police checks coordinated by TISPOL in 2008-2019

Date	Number of countries	Number of motorists controlled	Drug offences detected	%
2008.06.08-02	?	860174	1021	0.12
2008.12.14-08	24	1009926	939	0.09
2009.06.08-02	21	690383	985	0.14
2009.12.13-07	20	863204	861	0.10
2010.06.13-07	21	422181	561	0.13
2010.12.19-13	27	796812	1265	0.16
2012.12.16-12	29	1203095	1830	0.15
2013.06.13-09	30	832745	1777	0.21
2013.12.15-09	31	1140346	2128	0.19
2014.06.08-02	30	1168631	2976	0.25
2015.06.07-01	28	1124163	2764	0.25
2015.12.13-07	27	1134924	3157	0.28
2016 (x2)[29]		> 2000000	5820	
2017.06.11-05	23	945447	2946	0.31
2017.12.17-11	16	796725	2381	0.30
2018.06.10-04	24	1040812	4345	0.42
2018.12.16-10	23	806384	3387	0.42
2019.06.09-03	21	1257253	4109	0.33
2019.12.15-09	18	1057467	3373	0.32

Source: TISPOL, 2008-2019.

During the controls performed since June 2008, the percentage of drivers stopped for drug driving did not exceed 0.5%. However, the percentage of drivers found to be driving under the influence of drugs has been increasing during this period. The prevalence of drug use in the population of drivers estimated in the TISPOL operation is lower than that estimated in the DRUID study (Bernhoft, I. M. et al., 2011).

For the purpose of this report, data on police controls for drugs have also been collected from national experts. Six out of 30 analysed countries (Finland, Ireland, Italy, Poland, Slovenia, Spain) were able to provide relatively complete data on the number of drug checks and the number of the revealed impaired drivers at the same time. Figure 4.8 shows data on drugged drivers revealed during police checks in the six countries that provided this data. Countries in the table are set according to the percentage of tested drivers who were found to drug driving in 2019.

Table 4.8 Percentage of positive drug checks in total police drug checks in 6 EU countries

	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
Italy						20.3	28.3	47.0	42.9	39.8
Finland	42.5	33.3	34.6	32.9	35.0	38.1	39.4	38.2	36.7	37.9
Spain		51.5	62.6	49.5	35.1	33.3	39.4	34.7	35.7	36.1
Slovenia					31.7	19.8	25.9	16.9	20.9	17.6
Ireland								14.0	13.2	16.0
Poland	18.8	14.0	22.2	13.8	12.9	13.1	15.9	13.9	8.1	14.2

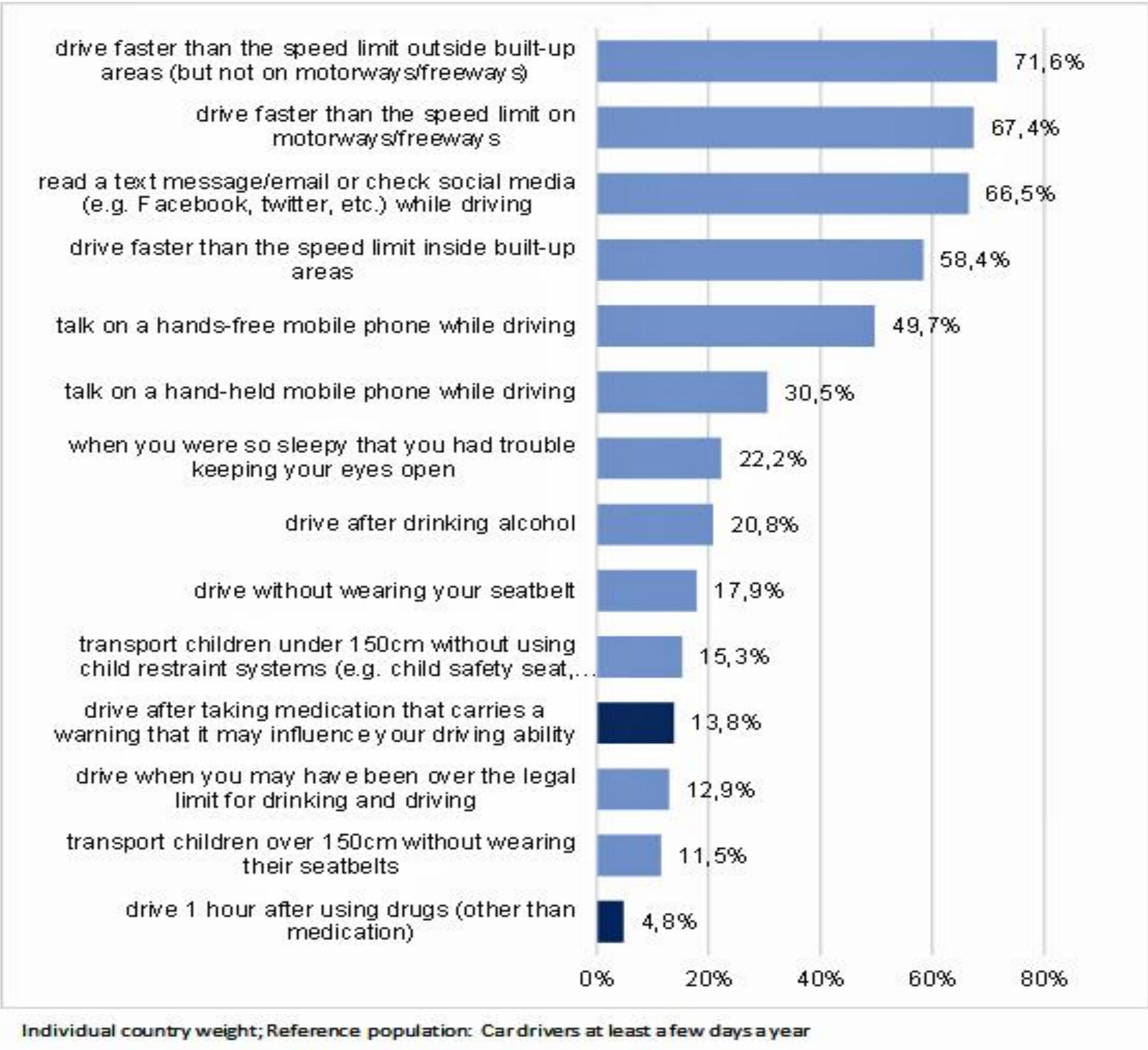
According to data from six countries, approximately 26% of drivers driving after using drugs were found in police checks in 2019. The highest number of drivers was revealed in Italy (39.8%), Finland (37.9%) and Spain (36.1%). In these countries, the DRUID study indicated a higher prevalence of some drugs. The data should however be treated with caution; there is no information on how police checks were carried out, or whether laboratory tests subsequently confirmed the results of police checks.

29 In 2016 there were 2 controls performed, but available data does not allow to calculate the % of drugged drivers among all police checks.

4.3.3 Drugs – DUI revealed in public surveys

In recent years, two public surveys – ESRA1 and ESRA2 – have been conducted in Europe, which also included questions about the prevalence of drugs in road traffic. Car drivers from Europe have been asked how often they had engaged in risky and dangerous behaviours over the last 30 days. The questionnaire presented 14 different behaviours (e.g. speeding, driving under the influence of alcohol, in a state of high fatigue or while making a phone call). It also included a question on driving one hour after using drugs (other than medication) and a question on driving after taking medication that carries a warning that it may influence the ability to drive. Figure 4.6 shows the answer pattern.

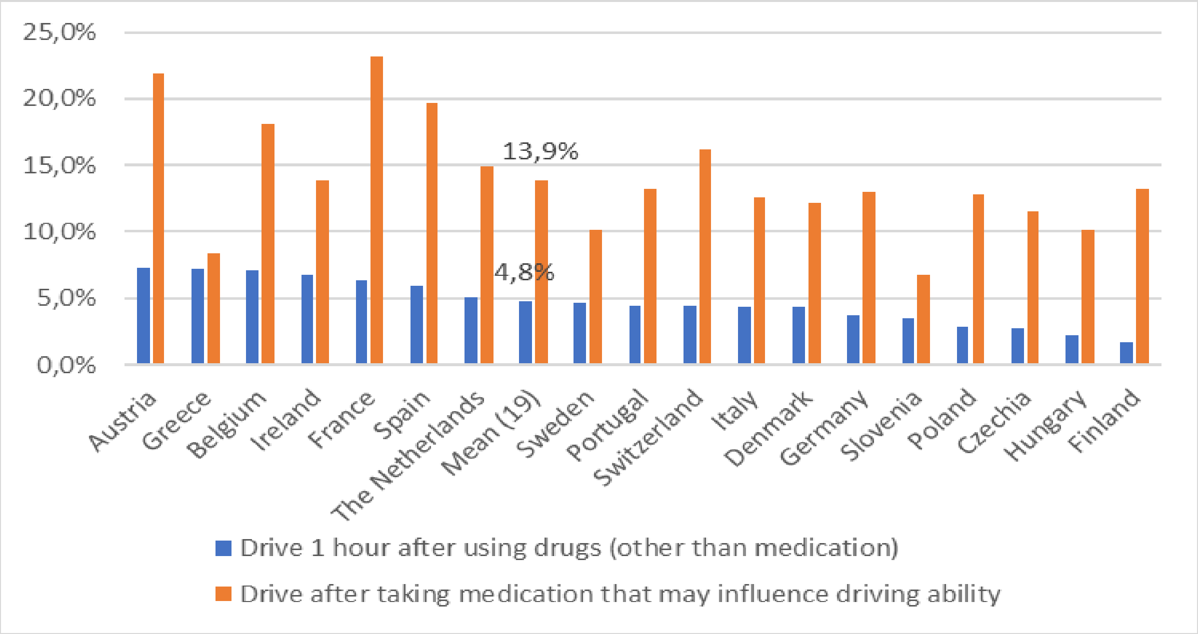
Figure 4.6 Self-declared risky behaviour (% car drivers that did it at least once in the past 30 days)



Source: ESRA 2, 2018.

In total, 14% of European drivers admitted that they had been driving in the last 30 days after taking medication that may had affected their driving ability. As the figure shows, this type of behaviour is not very common, but this value indicates also that it is not a problem that can be completely ignored. On the other hand, 5% of car drivers admitted that they had been driving 1 hour after using drugs in the past month. These values are higher than those recorded in 2010 in the DRUID study. Figure 4.7 provides data on the prevalence of drugs and medicines in the driver population in individual countries.

Figure 4.7 Percentage of car drivers who admitted they had driven 1 hour after using drugs and after taking medication in the past 30 days by country



Source: ESRA 2, 2018.

According to this table, in the United Kingdom, Austria, Greece and Belgium, more than 7% of drivers admitted that they had taken drugs just before driving. On the other hand, in Finland or Hungary, only about 2% of surveyed drivers admitted to this type of behaviour. In all countries surveyed, the percentage of drivers declaring to use medicines that affect driving abilities is higher than that of drugs.

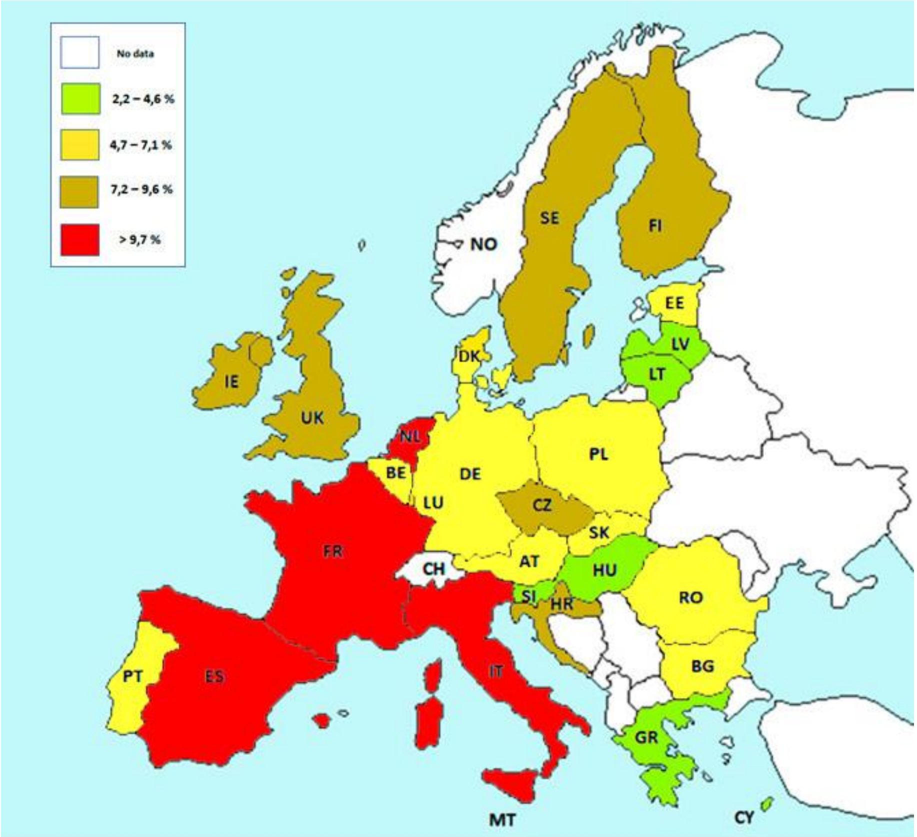
4.3.4 Prevalence of drugs in general population in the EU, EFTA and the UK

It can be assumed prevalence of drugs in general population influences prevalence of drugs in traffic and trends in prevalence in the population may provide an indication for what can be expected in traffic.

According to ECMMDA (2020), in Europe around 96 million people aged 15-64 (29% of all adults) have had at least once tried the illicit drug in their lifetime. Results of public polls show drug use in recent years is largely concentrated among young adults aged 15-34. 20 million of young adults (16.6% of young adults population) used drugs with about twice as many males (21%) as females (12%). Figure 4.8 shows the prevalence of all illicit drugs in the 27 European countries (no data from Norway, Malta and Switzerland).

Prevalence of drug use in the general population is usually assessed through surveys based on representative samples of the whole population. In the ECMDDA (2020) study participants answered the question of whether they had taken illicit drugs in the last 12 months.

Figure 4.8 Prevalence of using illicit drugs during the last 12 months per country



Source: ECMDDA, 2020 https://www.emcdda.europa.eu/data/stats2020/gps/.

The graph shows that the highest prevalence of illicit drugs was recorded in Spain (11.9%), France (11.5%), the Netherlands (11%) and Italy (10.6%). Table 4.9shows the most recent available data on the drug situation in Europe provided by the European countries.

Table 4.9 Prevalence of drug use during the last 12 months in individual countries in Europe

	Year	All illegal drugs	Cannabis	Cocaine	Amphetamine	Ecstasy	LSD
AT	2015	6.7	6.4	0.4	0.4	0.4	0.3
BE	2013	5.1	4.6	0.5	0.2	0.3	0
BG	2016	5.7	4.2	0.3	0.7	1.3	0.2
HR	2015	8.3	7.9	0.8	1	0.6	0.2
CY	2016	2.2	2.2	0.2	0.1	0.1	0.1
CZ	2017	9.5	8.9	0.1	0.3	0.8	0
DK	2017	7.1	6.4	1.6	0.7	0.5	0.2
EE	2008	6.5	6	0.7	1.1	1.2	0.3
FI	2014	7.2	6.8	0.5	1.1	1.1	0.5
FR	2017	11.5	11	1.6	0.3	0.6	0.4
DE	2015	6.6	6.1	0.6	1	0.6	0.3
EL	2015	2.9	2.8	0.4		0.2	0
HU	2015	2.3	1.5	0.3	0.5	0.9	0.2
IE	2015	8.9	7.7	1.5	0.3	2.1	0.3
IT	2017	10.6	10.2	1.2	0.1	0.4	0.1
LV	2015	4.6	4.2	0.5	0.3	0.3	
LT	2016	3.1	2.7	0.1	0.3	0.4	0.1
LU	2014	6.2	4.9	0.4	0.1	0.2	0.1
MT			0.9				
NL	2017	11	9.2	2.2	1.8	3.3	0.1
NO			5.3	1.1	0.6	1	0.5
PL	2014	4.7	4.6	0.2	0.2	0.4	0.1
PT	2016	5.4	5.1	0.2	0	0.1	0

	Year	All illegal drugs	Cannabis	Cocaine	Amphetamine	Ecstasy	LSD
RO	2016	5.8	3.2	0.2	0.1	0.1	0.3
SK	2015	4.7	4.3	0.1	0.4	0.6	0.1
SI	2012	4.5	4.4	0.5	0.3	0.3	0.1
ES	2017	11.9	11	2.2	0.5	0.6	
SE	2017	9.4	4.6	1.2	0.7	0.9	
UK	2017	9	7.2	2.7	0.5	1.7	0.4
Mean[30]		6.7	5.7	0.8	0.5	0.8	0.2

Source: EMCDDA, 2020; https://www.emcdda.europa.eu/data/stats2020/gps.

The most commonly used drug in European countries is cannabis[31], followed by cocaine, MDMA and amphetamine. While the use of heroin and other opioids remains relatively rare, these continue to be the drugs most commonly associated with the more harmful effects (EMCDDA, 2020). Experience of drug use is more frequently reported by males (57.8 million) than females (38.4 million). The latest ECMDDA report (2020) also points out that there have been indications that cocaine is appearing in countries where it has not previously been available. Among people who use drugs, polydrug (combination of several drugs) consumption is common but challenging to measure, and individual patterns of use range from experimental to habitual and dependent consumption. New psychoactive substances continue to be of interest. In recent years, around 50 new substances have been detected each year, and the EU's Early Warning System (EWS) monitors over 400 new psychoactive substances.

The next table summarises the leading indicators used to assess the prevalence of illicit drugs in the population of young people. The compilation of the table has benefited from the results of successive studies of the European School Survey Project on Alcohol and Other Drugs (ESPAD).

Table 4.10 ESPAD average for selected indicators for drugs in 30 countries 1995-2019 (percentage)

Measure (% of population)	1995	1999	2003	2007	2011	2015	2019
Lifetime illicit drug use	12	18	19	19	20	19	18
Lifetime cannabis use	11	16	18	17	18	17	16
Lifetime use of illicit drugs other than cannabis	3	6	5	7	6	5	5
Current cannabis use (last 30 days)	4	7	7	6	8	7	7

Source: The ESPAD Group, 2020[32].

Generally, between 1995 and 2011 an increase in the prevalence of illicit drug use can be observed. Since 2011, the prevalence has started to decrease slowly. Trends in illicit drug use experiences among boys and girls follow the general trend, with girls' rates being about five-six percentage points lower than boys' rates. Cannabis is the most widely used illicit drug and the trends for lifetime cannabis use are similar to the trends for illicit drug use, with rates being only slightly lower. Prevalence rates of lifetime cannabis use as well as current (last 30 days) use for both genders peaked in 2003 and stabilised after that.

4.4 *Drug related traffic fatalities in the EU and EFTA*

The most serious consequence of drug-driving is a crash-related death and serious injuries. This part of the study will present the results of several studies on the prevalence of drug use among victims of road traffic crashes.

The DRUID project has provided an estimate of the prevalence of drugs in seriously injured or killed drivers in traffic accidents in nine European countries. Studies of seriously injured drivers were carried out in six European countries (Belgium, Denmark, Finland, Italy, Lithuania and the Netherlands) between October 2007 and May 2010, and studies of road fatalities were conducted in four countries (Portugal, Finland, Sweden and Norway) between January 2006 and December

30 The mean was calculated for the countries that provided the data.

31 Cannabis resin and herb nowadays contain on average about twice as much THC as ten years ago.

32 http://www.espad.org/sites/espad.org/files/2020.3878_EN_04.pdf.

2009. All countries conducted surveys according to uniform study design (Schulze, H. et al., 2012). The results of these studies are presented in Table 4.11. It shows similar variations in prevalence of substances across countries, but with cannabinoids (THC) and benzodiazepines most frequently found in most countries.

Table 4.11 Percentage of drivers after drug use in road traffic accidents (percentage)

Toxicological finding	Killed drivers				Seriously injured drivers					
	FI	NO	PT	SE	BE	DK	FI	IT	LT	NL
Amphetamine	2.1	7.4	0.0	6.6	2.6	4.2	3.7	0.1	0.5	2.1
Benzoylecgonine[33]	0.0	0.6	0.7	0.7	1.4	0.7	0.0	2.8	0.3	2.7
Cocaine	0.0	0.0	0.7	0.7	2.3	0.6	0.0	2.7	0.3	2.1
Cocaine and/or benzoylecgonine	0.0	0.6	1.4	1.3	3.8	1.3	0.0	5.4	0.5	4.8
THCCOOH[34]	n.a.	n.a.	4.2	0.0	2.3	5.3	0.0	1.3	0.3	1.1
THC	1.3	6.1	0.0	1.3	7.6	1.3	5.7	3.7	0.5	0.5
THC and/or THCCOOH	1.3	6.1	4.2	1.4	9.9	6.6	5.7	5.1	0.8	1.6
Illicit opiates	0.0	0.0	0.0	0.0	0.6	0.5	0.0	2.1	0.3	0.0
Benzodiazepines	13.3	9.7	1.8	3.9	7.3	6.7	10.2	0.7	3.6	0.0
Z-drugs	3.0	4.4	0.0	3.2	1.7	1.2	3.8	0.0	0.0	0.5
Medical opioids	2.1	1.7	2.1	4.1	3.3	4.2	4.0	3.7	7.8	0.5

Source: Verstraete et al., 2011.

In addition to the DRUID study, information on accidents and fatalities with involvement of drugs has also been collected from national statistics and from national experts.

Not all countries collect and publish such data. Countries that do, apply various breakdowns in reporting, differentiating between a limited number of drugs and/or medicines, in accordance with the substances that are considered illegal when driving (or at all) in the specific country and which are tested for in case of traffic accidents in the country (not all substances regulated in road traffic regulations are tested for in traffic accidents/enforcement). In addition, national statistics on drug-related accidents and fatalities do not specify classifications of drug concentrations, something what is quite common in alcohol-related accident statistics. Even in countries that apply analytical thresholds (i.e. a level above zero, based on analysis of the impact of a substance on driving behaviour or accident risk) as legal level for certain substances are often unclear if drug-related accidents statistics relate to involvement of drugs above the legal level or to any level of drugs detected. Finally, no statistics have been found commenting on whether or not drug presence had any causal relation on the occurrence of a road accident

Table 4.12 shows the prevalence estimates from national statistics and national experts on involvement of drugs in road fatalities. The countries have been set according to value in 2018 (the last year in which comparable data was collected for most countries).

Table 4.12 Percentage of drug-related deaths in the total number of deaths in road accidents

	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
France	13.1	12.6	14.5	13.3	14.5	14.5	14.0	14.3	15.5	15.2
Sweden	7.1	8.8	8.1	6.5	7.8	8.1	13.0	15.8	9.6	10.0
Spain	4.3	5.1	4.1	5.1	4.9	5.2	7.7	10.1		
Cyprus	5.0	7.0	7.8	9.1	2.2	5.3	2.2	3.8	8.2	11.5
Denmark	4.3	3.6	4.8	4.7	4.9	7.9	4.7	6.9	7.4	10.6
Slovenia							8.5	4.8	6.6	9.8
Switzerland	4.0	6.3	6.5	7.1	6.6	6.3	10.6	8.7	6.4	4.3
Finland			6.7	3.5	6.1	3.3	7.8	3.9	4.6	3.3
Luxemburg				7	3	6	10	21	3	18
Czechia	2.0	1.4	1.2	2.1	1.0	1.6	2.0	0.9	2.9	2.6

33 Benzoylecgonine but negative for cocaine.
34 THCCOOH but negative for THC.

Italy						1.9	1.8	2.2	2.3	2.1
Germany	1.2	1.2	0.9	1.0	1.2	1.2	1.0	1.3	1.8	
Poland	0.0	0.3	0.4	0.1	0.4	0.5	0.5	0.7	0.7	0.8
Austria			0.2	0.0	0.2	0.4	0.5	1.2	0.5	0.7
Estonia	0.0	0.0	0.0	1.2	2.6	1.5	0.0	4.2	0.0	0.0
Lithuania					0.0	0.0	0.0	0.0	0.0	0.0
Portugal	6.7	8.3	8.6	11.2	9.9	8.9	11.2	11.4	11.6	13.3
Data not collected: Belgium, Bulgaria, Croatia, Greece, Hungary, Ireland, Latvia, Netherlands, Romania, Slovakia, United Kingdom										
Lack of data: Malta, Norway										

Source: 2010-2017 DG Move Road safety evolution (December 2018); Podda, F., 2012; Calinescu, T., 2018; La Lievre, P., 2019; data collected from National expert panel (see annex 1).

The country with the highest percentage of drug related road deaths in 2019 was Cyprus (11.5%), followed by Denmark (10.6%) and Sweden (10%). It was noted that in Estonia and Lithuania in 2018 and 2019 no road deaths related to drug use were recorded. At the same time, care should be taken in comparison of countries. As mentioned in this report, there are many differences between countries in the drugs regulated and screened for, as well as definitions and methodologies applied to trace and record them. Hence, there are no comparable data available for road collisions related to drugs and psychoactive medicines, though these have been receiving increasing attention over the past decade (Adminaite, Jost, Stipdonk, & Ward, 2018).

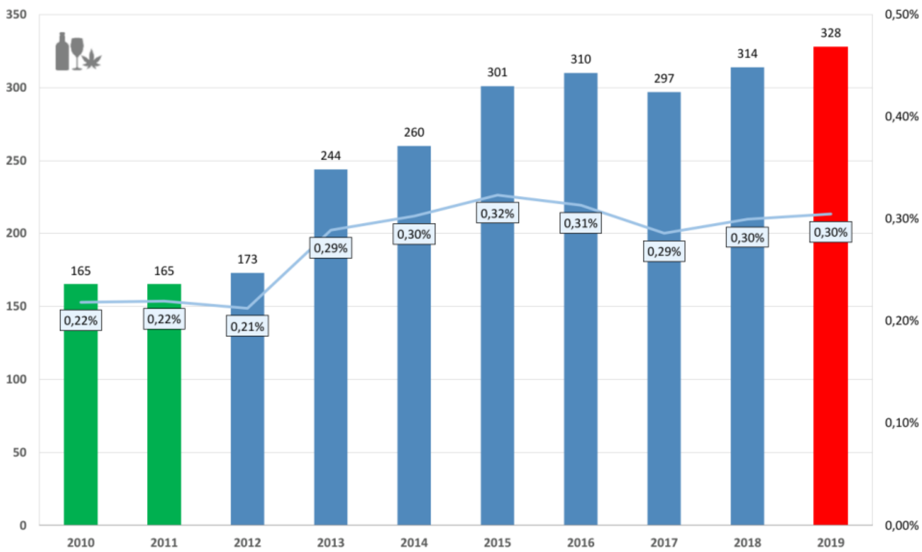
While acknowledging the variety of shortcomings in comparability, the data in Table 4.12 would suggest on average 6% of road fatalities in European countries drugs are involved (N=16). The shares reported for the countries in Table 4.12 imply that there were at least around 1,020 drug-related fatalities in 2018 (see also Annex 3). Extrapolating the share of 6% to all EU27 countries would result in some 1,360 drug-related driving fatalities for the EU27.

What Table 4.12 also shows is the trend in recorded road fatalities with involvement of drugs. While there are year-on-year fluctuations, in many countries there is an upward trend in the percentage of road fatalities with involvement of drugs. Comparing national data for 2018 with the earliest data available per country from the period 2010-2013, the growth in traffic fatalities with involvement of drugs has been 39% (N=14).

The upward trend in road fatalities with involvement of drugs is also confirmed by findings of various studies at national level. Also, the shares of drug-related fatalities in overall traffic fatalities are often higher than the average of 6% reported above.

Analysis of accident involvement of drugs (including medicines) in **Czechia**, shows the share of accidents caused by drivers under the influence has increased in the period 2010–2019 (BESIP, 2020). Apart from a small decrease in 2017 both number of accidents and the share of drug-related accidents have been increasing in the past decade.

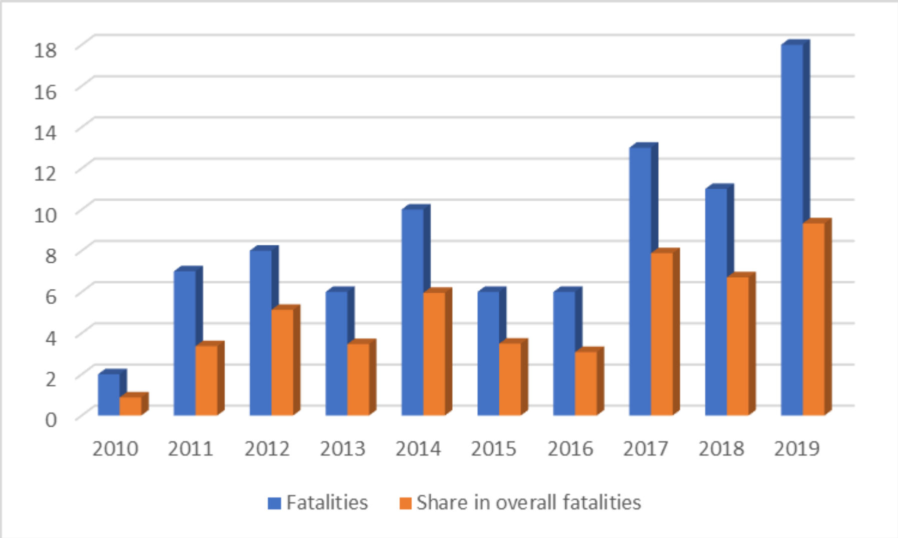
Figure 4.9 Number and share of accidents caused by drivers under the influence of addictive substances in the Czech Republic



Source: BESIP, 2020.

In **Denmark**, the share of traffic fatalities with involvement of drugs / medicines rose from 1% in 2010 to 9% in 2019. Also, the number of drug-related fatalities grew. In 2019, there were 56 fatal accidents where the driver was under the influence of drugs or medication (Vejdirektoratet, 2020).

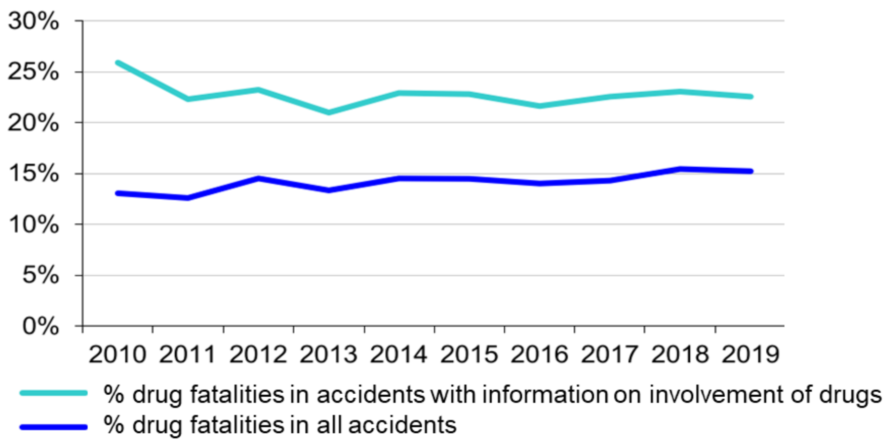
Figure 4.10 Fatalities with involvement of drugs and medicines in Denmark 2010-2019



The latest OTI substance abuse report looked at fatal collisions investigated in **Finland** over the period 2014–2018 and drivers who had been driving under the influence of alcohol or drugs or both. For 837 of the 907 drivers who caused fatal motor vehicle accidents, it is known whether they were driving under the influence of alcohol, drugs or medicines that affected their ability to drive. About these drivers one-third (n = 280) drove under the influence of any of the above-mentioned intoxicants. Of these drugged-drivers, 198 drove at least under the influence of alcohol, 80 at least under the influence of drugs and 76 at least under the influence of a drug that affects driving ability. Some 18% (n=51) of the drivers were under influence of drugs or medicines only. Eighty-five percent (n = 157) of alcoholic drinkers drove exclusively under the influence of alcohol, while one in five (n = 40) had other substances in their blood in addition to alcohol (Finnish Crash Data Institute (OTI), 2020).

In **France**, the share of fatalities based on the number of accidents where information on drug involvement was available has remained fairly constant over the past decade, while the share of fatalities with involvement of drugs in the total number of fatalities has slightly increased. Among the 453 drug-positive drivers involved in a fatal accident in 2019, half (228) also has BAC > 0.5 g / L. A similar proportion is also found in bodily accidents. Furthermore, of the 670 drivers who were involved in a fatal accident in 2019 and tested positive for alcohol, 34% were also positive for at least one narcotic (ONISR, 2020).

Figure 4.11 Share of fatalities in accidents with involvement of drugs in France



Source: ONISR (2020).

Based on an analysis of victims of fatal road traffic accidents in over a 7-year period (2011-2017) **Greece**, psychoactive substances were detected in 348 (18.9%) of the victims (Papalimperi, et al., 2019). Cannabinoids were most observed (46.6%), followed by benzodiazepines (25.9%), opiates (16.4%) and cocaine (11.1%). The percentage of the RTA-related victims that had consumed alcohol in combination with other psychoactive substances was 4.5%.

Examination of toxicology results for 379 drivers killed during 2013-2017 in **Ireland** found 29% was positive for drugs, of whom 13% in combination with alcohol (Kervick, 2020). Of these:

- 11% had a positive toxicology for at least one benzodiazepine (e.g. diazepam, flurazepam);
- 10% had a positive toxicology for cocaine;
- 7% had a positive toxicology for cannabis;
- 7% had a positive toxicology for at least one opioid (e.g. heroin, codeine);
- 4% had a positive toxicology for at least one stimulant (e.g. MDMA, flephedrone);
- 3% had a positive toxicology for pregabalin or gabapentin (used in the treatment of epilepsy, generalised anxiety disorder or neuropathic pain);
- 3% had a positive toxicology for a z-drug (zolpidem or zopiclone, used in the treatment of insomnia).

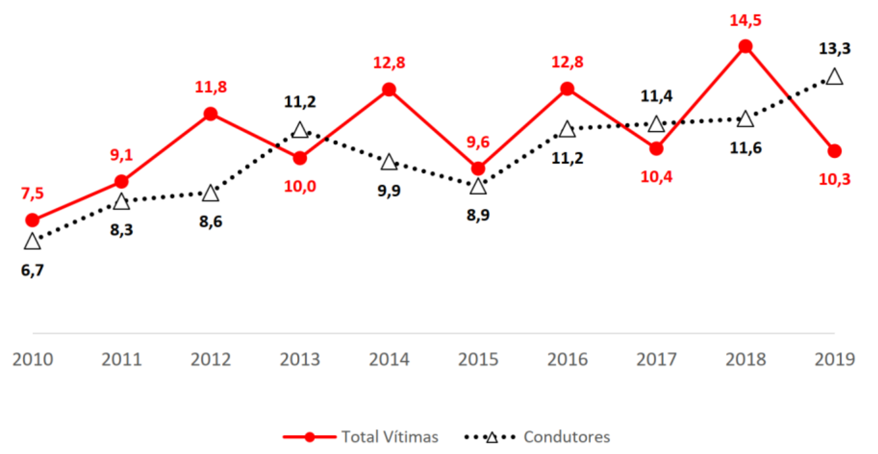
As becomes apparent from the above-mentioned percentages, more than one drug has been detected in some casualties. In some 6-7% of drivers at least two drugs have been detected.

An **Italian** study assessed the prevalence of drugs in Italian drivers involved in a road traffic crash and in predefined population subgroups (Pelletti et al., 2019). The blood samples were taken from 1026 drivers involved in a road traffic crash in the area of Bologna, Italy. The research was carried out between January 2017 and March 2018. The highest prevalence was found for medicinal drugs (13.6%) and illicit drugs (5.5%). The prevalence of benzodiazepines and Z-drugs (BDZ), antidepressants and antipsychotics (AA) and medical opioids (MO) were 7.3%, 7.2% and 3.1%, respectively. The frequency of BDZ and AA was significantly higher in female drivers and showed higher prevalence at increasing age.

In another Italian study (Barone , et al., 2019) toxicological analyses were performed on the whole blood of 7593 injured drivers involved in road traffic crashes between 2011 and 2018. Some 2.5% for cocaine, followed by opiates (2.0%), cannabinoids (1.5%), and amphetamines (0.5%). The overall prevalence of alcohol and drugs was lower than those reported in previous epidemiological studies of the DRUID project. The year 2011 showed the highest prevalence of drug-positive cases (24.1%), while the lowest prevalence was found in 2016 (16.8%), after the update of the Road Traffic Law which increased punishments for driving under the influence. A progressive increase in the number of alcohol-positive female drivers was observed from 2011 to 2018.

Toxicological analysis of victims of fatal road traffic accidents in **Portugal** has shown an increase of fatalities with involvement of drugs in the past decade. In the total of positive cases among fatal victims, the predominant substances were the cannabinoids (5.1%), with an emphasis on the association of alcohol and drugs (4.4%). In 2019, 10.3% of driver fatalities tested positive for drugs.

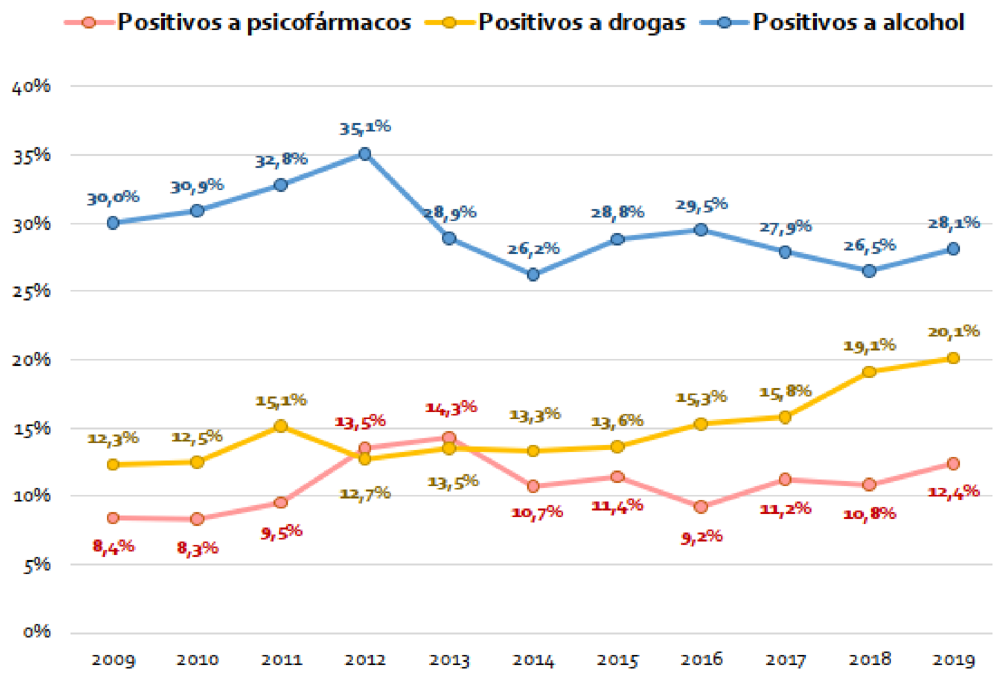
Figure 4.12 Share of total fatalities and drivers fatalities with involvement of drugs in Portugal, 2010-2019



Source: ANSR (2020).

In **Spain**, some 20.1% of driver fatalities was tested positive for drugs and 12.4% for medicines (INTCF, 2019). A comparative analysis of drivers killed in accidents from 2009 to 2019 shows an upward trend in drug use: it increases by almost 7.8 percentage points from 2009 (12.3%) to 2019 (20.1%). Especially, there has been an upward trend in the use of cannabis and cocaine since 2016 (INTCF, 2019).

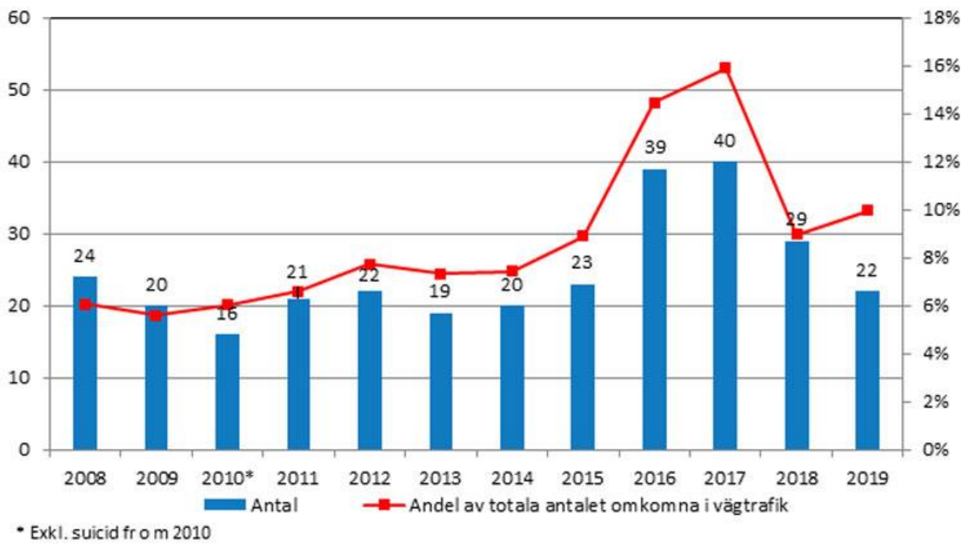
Figure 4.13 Share of driver fatalities with involvement of drugs



Source: INTCF (2019).

A study of fatal accidents by the Swedish Transport Administration shows 22 people (15 drugs + 7 both alcohol and drugs) died in drug-related accidents in **Sweden** in 2019, which is 7 people fewer than in 2018. Between 2015 and 2017, there was almost a doubling of the number of fatalities in drug-related accidents, from 21 to 40 people, while it in 2019 has decreased to about the same level as previous years. A review of all car drivers who died during the years 2005–2013 shows that amphetamine was the most common illegal drug (Forsman, 2015). The second most common was THC (cannabis).

Figure 4.14 Number and share of fatalities in drug-related fatal accidents in Sweden, 2008-2019



Source: Swedish Transport Administration (2020).

4.5 *Drugs in road traffic - Legal framework, enforcement and sanctions*

Similar to alcohol-impaired driving, drug-impaired driving is primarily addressed through a combination of law, enforcement, and education. This area of action falls within the competence of the Member States.

This section describes the legal frameworks in the EU Member States and other European countries for driving under the influence of drugs.

4.5.1 Drug limits

Most countries have specific legislation for driving under influence of drugs, but there is a lack of uniformity in the way in which nations approach the DUID problem (Marillier & Verstraete, 2019).

There are two basic types of laws that regulate dealing with impaired drivers. The first type is a *behaviour-based impairment approach*, which states that it must be proved that the driver was impaired or under the influence of drugs. Signs of impairment are usually observed and recorded by the police when they stop a driver. Most countries use a fixed testing protocol for police to follow (Atchison, 2017). The problem with such an approach is usually the lack of a single, common definition of impairment and the lack of unified methods to measure it. This kind of legislation is subjective and requires the assessment by a medical doctor or a specially trained police officer. As a consequence, many of the countries with this kind of legislation experienced difficulties in obtaining convictions (Marillier & Verstraete, 2019).

The second type is known as a *'per se' law*, which states that it is an offence to operate a vehicle with a concentration of drugs in the body fluids (mainly in whole blood), which exceeds the specified threshold value. The drug limit can be set in few ways (Wolf, 2017; Atchison, 2017). A threshold can:

- Be analytical and refer to a laboratory limit-of-detection. This is the lowest concentration of the drug that the laboratory can reliably differentiate from a concentration of zero and can positively identify according to predetermined criteria or levels of statistical confidence;
- Be technical and refer to the laboratory limit-of-quantification. This is the lowest measurable quantity of a drug that can be detected according to the technological limits of the equipment;
- Specifically relate to the effect of a drug. This is the lowest concentration of a drug, where there are changes in driver behaviour;
- Relate to risk. This is the lowest concentration of drug indicating a certain accident risk associated with driving under the influence of a drug above the threshold.

A special form of 'per se' law sets the threshold value at zero, which is often referred to as "zero tolerance." Any detectable amount of a relevant psychoactive substance is considered to break the law.

'Per se' laws for drugs are often viewed as a more efficient, effective means of dealing with drug-impaired drivers than a system that requires evidence of impairment. Since in the case of an offence, the prosecution does not have to prove that the driver was impaired, this kind of legislation facilitates the enforcement process. However, the fact that 'per se' law makes prosecution less difficult, but does mean, at least in theory, that drivers who are not impaired can be prosecuted (Stewart, K., 2006).

A per se approach has the potential to target individuals who use drugs and might have very low residual levels of drugs and who pose little risk to road safety. This could amongst others affect prescription drugs users, but also passive consumption/inhalation of drugs could result in concentration of a drug in the body. To limit this potential, there are several difficulties in setting thresholds, or cut-off levels, which need to be overcome. Difficulties relate to the fact that:

- There can be variations of the observed effects of the drug at different concentrations (i.e., pharmacodynamics) depend on the gender, weight, age, disease state of the individual and the extent of acquired tolerance to the substance (Vindenes, et al., 2011) (Wolff, Driving under the influence of drugs: report from the expert panel on drug, 2013) (Wolff, 2016) (National Transport Commission, 2018) (Canadian Centre on Substance Use and Addiction, 2019). Some drugs form active metabolites (e.g., diazepam) that can have impairing effects even after the level of the parent drug has waned. Per se laws would have to take into account the metabolic breakdown patterns of such substances (Canadian Centre on Substance Use and Addiction, 2019). Furthermore, the notion of threshold is not only complicated by individual differences but further by poly drug use and use of drugs in combination with alcohol, both of which are a regular occurrence;

- Deciding between any cut off level, is a difficult and somewhat arbitrary decision and cannot necessarily be applied to all drivers, with equal meaning, at all times, and across all circumstances. At the same time drugs can exert pharmacological effects at very low concentrations, typically in the order of nanograms, and drug driving limits will need to reflect (Wolff, 2013);
- There 'is no technology currently available which can accurately detect the level of impairment caused by drug-taking' (NTC, 2018). It is widely accepted that blood and, to a lesser degree, OF are likely to give the most accurate measurement of drugs currently active in the body. However, countries have adopted the use of use of different biological matrices (serum in Germany, plasma in Belgium and Luxemburg, and whole blood in most of the other countries) (Marillier & Verstraete, 2019). This choice is also affected by differences in how offences are treated within national legislation (i.e. criminal law v administrative sanction and cut-off which needs to be enforced). In general, more severe penalties and/or stricter limits that need to be enforced, require more accurate tests. OF tests cannot be used to give a precise prediction of the concentration of a drug in blood (or plasma or serum) and therefore prediction of possible drug effects (Wille et al, 2009; Gjerde & Verstraete 2010).

Taking these issues into account, in setting cut-offs, the following principle seems recommendable: setting a limit at the lowest level at which a valid and reliable analytical result can be obtained, yet above which issues such as passive consumption or inhalation can be ruled out— a "lowest accidental exposure limit" (Marillier & Verstraete, 2019).

It is worth mentioning at this point that some countries are trying to introduce some modifications to the 'per se' approach. The idea is that the threshold for a particular drug should reflect the impairment equal to legal BAC limit in the country. Such a proposal was suggested in the DRUID programme (Schulze, H. et al., 2012) and implemented in practice in the Netherlands.

Finally, the *'two-tier approach'* is a combination of impairment approach and 'per se' approach. This system combines the advantages of the two legal regulations. For a limited list of drugs, the per se approach allows easy prosecution, and the impairment legislation is used to cover less frequently used drugs and other special cases like combinations, withdrawal, etc. (Marillier & Verstraete, 2019).

The list of drugs to be included in 'per se' legislation depends on the situation in each country, e.g. the prevalence of drugs in driving population or among drivers involved in an accident. Most countries that apply a 'per se' approach have a limited list of 10 substances or less. The exceptions to this rule are the solutions introduced in Norway and the United Kingdom. Table 4.13 provides information on the solutions adopted in countries that have introduced 'per se' limit for selected drugs.

Table 4.13 Legal limit for drugs in European countries

	Controlled substances
Belgium	6 substances. In blood: THC – 1 ng/ml; amphetamine – 25 ng/ml; MDMA or ecstasy – 25 ng/ml; cocaine – 25 ng/ml; morphine – 10 ng/ml. In 2009 the law allowing the use of saliva tests and saliva analyses as legal proof was published. Different detection limits apply for saliva. Driving under the influence of other drugs may be punishable under Article 35 of the Road Traffic Act (impairment).
Ireland	9-Tetrahydrocannabinol (Cannabis) – 1 ng/ml; 11-nor-9-carboxy-9-tetrahydro-cannabinol (Cannabis) – 5 ng/ml; Cocaine – 10 ng/ml; Benzoylecgonine (Cocaine) – 50 ng/ml; 6-Acetylmorphone (Heroin) – 5 ng/ml; in whole blood.
Luxembourg	The maximum blood drug content authorised for the following drugs: THC – 1 ng/ml; amphetamine, methamphetamine, MDMA, MDA, cocaine, benzoylecgonine – 25 ng/ml; morphine – 10 ng/ml.
The Netherlands	Amphetamine – 50 µg/L; methamphetamine – 50 µg/L; MDMA – 50 µg/L; MDEA – 50 µg/L; MDA – 50 µg/L; group of amphetamines (used in combination) – 50 µg/L; cannabis (THC) – 3 µg/L; cocaine – 50 µg/L; heroin/morphine – 20 µg/L; GHB, gamma butyrolactone or 1.4-butanediol – 10 µg/L. The threshold values for impairment of fitness to drive have been set up to equal the impairment thresholds of alcohol use of 0.5 g/l. In combination, lower cut-offs apply for these substances

	Controlled substances
Norway	Benzodiazepines and z-hypnotics: Alprazolam – 3 µg/L (impairment limit – 6 µg/L); Clonazepam – 1.3 µg/L (3 µg/L); Diazepam – 57 µg/L (143 µg/L); Fenazepam – 1.6 µg/L (3 µg/L); Flunitrazepam – 1.6 µg/L (3 µg/L); Nitrazepam – 17 µg/L (42 µg/L); Oxazepam – 172 µg/L (430 µg/L); Zolpidem – 31 µg/L (77 µg/L); Zopiclone – 12 µg/L (23 µg/L). Cannabis: THC – 1.3 µg/L (impairment limit – 3 µg/L). Central stimulants: Amphetamine – 41 µg/L (impairment limit not defined); Cocaine – 24 µg/L (impairment limit not defined); MDMA – 48 µg/L (impairment limit not defined); Methamphetamine – 45 µg/L (impairment limit not defined). GBH: GBH – 10300 µg/L (impairment limit – 30900 µg/L) Hallucinogens: Ketamine – 55 µg/L (137 µg/L); LSD – 1 µg/L (impairment limit not defined). Opioids: Buprenorphine – 0.9 µg/L (impairment limit not defined); Methadone – 25 µg/L (impairment limit not defined); Morphine – 9 µg/L (impairment limit – 24 µg/L). 'Per se' limits equivalent to BAC of 0.2 g/L, 0.5 g/L and 1.2 g/L were introduced for 20 non-alcohol drugs.
Switzerland	Switzerland has a two-tier system based on impairment by any psychoactive substance which affects the capacity to drive safely and zero tolerance for the following illicit drugs: tetrahydrocannabinol (Cannabis), free morphine (metabolite of heroin), cocaine, amphetamine, methamphetamine, MDMA (methylenedioxymethamphetamine) or MDEA (methylenedioxyethylamphetamine). Actually, the set limits are 1.5 ng/ml for THC and 15 ng/ml for the other substances with a confidence interval of 30% of the measured value. For all other psychoactive substances (including medicinal drugs), impairment must be proven by applying the so-called "three-pillar expertise". In these cases, the evidence of impairment is based on police observation, medical examination and toxicological analyses.
United Kingdom	Illegal drugs ('accidental exposure' – zero tolerance approach): benzoylecgonine – 50 µg/L; cocaine – 10 µg/L; cannabis (delta-9-tetrahydrocannabinol) – 2 µg/L; ketamine – 20 µg/L; lysergic acid diethylamide – 1 µg/L; methylamphetamine – 10 µg/L; MDMA (Methylenedioxymethamphetamine) – 10 µg/L; heroin (6-monoacetylmorphine) – 5 µg/L. Medicinal drugs (risk based approach): clonazepam – 50 µg/L; diazepam – 550 µg/L; flunitrazepam – 300 µg/L; lorazepam – 100 µg/L; methadone – 500 µg/L; morphine – 80 µg/L; oxazepam – 300 µg/L; temazepam 1000 µg/L. Separate approach (to balance its risk): amphetamine – 250 µg/L.

Source: EMCDDA, 2020[35]; literature review and data collected from National expert panel (see annex 1).

Table 4.14 shows types of law for dealing with drug driving in individual countries, based on available data and information received from national experts.

Table 4.14 Types of law for dealing with drug driving in European countries and year of introduction

Type of approach	Country
Impairment approach	Austria, Croatia, Cyprus, Estonia, Greece (1977), Hungary, Latvia, Lithuania, Malta, Poland, Portugal, Romania, Slovakia
'Per se' limits	Netherlands (2017)
Zero tolerance	Bulgaria (2009), Czechia (1975), Finland (2003), France (2003), Germany[36], Italy (1988), Slovenia, Sweden (1999)
Two-tier system	Belgium, Denmark (2007), Ireland (2017), Luxembourg, Norway (2012), Spain (1992), Switzerland (2005), United Kingdom (2015)

Source: ECMDDA[37]; ITF, 2019; information collected from National expert panel (see annex 1).

[35] https://www.emcdda.europa.eu/publications/topic-overviews/legal-approaches-to-drugs-and-driving/html_en#panel6.

[36] Recommended analytical limits (in serum): THC=1 ng/ml, amphetamine=25 ng/ml, cocaine=10 ng/ml, morphine=10 ng/ml.

[37] https://www.emcdda.europa.eu/publications/topic-overviews/legal-approaches-to-drugs-and-driving/html_en.

The impairment approach is executed in 13 European countries, zero-tolerance or '*per se'* limits in 9, and a combination of these two approaches into a two-tier system – in 8.

Little is known about potential differences in effects between these regulatory approaches on the number of drugged drivers in traffic or on drug-related accidents and fatalities. For example, the introduction of the zero tolerance limit in Sweden in 1999 has not led to a reduction in the number of drivers who decided to drive after using illegal drugs, nor has the structure of drugs detected in blood samples submitted for toxicological tests changed. On the other hand, there has been a clear increase in prosecutions of drugged drivers in Sweden.

Preliminary evidence indicates that Norway's laws appear to have increased detections with little impact on general deterrence. The main benefit has been the significant reduction in the need for expert testimony to support charges (Schulze et al., 2012). In the UK, the 'Evaluation of the new drug driving legislation, one year after its introduction' (Risk Solutions, 2017) found prescription of upper limits for the level of specific controlled drugs in a driver's blood[38] did lead to additional police activity against drug drivers (e.g. prosecutions under the new Section 5A increased), but it was not possible to assess if driving while under the influence of those drugs had reduced.

Drug threshold legislation applied in the Netherlands has yet to be empirically analysed in regards to effectively deterring offending behaviours as well as prosecuting identified offenders.

Several studies[39] estimated alcohol per se laws are associated with an 8 to 15% reduction in alcohol-related fatal crashes. While it is often assumed that per se laws for drugs would have similar effects, to date there is a lack of empirical evidence to support this hypothesis (Canadian Centre on Substance Use and Addiction, 2019).

Following a review of international literature and practice in overseas jurisdictions, Australia's National Transport Commission draw a similar conclusion that, there is no evidence available they believed justifies a shift away from their 'presence based' position currently adopted by all states and territories' (National Transport Commission, 2018).

Also, a study into the effect of passing driving under the influence of drugs (DUID) per se laws on the volume of DUID arrests and on conviction patterns in the US could not assess, as data to directly address those issues were not available. A general consensus among law enforcement officers was the adoption of drug per se laws did not necessarily make enforcement easier, but did have a positive effect on prosecution. This general perception was shared by prosecutors interviewed (Lacey, Brainard, & Snitow, 2010).

4.5.2 Drugs enforcement and detection

In most countries (in 26 out of 30 analysed) the police have the right to stop drivers randomly for drug driving checks. In three countries: Estonia, Switzerland and the United Kingdom, a driver may only be stopped for drug checks if the police officer suspects that the driver is impaired by drugs. Besides that, in Ireland drivers can be randomly stopped if driving through a designated intoxication checkpoint. However, it seems that despite the legal basis, random checks on the presence of drugs in the body are rarely carried out in Europe. In some countries police also has the right to test drivers randomly, but due to costs and duration of the testing, in practice tests are done when there is a suspicion.

During roadside checks, the police in most countries use the oral fluid device as a pre-test. The exceptions are Greece, Hungary, Latvia, Malta, Slovakia and Sweden, where such devices are not used. Also, in Croatia the oral fluid test can be used before a test of physical or behavioural signs (such as pupil dilation or ability to walk in a straight line), and in Luxembourg – after such test.

---

[38] Section 5A of the Road Traffic Act 1988.

[39] Mann, R.E., Macdonald, S., Stoduto, L.G., Bondy, S., Jonah, B., & Shaikh, A. (2001). The effects of introducing or lowering legal per se blood alcohol limits for driving: An international review. Accident Analysis and Prevention, 33(5), 569–583. Tippetts, A.S., Voas, R.B., Fell, J.C., & Nichols, J.L. (2005). A meta-analysis of.08 laws in 19 jurisdictions in the United States. Accident Analysis and Prevention, 37, 149– 161. Villaveces, A., Cummings, P., Koepsell, T.D., Rivara. F.P., Lumley, T., & Moffat, J. (2003). Association of alcohol-related laws with deaths due to motor vehicle and motorcycle crashes in the United States, 1980–1997. American Journal of Epidemiology, 157, 131–140.

If the behavioural or oral fluid test is positive, a second sample is collected for evidential analysis. Toxicology tests are based on blood analysis (less often on saliva or urine) and performed in a hospital or laboratory. It is important to keep in mind that a positive drug test does not necessarily indicate "impairment". The level of drugs detected may have been too low to be considered as impairing.

Table 4.15 shows the number of roadside police drug checks per 1000 inhabitants in the last ten years for countries for which information could be obtained. In the table, the countries were listed according to the indicator value in 2019.

Table 4.15 Number of police checks for drug-driving per 1000 inhabitants by country, 2010-2019

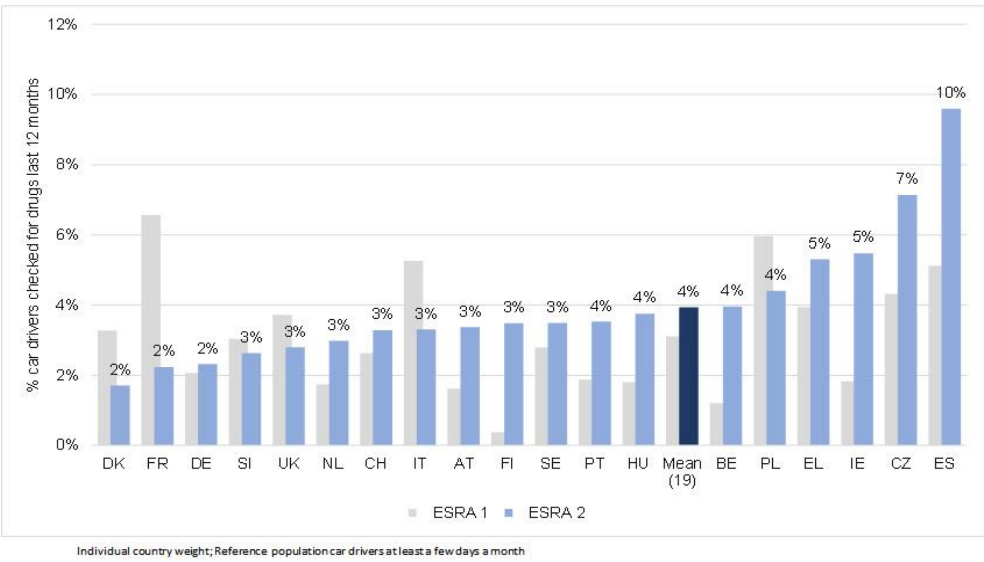
	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
Finland	0.54	0.69	0.76	1.05	1.34	1.50	1.64	2.11	2.68	2.70
Spain		0.02	0.07	0.10	0.64	1.64	1.40	1.93	2.99	2.03
Slovenia					0.38	0.35	0.44	0.68	0.60	0.78
Ireland								0.14	0.42	0.72
Netherlands	0.06	0.06	0.06	0.06	0.06	0.06	0.07	0.12	0.33	0.60
Poland	0.09	0.28	0.23	0.15	0.22	0.23	0.22	0.28	0.50	0.43
Italy						0.02	0.02	0.04	0.04	0.04
No data available: Austria, Belgium, Bulgaria, Czechia, Denmark, Estonia, Germany, Greece, Hungary, Latvia, Lithuania, Portugal, Romania, Sweden, Switzerland, United Kingdom										
Lack of data: Croatia, France, Luxembourg, Malta, Norway, Slovakia										

Source: data collected from the National expert panel (see annex 1).

Enforcement intensity (i.e. number of checks per 1 000 inhabitants) was highest in Finland (2.70) and Spain (2.03), and least in Italy (0.04) and Poland (0.43). In recent years, the number of police checks has been increasing, but their intensity is still very low, considering average the number of checks for alcohol of European countries (n=13) was 202 per 1 000 inhabitants (see Table 3.18) in the same year.

The relatively low enforcement intensity for driving under influence of drugs is also reflected in results of public surveys (ESRA studies) where car drivers were asked whether the police had checked them for alcohol in the last 12 months. The figure below shows the percentage of responses 'At least once' to the same question in 2015 and 2018.

Figure 4.15 Percentage of respondents who admitted they had been checked by police for drugs at least once during the last 12 months in ESRA1 (2015) and ESRA2 (2018)

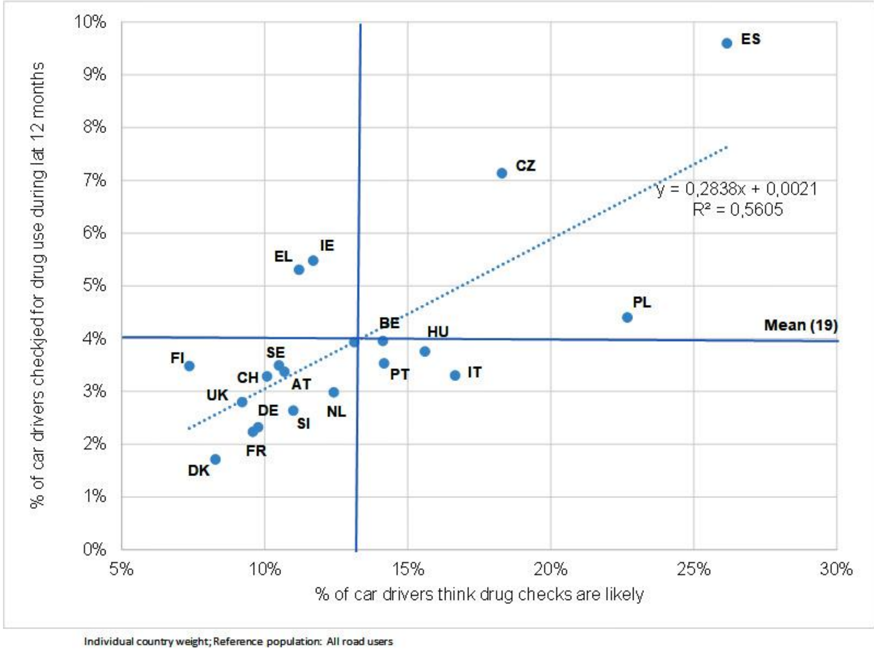


Source: ESRA1, 2015; ESRA2, 2018.

The figure shows that in 2018 on average 4% of respondents had at least once undergone drug checks during the last 12 months, against 23% for alcohol. Since 2015, the intensity of police checks has not changed much, although there are differences between countries. For example, statements from car drivers in France, Italy, Denmark and Poland indicate that the number of drug checks in these countries has decreased, while in Spain, Ireland and Czechia it has increased.

As shown by Figure 4.16, there is a strong correlation between respondents' opinions on the probability of a drug check and their past experience of such checks.

Figure 4.16 Percentage of respondents checked for drug driving and those who thought that police drug check on a typical journey was likely to happen in 2018

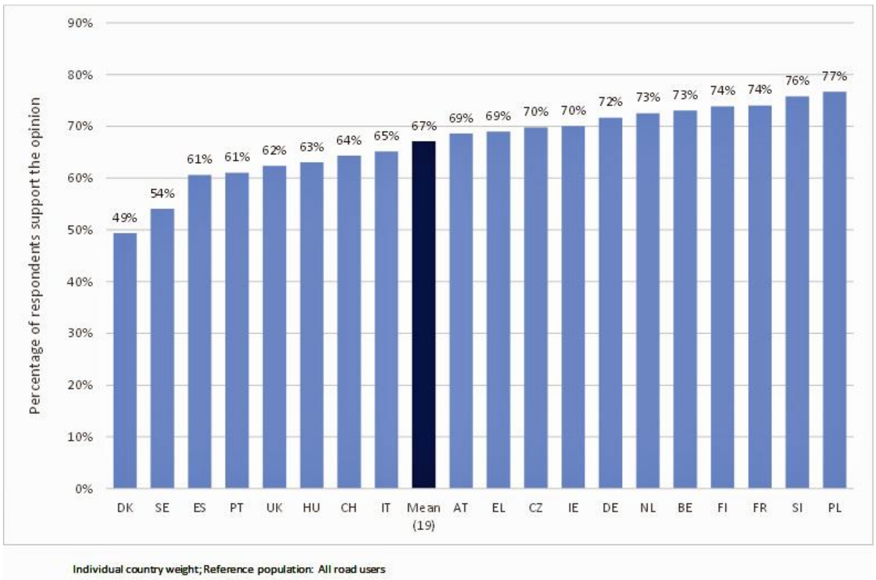


Source: ESRA2, 2018.

Perhaps not surprising given the two findings of the ESRA studies, the studies also found only 13% of surveyed drivers thought that they could undergo a police check, where the presence of drugs in the driver's body would be checked. The differences between countries are very clear. Respondents from Finland, Denmark and France have the lowest estimate of the likelihood of such an event; those from Spain, Poland and Czechia have the highest estimates. It is very difficult to estimate the impact of actual police activities in this regard on these opinions, as most of the countries analysed in the report do not collect data on the number of carried out police drug checks.

The (perceived) limited likelihood of being checked for driving under the influence of drugs, is also met with disapproval by respondents when asked in the ESRA1 study in 2015 whether road traffic regulations on drugs are sufficiently enforced (see Figure 4.17). In 2018, the question was not included in the questionnaire.

Figure 4.17 Percentage of road users who support opinion that drug traffic rules are not being checked sufficiently



Source: ESRA 1, 2015.

There is consensus among most researchers that the frequency of testing should increase and that highly visible testing units are necessary to create an effective deterrence of DUI (Davey, Armstrong, Freeman, & Sheldrake, 2017) (Goldenbeld, Torfs, Vlakveld, & Houwing, 2020) (Ministry of Transport, New Zealand, 2020) (Schulze et al., 2012). However, cost (i.e. funding limitations) are frequently mentioned as the key factor limiting large scale deployment of roadside testing. Rather, selective checks will be carried out (for example in the case of events where drug use is suspected) or selective cases where there is a suspicion of drug use on the basis of concrete indications, such as conspicuous driving behaviour, the physical appearance of the driver, a smell of cannabis or the presence of drugs in the vehicle (Abraham & Oberon, 2017).

In fact, relatively few studies have currently examined the impact of corresponding drug driving enforcement practices (TISPOL, 2012). There is limited empirical evidence on drug-driving deterrence, as evaluation of the road safety impacts of roadside drug testing has generally been poor in jurisdictions that operate the schemes. Existing evidence is also mixed. In the previous section examples from Norway, Sweden and UK were already provided, where no effects on drug-driving could be established from increased enforcement of drug-driving regulations. Also various studies (Horyniak, et al., 2017) (Davey, Armstrong, Freeman, & Sheldrake, 2017) in Australia did not find evidence roadside drug testing had a specific deterrent effect on drug-driving. In addition, using data for various European countries from the ESRA2 survey, Goldenbeld, et al (2020) found enforcement-related expectations and experiences are only weak predictors of self-reported drug driving. Drivers who had experience with being checked for drugs and a higher perceived likelihood being checked for drug driving, were more likely to engage in this risky behaviour. For Goldenbeld, et al (2020) this does not cast large doubt over the validity of the basic hypotheses from deterrence theory (i.e. enforcement creates deterrence). Explanations are offered in the facts that these drivers may show driving behaviours that alert the police to them; that drivers who use drugs do so at times and near locations where police may focus enforcement efforts, and, that these drivers are more motivated to look for and notice police checks.

A cost benefit analysis for increased drug-driving enforcement in Belgium, the Netherlands and Finland as part of the DRUID project concluded that increased drug-driving enforcement based on roadside oral fluid screening is potentially cost-beneficial. However, this is by no means straightforward, and depends on the initial levels of both drug prevalence and law enforcement.

4.5.3 Drug sanctions

A variety of legal sanctions are applied to drug drivers throughout Europe. Differences exist in the way these sanctions are administered, depending on whether the primary objective is to punish, restrain or reform offenders.

If drivers are found guilty, they can be, as in case of drink driving, fined, banned from driving or even imprisoned. The sanctions for drug driving offences vary between countries, and in the majority of European countries are similar to sanctions for drink driving.

The (weights of the) penalties is linked to the offence, much like penalties for drink driving. Circumstances, like whether it is a first-time offence, whether multiple substances were used or whether there damages occurred in relation to the offence, can be taken into account when determining the weight of a penalty.

In countries with impairment approaches the public authority has to demonstrate that the driver was impaired, not fit to drive or “under the influence”. The analysis of drugs in body fluids only provides corroborating evidence as to the cause of the impairment. This kind of legislation is subjective and requires the assessment by a medical doctor or a specially trained police officer. As a consequence, many of the countries with this kind of legislation experienced difficulties in obtaining convictions.

A “per se” law prohibits driving if drugs are present in blood, serum, plasma, or OF above a certain threshold. As mentioned in section 4.5.1, thresholds can vary per drug. The range is not as wide as BAC limits and in many countries and for many drugs as zero-limit is applied.

In two countries, the Netherlands and Norway, the drug thresholds refer to disorders that occur in the driver when the blood alcohol level is above a given level. This makes it possible, at least in theory, to use existing penalty sets for drink driving.

There are differences across European countries in who applies penalties for drug-driving offences. In some countries, all cases are dealt with in court, while in others cases are dealt with through an administrative process rather than in the courts enables the court to focus on other cases involving and it also demands less Police resources for preparation of court briefs, etc.

Table 4.16 Driving license suspension and monetary fines for drug driving in European countries

	Type of law	Driving licence suspended/revoked	Fines (in Euro)
AT	Impairment approach	1 month (from 3 months for recidivists)	800-3700
CY	Impairment approach	Up to 3 years	Up to 8000
EE	Impairment approach	(Traffic Act) None	(Traffic Act) Up to 1200 (drug use offence)
		(CC) Up to 3 years	(CC) 30-500 daily rates (average daily income)
EL	Impairment approach	3-6 months	Hefty fine in the court
HR	Impairment approach		
LT	Impairment approach	12-18 months	800-1100 (fine or detention)
LV	Impairment approach	(AVC) Up to 4 years	AVC) Any drug: 1200-1400; Medicinal product: 40-280
		(CC) Up to 5 years	(CC) Fine not exceeding fifty times the minimum monthly wage
MT	Impairment approach	At least 6 months	At least 1200
PL	Impairment approach	(Driving after drugs) 6 months – 3 years	11-1092
		(Driving under the influence of drugs) Minimum 3 years	A fine in the number of daily rates from 10 to 540, with a daily rate of between 2.2 and 437
PT	Impairment approach	2 months – 2 years	500-2500
RO	Impairment approach	90 days Cancellation possible for sentence of detention (suspended or not)	30-400 day-fines (10-500 Ron per day)
SK	Impairment approach	(AAO) Up to 1 year	(AAO) 200-1000, or up to 3500 (legal person)
		(CC) 1-10 years (general ban on activity)	(CC) 160 to 31 930 (general fine)
NL	Per se approach	Up to 5 years	6700 If accident causing bodily injury – up to 16 750; If fatality – 16 750, or 67 000 if reckless
BG	Zero tolerance approach	Court's decision	256-767
CZ	Zero tolerance approach	6 months - 1 year	100-800
		1-2 years, in serious cases up to 10 years	1000-2000
DE	Zero tolerance approach	(Road Traffic Code) 1-3 months	(Road Traffic Code) Up to 3000
FI	Zero tolerance approach	Up to 5 years	A fine depending on income (unit fines). Drug driving penalties are given according to drink driving (aggravated or not); Punishment level depends on police's statement on the influence of drugs in driving

	Type of law	Driving licence suspended/revoked	Fines (in Euro)
FR	Zero tolerance approach	Up to 3 years	4500; if the driver is also under the influence of alcohol – 9000
IT	Zero tolerance approach	1 up to 2 years (2 up to 4 years if driver is not the vehicle owner)	1500-6000
SE	Zero tolerance approach	At least 1 year	50 rates (If it’s not considered to be a severe offence, then it is the same as for >1 g/L alcohol, imprisonment)
SI	Zero tolerance approach	6 months – 1 year	From 1200
BE	Two-tier approach	1 month – 5 years	1000-10 000
DK	Two-tier approach	3 years	One month net salary (approximately)
IE	Two-tier approach	Min. 1 year; Offence of exceeding the legal limits for cannabis, cocaine or heroin	Up to 5000
		Min. 4 years; Offence of drug-driving while impaired	
ES	Two-tier approach	(Presence) No	1 000
		(Influence) 1-4 years	No information
LU	Two-tier approach	1 month – for life	250-5000
CH	Two-tier approach	at least 3 months	Depends on many factors
NO	Two-tier approach		Fine is proportional to the offender’s salary. Fines escalate as the drug concentration increases.
UK	Two-tier approach	Minimum 1 year (unlimited maximum)	Unlimited

Source: Information collected from national expert panel (see annex 1); EMCDDA; Atchison, 2017.

There is no research evidence on whether the administration of penalties is more effective via the courts or administratively (National Transport Commission, 2018). The primary motivation for jurisdictions that have moved offenders away from the court system is largely to ensure offences are dealt with quickly to create a better deterrent. It also reduces some burden on the court system which can be under great stress and reduces police time and resources involved in preparing court briefs.

It is practically impossible to summarise the information contained in the table above. There are no reference points because there have been no evaluations of the effect of drug-impaired-driving laws on the prevalence of drug-impaired driving or accidents (Richard, 2018). However, it is worth recalling at this point the recommendations on the application of the penalty of driving licence suspension, as developed under the DRUID project. An analysis of the legal procedures for dealing with drunk drivers in European Union countries (Kærup, S. et al., 2009) has shown that:

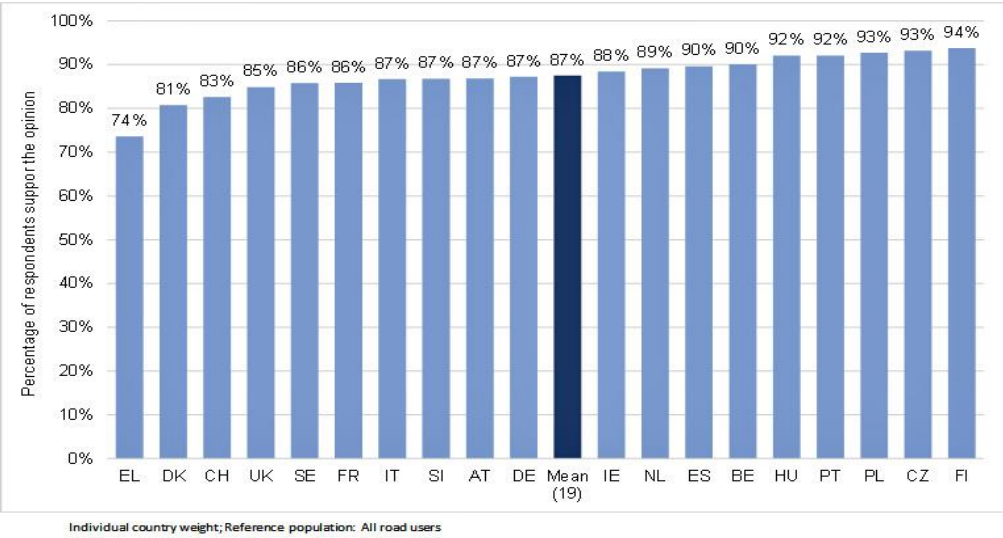
- A driving ban is a more effective method of general deterrence than, for example, financial penalties or imprisonment, but its effectiveness depends primarily on whether the police can enforce the ban;
- The effectiveness of a driving ban depends on the certainty of the penalty and the speed with which it is awarded, less so on its severity;
- The administrative procedure for issuing a driving ban is more effective than the criminal procedure, primarily because it is usually quicker and more certain than judicial procedures. Also, the issuing of driving bans as part of the criminal procedure involves a very large variation in the level of sentences;
- The administrative procedures for issuing driving bans result in a decrease in the rate of recidivism, both in the group of drivers who have committed an offence for the first time and in the group of drivers who have committed two or more such offences;
- The introduction of additional solutions can strengthen the deterrent effect of a driving ban: for example, medical and psychological examinations, compulsory training, and alcohol lock installation programme, the introduction of obligatory social work, etc.;

- A ban on driving for a short period (for several or more hours) is ineffective. The best results were achieved when the ban was in force from 3 to 12 months. Extending the period of suspension of a driving licence increases the probability of drivers deciding to drive without a valid driving licence.
- In the United States, it is estimated that between 25 and 75% of drivers who have been temporarily or permanently withdrawn from their driving licence continue to drive (McCartt et al., 2003; Goodwin, A. et al., 2013). The worst results were recorded when the driving ban was longer than three years.

These conclusions are based on an analysis of legal actions against drunk drivers. It is difficult at the moment to assess whether they would also work if were applied to drugged drivers.

It is also worth mentioning the results of public opinion polls with regard to sanctioning. In ESRA study, respondents were asked how they had assessed the regulations on driving after drug use. shows the answers received.

Figure 4.18 Support (%) for stricter traffic rules for driving under the influence of drugs



Source: ESRA1, 2015.

The results presented in the figure indicate that most road users in Europe (on average 87%) believe that road traffic regulations for drug driving should be stricter. However, it is difficult to assess whether these opinions are the result of an evaluation of the legal solutions already in place, or rather an expression of the more general belief that the problem of drug driving is an important road safety problem, but authorities are not managing to solve this problem.

4.6 *Conclusions*

The main conclusions regarding the drug driving in Europe are presented below:

- At least 29% of all people in Europe aged 15-64 have used illicit drugs at least once in their lifetime. The most frequently used drugs were cannabis, cocaine, MDMA and amphetamines. The use of drugs, including medicines can have negative impact on several driving skills, such as attention, tracking, reaction time, information processing, perception, psychomotor skills, visual function, divided attention tasks, cognitive and executive functions, car following, lane keeping, speed control and emergency manoeuvres. However, large variations in impact have been found between individual drugs, combination of drugs, duration of use and between users. Much is still unclear about these variations;
- Prevalence of drugs in traffic is becoming more apparent. The share of persons driving under the influence of drugs in the general driving population is estimate between 2-5% based on roadside and self-report survey data. On some days and times (e.g. weekend, nights, holidays) this share can increase to an estimated 27% on average. THC and benzodiazepines are most observed;
- Findings from research suggest an increased risks of accident involvement, including with injuries or fatalities, related to drug-driving in relation to some drugs. Increased risks have been found for amphetamines in particular, but also for cocaine and benzodiazepines. The

majority of estimates indicate that the increase in risk is lower than twofold, far less than for alcohol. The increase in accident risk is largest for fatal accidents. However, findings are inconsistent, in particular for THC. Many studies are based on small sample size, are difficult to compare and some have been criticised for lack of methodological rigour;

- The share of fatalities with drug involvement has increased in almost all European countries over the past decade. In 2018 (the last year in which it was possible to collect data from a larger number of countries (N=16), around 1,020 people died in drug-related road accidents, which represents 6% of all deaths in road accidents in these countries. Extrapolating this share to the EU27, this would result in some 1,360 drug-related driving fatalities for the EU27. At the same time, epidemiological studies of traffic fatalities at national level have found higher shares of fatalities with involvement of drugs. It is roughly estimated this share of fatalities with involvement of drugs (including medicines) is at least 15-25%. Much more than for alcohol, definitions and methodologies applied to trace and record drug-related fatalities differ between countries;
- Three types of legislation exist to regulate driving under influence of drugs: "impairment" legislation, "per se" legislation and the "two-tier" approach that combines both. The impairment approach is executed in 14 European countries, zero-tolerance or '*per se'* limits in 9, and a combination of these two approaches into a two-tier system – in 7. There is no strong evidence on differences in impacts between these approaches the number of drugged drivers in traffic or on drug-related accidents and fatalities. In addition, little is known about the effects of applying stricter norms or thresholds on deterrence of driving under influence of drugs;
- In most countries (in 26 out of analysed 30) the police have the right to stop drivers randomly for drug driving checks. However, it seems that despite the legal basis, random checks on the presence of drugs in the body are rarely carried out in Europe. Due to costs and duration of the testing, tests are practically done when there is a suspicion. During roadside checks, the police in most countries use the oral fluid device as a pre-test;
- Only seven countries provided data on the number of police checks for drug driving. Enforcement intensity (i.e. number of checks per 1 000 inhabitants) has been increasing in the past decade, but their intensity is still very low, considering average for alcohol of European countries (n=13), which is almost 200 times higher. Some 13% of drivers in the ESRA survey expected they would be stopped by police and checked for driving under influence of drugs;
- The sanctions for drug driving offences vary between countries, and in the majority of European countries they are similar to sanctions for drink driving. In most countries there is no differentiation of penalties according to the type of drug or its concentration in the human body. In such situation it is the judge who decides about the penalty.

5 Technologies for alcohol enforcement

5.1 *Roadside Impairment Testing alcohol*

Roadside Impairment Testing (RIT) involves the testing of psychomotor functions and cognitive functions of a driver suspected of DUI. First developed in the mid-1970s in the US by the NHTSA, the test is better known as the Standard Field Sobriety Tests, although in Europe various other names are use at national levels. It consists of a battery of three tests administered and evaluated in a standardized manner by specially trained law enforcement officers at roadside to assist them in making an arrest decision:

- Gaze Nystagmus Test, assessing the size of the suspect's pupils, and the condition of their eyes (this can help indicate whether drugs are present and what type of drug has been used);
- One-leg stand test – ability to balance on one leg;
- Walk and turn test – tests ability to follow multiple instructions, to stand still, and to perform the actual walk and turn as instructed.

Additional test are included in the also American Drug Evaluation and Classification (DEC) system which adds:

- Romberg test – a test of whether the suspect can remain still, and judge whether a certain amount of time has passed;
- Finger and nose test – where the suspect is asked to close their eyes and touch the tip of their nose with the forefinger of one hand (this tests spatial awareness);
- Initially validated for BAC level of 0.1 g/L, a study by (Stuster & Burns, Validation of the Standardized Field Sobriety Test Battery at BACs Below 0.10 Percent, 1998) found the SFSTs to be extremely accurate in discriminating between BACs above and below 0.08 percent. SFST-based estimates at the 0.08 level were accurate in 91 percent of the cases, or as high as 94 percent if explanations for some of the false positives are accepted.

Although no studies have explicitly assessed the relatedness of cognitive ability and performance on the SFST, there is evidence of the validity of the SFST Battery as an accurate and reliable decision aid for discriminating between BACs above and below 0.8 g/L[40] (Stuster, 2006). Yet, another study found the accuracy of the SFSTs depends on the BAC level and is much poorer than that indicated by Stuster and Burns whose study was heavily weighted by the large number of subjects with very high BAC levels (Hlastala, Polissar, & Oberman, 2005). Also, an UK based study (Dixon, Clark, & Tiplady, 2009) found the impairment test to have a diagnostic accuracy of 62.7%.

Although studies have concluded there is some correlation between roadside impairment test results and BAC levels, especially at higher BAC levels (>0.8 g/L), the main method applied to detect alcohol use among drivers, is the use of screening devices.

5.2 *Screening devices for alcohol*

EU Member States all use screening and evidence devices to determine the BAC. These devices are adapted or adaptable for the various BAC limits in the EU and have to be type approved for each Member State and calibrated before they can be used in operational traffic policing.

Technologies for detection and analysing alcohol concentration in blood or breath, may be sorted by their main features. The two following main technology groups are:

- Invasive/intrusive technologies;
- Non-invasive/non intrusion technologies.

Most technologies for detection of alcohol impairment in people are invasive or intrusive. They demand a sample of blood, saliva, urine (equal to blood testing) or breath air from the person.

[40] It can be noted that the purpose of the test was to provide statistically valid and reliable indications of a driver's BAC, rather than indications of driving impairment.

5.2.1 Invasive/intrusive technologies

The alcohol in the human body may be excreted in the breath, through the skin, or in the urine or sweat. Excretion through the skin is very low at just one per cent, but it has a distinct advantage. The quantity of alcohol which passes out of the body by that route, gives a clear picture of the alcohol concentration in the body, with a delay between half an hour and two hours. This makes it an easily accessible marker for alcohol consumption.

Invasive/intrusive technologies demand a sample of either blood, saliva or breath. The capture of a blood sample and the related analysis, has to be done by medical personal, which makes it both cost and time consuming. However, this technology is capable of detection both alcohol and any drug or narcotics with an undisputable accuracy, reliability and security. For many years, only these results from blood tests would hold up as evidence in the Court of law in most countries.

Another roadside test being introduced by police forces is based on saliva. Saliva testing is mostly for detection of drugs and narcotics. It gives a fairly accurate reading of detection, but has to be followed by a blood test analysis in case of prosecuting the perpetuator in a court of law.

The most prevalent technique by which a driver's alcohol level can be detected is breath analysis. Breath analysers are the new roadside test instruments in use by the police. It is an alcohol screening device, capable of detecting alcohol impairment through a breath test. The tested person must take a deep breath, and then blow in a constant stream through a mouthpiece. The common routine used by police for random roadside testing in most countries, consists of a two-step procedure.

In the first step, is usually based on a handheld breath tester or ‘alcometer’. By breathing over such test device, breath passes it into a fuel cell sensor that can detect very small amounts of alcohol. These testers do not give an accurate reading of BAC, but only an indication if alcohol is present. If any alcohol is detected, a breath screening test will be required. This second step is performed with more advanced instruments providing output which can be used as judicial evidence.

There are a few primary types of breath analyser devices for determining blood alcohol levels in the body, each based on a different technology:

Screening devices

The technology of breath-alcohol testing has changed dramatically over the years from chemical oxidation and colorimetric procedures towards physicochemical techniques such as gas chromatography, electrochemical oxidation, and multiple wavelength infrared spectrophotometry. In the early 1980s evidential breath-alcohol instruments were approved for law enforcement purposes in many European countries and threshold limits of BrAC were introduced alongside the existing statutory BAC limits.

For screening devices based on breath analysis three main technologies are in use:

- Electrochemical sensors (fuel cell) technology (compliance with EN 50436);
- Semiconductor sensor technology (non-compliance with EN 50436);
- Infrared spectrometry.

Electrochemical sensors (fuel cell, compliance with EN 50436)

The dominating sensor technology in present screening and devices and alcohol interlocks is based on catalytic combustion, either in fuel cells or in heated metal oxide mixtures. Reliability and long-term stability are issues with both sensor types, due to degradation and possible contamination of the catalytic surfaces. The devices require periodic recalibration and occasional replacement of degraded sensor elements.

The electrochemical sensor technology for both screening devices as alcohol interlocks, has gone through a significant development process over the last 3 decades, since they were introduced around 1990. The time for testing period has vastly been cut down from several minutes to less than 30 seconds for the premium type of alcohol interlocks. In line with the alcohol interlock standard (CLC EN 50436 published in 2005), the certified device should perform the same quality level as any other instrument or piece of equipment in a motor vehicle.

Where use of alcohol interlocks has been made mandatory for some specific vehicle categories in some countries (Norway, Finland, France, and Sweden) these instruments have to comply with the CENELEC standard EN 50436. The same is the case with the new EU regulation for type approval of vehicles (2018/858, 16/04/2019) where automotive industry are bound to prepare vehicles for installation of alcohol interlocks in order to receive type approval for their vehicles in the EU/EEC markets. Most rehabilitation/offender programs are using alcohol interlocks that are based on the electrochemical sensor (fuel cell) as infrared technology is more complicated and expensive.

Semiconductors (Not compliant with EN 50436)

These sensors are solid-state devices composed of sintered metal oxides which detect gas through an increase in electrical conductivity when reducing gases are adsorbed on the sensor surface. They are reactive when heated to 350 °C to 400 °C. Their sensitivity and accuracy is dependent upon ambient conditions of temperature and humidity. They are also dependent on the concentration of oxygen in the breath which, in turn, is influenced by the way the breath sample is delivered. Their long term stability may be limited.

While chemical formulation of the metal oxide and operating temperature of the sensor will result in some improvement in selectivity of response to target gases, semiconductor sensors are generally non-specific in response to reducing gases such as hydrocarbons and volatile organic compounds. Semiconductor sensors have been used extensively in low cost breath alcohol testers in which lower levels of accuracy are acceptable. Most of alcohol testers available in the market for personal and private use, are based on semiconductor technology. They may perform an indication, but may deviate from the exact figures at high and low BAC.

However, in an automotive environment cross sensitivity with hydrocarbons from fuel and vehicle exhaust renders the application problematic. Swedish SAAB automotive factory worked for almost a decade to develop semiconductor alcohol interlocks as a standard safety equipment in the SAAB cars. In the end, the semiconductor alcohol interlock was impossible to make in compliance with the CLC EN 50436 standard, and the project was dismissed.

Infrared transmission spectroscopy without a mouthpiece

Breath sampling without the use of a mouthpiece involves one basic difference from conventional techniques. Since the sample is mixed with ambient air, it is necessary to correct the breath alcohol concentration for the dilution. The approach to this problem is simultaneous measurement of carbon dioxide (CO2) at the same sampling point as for alcohol. As a first approximation, one may neglect the CO2 concentration of ambient air in comparison to its alveolar concentration, CintCO2, which, again as a first approximation, may be considered to be constant at 4.8 kPa [3]. With these approximations, the internal breath alcohol (ethanol, EtOH) concentration CintEtOH can be determined from external measurements using simple equation.

The mixing ratio may typically range from 20 to 60% at a sampling point 5-15cm from the mouth. This mixing ration can be determined either by measurements of water vapor concentration, or by temperature. The mucous tissues of the airways is normally wet, resulting in a water vapor concentration of expiratory air close to saturation at the prevailing body temperature.

This technology has been developed by Autoliv Industries in Sweden over the last two decades, but has not so far reached commercial use in cars. Some Swedish harbours with commercial ferry traffic from abroad, poles with this technology have been introduced, where truckdrivers have to deliver a breath test to open the gate. The CLC BTTF 116-2, Alcohol Interlocks, following initiative from Sweden, started in 2007 to develop a standard (EN 50436 part 5) for this technology, but so far it has not been finished. The technology would have to handle a lot of variables of circumvention in order to be accurate and not allowing perpetuator to pass when they should have been halted.

5.2.2 Non-invasive/non-intrusive technologies

Breath-based devices require the driver to exhale into a specific device. As mentioned, although generally considered as extremely minor, also use of breath can be considered an intrusive. Early in the decade following the turn of the century, the Trough Touch Technologies developed concepts for non-invasive/non-intrusive methods for detection of alcohol in a human body. Later integrated in Driver Alcohol Detection System for Safety (DADSS).

The National Highway Traffic Safety Administration (NHTSA) and the Automotive Coalition for Traffic Safety (ACTS) began research in February 2008 to discover potential in-vehicle approaches to the problem of alcohol-impaired driving. Members of ACTS comprise motor vehicle manufacturers representing approximately 99 percent of light vehicle sales in the U.S. This cooperative research partnership, known as the DADSS Program, is exploring the feasibility, the potential benefits and the public policy challenges associated with a broader use of non-invasive technology to prevent alcohol-impaired driving. The 2008 cooperative agreement between NHTSA and ACTS for Phases I and II outlined a program of research to assess the state of detection technologies that are capable of measuring Blood Alcohol Concentration (BAC) or Breath Alcohol Concentration (BrAC) and to support the creation and testing of prototypes and subsequent hardware that could be installed in vehicles. *(US National Highway Traffic Safety: Paper Number 15-0276)*

In 2010, the NHTSA set out some minimum criteria for acceptable widespread use of alcohol interlocks, suggesting they should be:

- Non-invasive;
- Quick to use (determines breath alcohol concentration in <0.5 seconds from activation and recycle);
- Highly accurate;
- Small;
- Highly reliable;
- Repeatable;
- Durable, robust;
- Low cost;
- Require no or low maintenance;
- Virtually invisible to sober drivers.

Since then, other less invasive techniques have been proposed to detect a driver's alcohol level. Followed by an overview of the most advanced projects working with other technologies:

- Transdermal (skin-contact) systems;
- Tissue spectroscopy;
- Distance spectroscopy;
- Behavioural Systems;
- Optical sensors;
- Intelligent Fingerprinting (combination alcohol and drugs/narcotics).

Two DADSS approaches are being pursued that have considerable promise in measuring driver BAC non-invasively within the time and accuracy constraints established (NHTSA, 2019):

- Distant/Offset Spectrometry, a breath-based approach that measures the concentrations of alcohol and carbon dioxide in the breath simultaneously. The known quantity of carbon dioxide in human breath is an indicator of the degree of dilution of the alcohol concentration in expired air. Molecules of alcohol and those of tracers such carbon dioxide absorb infrared radiation at specific wavelengths. The device directs infrared light beams on the breath sample and analyses the wavelengths returned to quickly and accurately calculate the alcohol concentration;
- Tissue Spectrometry, a touch-based approach that analyses alcohol found in the driver's fingertip tissue (or more specifically, the blood alcohol concentration detected in the capillaries). This is done by shining a near infrared light on the driver's skin, similar to a low power flashlight, which propagates into the tissue. A portion of the light is reflected back to the skin's surface, where it is collected by the touch pad. This light transmits information on the skin's unique chemical properties, including the concentration of alcohol.

Currently, the programme is in Phase III of development and the breath-based technology is ready for real-world road testing in a naturalistic setting in the State of Virginia, U.S.A. The alcohol detection system is known to be accurate, precise, reliable, and maintainable based on laboratory and controlled test results (Fournier, Willis, Zaouk, Strassburger, & Spicer, 2019). This pilot program seeks to obtain data from naturalistic, uncontrolled test conditions. The pilot program will determine if: a) the system is generally accepted by drivers, b) there are any technical modifications required to significantly improve the system, and c) the system is ready for wider implementation in fleet, privately-owned, commercial, or other vehicles.. Lessons learned will be used to refine the performance specifications, sensor technology, and data acquisition systems for future on-road vehicle testing.

At this moment, these technologies are primarily being developed within the context of developing an alcohol interlock. As mentioned above, while progressing, the applications are not ready for market yet. In time, it may be possible that also other applications of the sensor-technology will be developed which are not directly tied to in-vehicle use.

5.2.3 Standards and requirements

Requirements for the development of alcohol interlocks are captured in the CENELEC series of standards for alcohol interlocks, EN 50436 and will be discussed in chapter 7. Devices are designed for law enforcement, evidential breath analysers, are covered by OIML R 126:1998. Without summing all details of these requirements, some key elements regarding measuring standards are listed discussed here:

- Breath alcohol analyser should be capable of measuring all mass concentrations in the range 0.00 mg/L to at least 2.00 mg/L. However, in the measuring mode, the breath alcohol analyser may indicate 0.00 mg/L for mass concentrations equal to or smaller than a given value defined under the responsibility of national authorities;
- The recommended values of maximum permissible errors, positive or negative, for breath alcohol analysers *in service* is 0.030 mg/L or 7.5 % of the reference value of mass concentration, whichever is the greater. If the upper limit of the measuring range is greater than 2.00 mg/L, the maximum permissible error should be the reference value × 0.75 minus 1.35 mg/L or all mass concentrations greater than 2 mg/L;
- The within the rated operating conditions the probability that the evidential breath analysers satisfies the these requirements should be at least 95%.

5.2.4 Reliability and effectiveness of breath screening devices

In a study of the performance of 13 screening devices used by police force across the EU, it was found half of the investigated number of instruments (6 out of 13) match the criteria for excellent performance in terms of accuracy (97%-100%), and even more do so (8 out of 13) when precision (2.5%≤) is considered (Rosenberg, 2015). Other studies (Kriikku, et al., 2014) (Roiu, et al., 2013) have indicated that breath analyser test results can vary by some 15% from actual blood alcohol concentration. There are a number of factors that can affect the results of breath alcohol analyser tests and can produce inaccurate readings. Some of these factors include:

- Human or device error – Machines may be used incorrectly or the devices may not be maintained or re-calibrated as required;
- Breathing pattern – Tests have shown that holding your breath prior to taking the test can increase results, while hyperventilation prior to a test can decrease readings of BAC;
- Temperature – False readings may be obtained if the device is not properly calibrated for surrounding air temperature or body temperature;
- Some products skew results – Usage of mouthwash, breath spray or other products containing alcohol will falsely raise test results. The alcohol in these products usually dissipates after two minutes, but studies have shown that their effect can last longer. Some law enforcement officials have regulations regarding how soon they can perform breathalyser tests after an individual eats, vomits or puts something in their mouth. This time limit is usually about 15 minutes;
- Differences among people – Breathalyzers assume a certain ratio between breath alcohol content and blood alcohol content in people to determine a blood alcohol content reading. This will not necessarily apply to all people for a variety of reasons and can produce inaccurate results.

No recent studies form the past 3-5 years could be found comparing performance of evidential screening devices. It is however noted that these instruments (Evidenzers) are operating in the same safety level as the alcohol interlocks, tested and approved in compliance with the CENELEC EN 50436 standard. In Scandinavia, test results from the police evidenzers and test results stored in the registry of alcohol interlocks, have the same and equal power as evidence in a Court of Law prosecution of a perpetuator performing DUI with alcohol.

In general, current alcohol breath testing devices are quite satisfactory. In a few seconds to a couple of minutes police can have a reliable indication of the alcohol consumption of the driver. (TISPOL, 2010) Also in terms of costs no indications have been found that these provide a major barrier. Estimate have been found for the costs of a roadside breath alcohol test mouth piece, costing approximately 5-15 cent. It is considered likely in the costs are in the lower part of this bandwidth in countries where more tests are conducted.

5.3 *Conclusions*

Findings from this chapter include:

- The use of screening and evidence devices for enforcement of drink-driving regulation is widespread in European countries;
- Reliable devices are considered to be available for purpose of screening and evidence, although no recent comparative studies have been found on the performance of the latter;
- No major barriers for their application in drink-driving enforcement have been found in terms of costs or otherwise.

6 Technologies for drugs enforcement

Internationally there are two main approaches being adopted for detection of driving under the influence of drugs. These are Roadside Impairment Testing and Roadside Chemical Testing. Roadside Impairment Testing has been the method applied in European countries for many years. Over the past decade, chemical testing has increased in many countries, once testing devices were considered to have become sufficiently reliable and practical to use as mobile, even hand-held, devices.

6.1 *Roadside Impairment Testing Drugs*

Roadside Impairment Testing (RIT) for drugs is basically the same tests as for alcohol, testing the psychomotor functions and cognitive functions of a driver suspected of DUI. As with alcohol, the test is conducted by specially trained police officers and the process takes 25-60 minutes to conduct, depending on where the test is performed. When safe, the test is performed at the roadside or a nearby location, but it may also be taken at the police station.

Evaluation findings on effectiveness of RIT for drugs have mainly addressed the relevance and reliability of test indicators on the one hand and the ability to use and apply the test in practice in the other. On the former, it has been noted that although test battery of RIT has been validated as a measure of alcohol impairment, its validity has never been firmly established for impairment by drugs (Canadian Centre on Substance Use and Addiction, 2018). In contrast, an examination of the validity of the Standardized Field Sobriety Test[41] in detecting drug impairment concluded its findings provide support for the use of the SFST as a screening tool for law enforcement to identify impairment in persons who have used stimulants, depressants, cannabis, or narcotic analgesics (Porath-Waller & Beirness, 2014). In later research, they found thirteen drug-related indicators were found to significantly contribute to the prediction of drug category indicators that police officers could initially consult to form their opinion of drug influence (Porath & Beirness, 2019). Specifically for THC (marijuana / cannabis), the field sobriety test proved to be sensitive to impairment, although no dose relationship could be established (Declues, Perez, & Figueroa, 2016) (Declues, Perez, & Figueroa, 2018).

According to the DRUID Project, dose concentration and time-lapse between use and testing are important. The study found only low correlation between the checklist items and the real presence of drug in the body, except for a high concentration or a very recent use (Schulze et al., 2012).

Finally, variation in some aspects of cognitive performance was found to be moderately and positively correlated with some individual aspects of the RIT, particularly among tasks which assess reaction time. This can also contribute to the completion of complex tasks such as tested in the RIT (Downey, AC, Porath-Waller, Boorman, & Stough, 2016). Complex behavioural tasks such as driving are often severely impaired due to intoxication, and thus in a practical sense, the SFST can still be considered a useful screening tool to identify drug or alcohol impaired drivers.

Nevertheless, following a reappraisal in June 2019, the Faculty of Forensic and Legal Medicine withdrew its support for the tests, stating on their website, 'The Field Impairment Tests (FIT) have never been scientifically or statistically calibrated using a control group of subject drivers who had not taken any drugs' (Trotter, Skinner, & Rooney, 2021).

When applied correctly and under the right circumstances (e.g. reasonable weather, flat surface, safe location) the performance on the indicators included in the field sobriety test provides good accuracy in assessment of impairment, with accuracy percentages for horizontal gaze nystagmus (HGN) 88%; Walk-and-turn (WAT) 79%; One-leg stand (OLS) 83% (NHTSA, IACP, TSI, 2018). In New Zealand, even in 92 percent of the cases where a driver fails a RIT, subsequent laboratory analysis of the driver's blood sample confirms the presence of a qualifying drug (Ministry of Transport, New Zealand, 2020).

[41] 'Standardized Field Sobriety Test' is the name for the roadside impairment test in Canada and the US.

The ability to use and apply the test in practice has also been subject of various evaluations. As mentioned, to conduct a RIT correctly this requires trained police officers. Results from the DRUID study (Blencowe et al., 2010) show that normal, untrained agents are barely able recognise drug impaired drivers from their physical characteristics during standard roadside checks.

However, training is costly and only a limited number of police officers is fully trained. Furthermore, in many countries a RIT can only be conducted once there is a probable suspicion of DUI. For example, a well-founded suspicion can be based on abnormal driving or the observation of suspicious behavioural characteristics or circumstances at check-points. However, there are no standards to establish 'good cause for suspicion. This can lead to differences in approach and applying the threshold means that it is likely that there are drug impaired drivers who are not being tested because there are no observable signs of impairment at the time of driving (Abraham & Oberon, 2017).

Furthermore, in many circumstances the police in unable or deterred from performing a RIT. Among others this is the case when drivers are in a state of shock following a crash or injured, especially when taken to hospital. Also, there are various circumstances, such as heavy weather conditions or unsafe roadside locations, in which police officers are deterred from admitting a RIT, saving them the "hassle" from having to go back to a police station to conduct a RIT that may take 20 minutes or more to conduct.

Several countries, including Austria, Belgium, Ireland and the Netherlands, found cause to both improve the current practical implementation of RIT, for example by training additional staff to conduct RIT, and to introduce standard Roadside Chemical Testing in addition.

6.2 *Screen Roadside Chemical Testing*

Screening drivers for drugs at the roadside could make it possible to test a significantly greater number of drivers, identify more drug-impaired drivers and improve the visibility of drug driving enforcement, creating a greater deterrent effect. Police work must be efficient and tests on the road (screening device) must be able to be done in a straightforward and easy manner. Tests must be operationally reliable enough to establish whether drivers have drugs in their system (TISPOL, 2010). This would help police officers to determine which drivers have to provide a blood sample, or to take immediate administrative measures like confiscating the driver's license or impounding the vehicle.

However, unlike screening for alcohol, screening for drugs cannot currently be undertaken by breath testing. Evidence of drug use can be determined from urine, blood or oral fluid. For practical reasons, oral fluid testing is the standard internationally for screening for drug driving.

Blood and urine testing are invasive procedures to impose on drivers who may not have consumed any drugs. They are also generally considered to be impractical options for roadside screening. The oral fluid collection is non-invasive and easy to perform; it can be achieved in privacy, under close supervision, thereby reducing any opportunity of sample adulteration (Gentili, et al., 2016). Evidence from a general population survey suggests oral fluid testing may have lower refusal rates than either hair or urine testing (Vindenes, et al., 2011).

Oral fluid screening devices work by detecting the presence of a drug (or active ingredient of a drug) by taking a swab of a driver's saliva and inserting the swab into a testing device. The device then shows either a positive result for drugs or a negative result, which can be read visually or with the aid of an electronic reader which use cameras to detect the lines and provide a more consistent interpretation of the result. Some devices have a facility to send part of the sample to the laboratory for evidential tests.

Drug screening devices currently take around three to six minutes to conduct and around three to eight minutes to produce a result (Kuijten, 2009; Compton, 2017; Davey, Armstrong, Freeman, & Sheldrake, 2017; MoT New Zealand, 2019; company websites). Devices can detect more than one drug at a time (see further below), however, the time taken to conduct the test can be longer if multiple drugs are screened.

There are numerous on-site testing systems for drugs in oral fluid. These tests can be described as immunochromatographic devices. They generally operate by lateral diffusion of the oral fluid sample mixed with labelled antibodies in a buffer across lines of immobilised drugs (Cusack, Leavy, & Maguire, 2012).

New technologies are emerging:

- The analysis of drugs in latent fingerprints is an exciting new development that shows promise in a number of arenas that require flexible drug screening services. However, quantitative analysis of drugs of interest is not currently well developed and therefore could not recommend the use of latent fingerprints as an alternative to blood for evidential testing (Wolff, et al., 2017);
- In Sweden, sensitive LC–MS/MS equipment has been used to detect therapeutic and illicit drugs which are present as non-volatile components in exhaled breath condensate (EBC). Recent studies show promising results providing support to exhaled breath as a viable specimen for testing of drugged driving (Miller, et al., 2019) (Beck, Ullah, & Kronstrand, 2019) (Kintz, Mura, & Jamey, 2017) (Kintz, Mathiaux, Villéger, & Gaulier, 2015);
- In Australia, researchers are developing a portable illicit drug detection device that can detect drugs from body fluids including plasma, urine, saliva, sweat (including fingerprints) and breath. The technology is known as Desorption Ionisation on Silicon (DIOS) and is based on nanostructured manufactured at the Melbourne Centre for Nanofabrication. The technology is also able to detect poly-drug use, and is confirmatory. Each chip used to conduct a roadside test costs approximately $5 per unit. Once a test is conducted, the chip needs to be inserted into a MALDI mass spectrometry benchtop instrument to undertake the analysis (see Figure 2). The benchtop instrument weighs approximately 63.5 kg and would fit into a standard light commercial van (48 cm wide × 66 cm deep × 134.62 cm high). The cost of the benchtop unit is currently approximately $150,000. DIOS is able to provide a confirmatory analysis with one test, with the analysis taking less than one minute per sample (National Transport Commission, 2018);
- Recent studies showed promising results of the use of capillary blood obtained by a finger prick and confirmation of the presence/absence of drugs by analysing dried blood spots using chromatography-mass spectrometry (Marillier & Verstraete, 2019). Although procedures and technology for both have not progressed far enough yet, there are developments of commercial devices that may result in the near future in devices that would be suitable for use in sampling suspected drug-drivers blood by law enforcement officers (Wolff, et al., 2017).

6.2.1 *Standards and requirements*

The effectiveness of a testing device is summarised by three measures (National Transport Commission, 2018):

- Sensitivity – the proportion of drug-positive drivers who were correctly identified (if sensitivity is low, many drug-positive drivers will not be detected);
- Specificity – the proportion of drug-negative drivers who were correctly identified (if specificity is low, many drug-negative drivers will be arrested and required to provide a second sample, only to have their charges dismissed when no drugs are detected by further analysis);
- Accuracy – the overall proportion of tests that were correct, both positive and negative.

In order to assess how screening devices perform om these criteria, it is necessary to consider which drugs need to be detected and against what cut-off limit or threshold.

What type of drugs to be screened for on the roadside is a policy decision based on technology, cost, appropriateness and need. The latter two are determined by what substances are regulated for in the law and the impairment effect on driving abilities in combination with the prevalence of a drug in traffic. From a road safety perspective, it makes most sense to target those drugs that pose the highest safety risks.

Technology determines to a large extend the drugs that can be detected. Currently, oral fluid testing devices can detect a limited range of substances. Three classes of drug pose particular problems when using the immunoassay screening test are opioids, amphetamines and benzodiazepines (Nordal, Øiestad, Enger, & Christophersen, 2015). In addition, synthetic cannabinoids and other ‘designer drugs’ (NPS) also cannot be detected very effectively at present (Arkell, et al., 2019) (NZ).

Whether a drug can be sufficiently detected also depends on what is required in the law. This is particularly important for confirmatory test devices (‘evidencers’). As described in section 4.5.1 countries apply different threshold levels for the amount of drugs which can be present in the body when driving. Oral fluid screening devices can only detect the presence of drugs. They cannot test for impairment related to a specific concentration of drugs present in the body[42]. As a minimum, confirmatory test devices should be able to detect the presence of drugs in the concentrations allowed in legislation (see further below). However, also for screening devices to effectively detect if drivers may have exceeded the legal limit is important. For one, many countries have adopted a zero-tolerance limit. In addition, failing to effectively detect presence of drugs above set limits would cause too many false positives adding costs and delays for driver and traffic enforcement, or it could leave too many drug-positive drivers undetected, causing a safety risk.

Table 6.1 shows the device cut-off limits applies in some frequently used devices.

Table 6.1 Drug cut-offs by manufacturer and device in ng/mL

Drug Class	Dräger DrugTest-5000	Securetec drugwipe S 5/6	Alere DDS®2	SoToxa Mobile Test System	Rapid Stat	Cozart DDS
Amphetamine	50	50	50	50	25	50
Benzodiazepines	15	5	20	20	25	30
Cannabis (THC)	05/10/20/25	05/10	25	25	15	31
Cocaine	20	10	30	30	12	30
Methamphetamine	35	80	50	50	25 (meth) 50 (XTC)	50
Opiates	20	n.a.	40	40	25	n.a.
Methadone	20	10	15		15	n.a.
Ketamine	300	n.a.	n.a.	n.a.	n.a.	n.a.

Source: Cusack, Leavy, & Maguire, 2012. *Lower cut-offs require longer time.

The effectiveness of testing devices is also of high importance to drivers suspected of violation of drug-driving regulations. As they could face severe penalties, effective performance against clear performance standards is of importance.

Unlike for (breath) alcohol testing devices, there are no international or EU standards set out for drugs screening devices. To date, no complete type approval specification has been drawn up for these devices by either the OIML (International Organization for Legal Metrology) or CEN (European Committee for Standardization). The importance of type approval standards is recognised by European countries. Standards have been developed at the national level. As a result, standards such as acceptance and error limits, vary between countries.

While countries could not benefit from a full set of harmonised standards related to a wide range of technical elements of screening devices, the European Integrated Project DRUID has offered guidance in the form of recommended minimum standards for sensitivity, specificity and accuracy. These were set at 80% for each parameter.

6.2.2 Reliability and effectiveness of oral fluid screening devices

The search for suitable roadside chemical testing devices has been continuing over the past two decades. There have been several international research projects conducted on various aspects of drugs and driving.

Independent studies of the accuracy of oral fluid drug testing devices have produced mixed results. The accuracy for different drug types and the various devices varied considerably. Some of the devices showed good performance characteristics for several drugs, but no device was deemed adequate for all drugs. Differences can partially be explained by the fact that countries have different standards relating to the drugs targeted and the individual cut-offs for the targeted drugs, collection times for the oral fluid or test time for the tester.

Although international literature suggests that manufacturers overstate the capabilities of on-site testing devices to detect drugs in oral fluids, a number of new on-site testing devices have been

42 It is noted that proving impairment in relation to concentration levels of drugs in the body has not been possible for many substances.

constantly developed (Gentili, Solimini, Tittarelli, Mannochchie, & Busardò, A Study on the Reliability of an On-Site Oral Fluid Drug Test in a Recreational Context, 2016).[43]

The accuracy of oral fluid drug screening equipment has continued to improve and available devices can reliably detect recent use of specific drugs at clinically relevant concentrations in an on-site drug testing environment (Toennes, Steinmeyer, Maurer, Moeller, & Kauert, 2005), (Walsh JM, 2007), (Blencowe, et al., 2011), (Pehrsson, et al., 2011).

In the DRUID project, Blencowe, Pehrsson & Lillsunde, et al (2010) evaluated eight[44] on-site devices for their ability to accurately detect amphetamines, cannabis, cocaine, opiates, benzodiazepines, methamphetamine, MDMA (i.e., ecstasy) and phencyclidine (i.e., PCP). None of the tests reached the target value of 80% for sensitivity, specificity and accuracy for all the separate tests they comprised. An overall evaluation, wherein any positive drug screening result was viewed as valid providing that the confirmation sample contained one of the DRUID substances analysed, was performed as a measure of the usefulness of the devices in police controls. Three of the devices performed at >80% for sensitivity, specificity and accuracy in the overall evaluation.

As none of the devices could effectively check for all drugs, the recommendation from the evaluation was that authorities could best consider the device with the best overall performance in detection of drugs which were most prevalent in their country or region.

In a study following up on the DRUID study in Belgium, Van Stechelman, et al. (2012) evaluated four on-site oral fluid drug testing devices[45] and concluded all tests showed good specificity, but more improvement in the area of sensitivity is required.

A study by the Medial Bureau of Road Safety (MBRS) in Ireland, reviewed the performance of four roadside testing systems[46] in detecting the most prevalent drugs found in Irish road users, cannabis and benzodiazepines. The devices were considered to be representative for the variety of test devices available and their different operational requirements (Cusack, Leavy, & Maguire, 2012). The review highlighted the importance of selecting devices that have a minimum number of steps and a short collection and test time. It also showed that devices capable of detecting the most prevalent drugs, are available and a number of these devices are currently in use for roadside drug testing in other jurisdictions.

Gjerde, Brennhovd Clausen, Andreassen, & Furuhaugen (2018) compared the results from field testing with and oral fluid screening device[47] to findings in blood samples above the Norwegian legal per se limits. The table below shows their findings.

Table 6.2 Comparison results OF drug screening device and blood test in Norway

	Cannabis	Ampheta-mine	Metha mphe-tamine	Cocaine	Opiates	Benzodia-zepines
False positives saliva v blood	14.5%	23.2%	38.4%	87.1%	65.9%	36.4%
False negatives total saliva v blood	13.4%	4.9%	6.1%	0.0%	0.0%	18.8%
% saliva positives in blood positives	82.9%	90.8%	75.7%	100.0%	100.0%	37.2%

Source: Gjerde, Brennhovd Clausen, Andreassen, & Furuhaugen (2018).

The devices did not absolutely correctly identify DUI offenders due to fairly large proportions of false-positive or false negative results compared to drug concentrations in blood. The police

43 Manufacturers of devices currently available for purchase report close to 100 percent accuracy for the drugs they test for. The manufacturers advise that a significant proportion of false-positives are due to operator error rather than device error (NZ).

44 BIOSENS Dynamic (Biosensor Applications Sweden AB), Cozart DDS (Cozart Bioscience Ltd.), DrugWipe 5+ (Securetec Detections-Systeme AG), Dräger DrugTest 5000 (Dräger Safety), OraLab6 (Varian), OrAlert (Innovacon), Oratect III (Branan Medical Corporation) and Rapid STAT (Mavand Solutions GmBH).

45 DrugTest, DDS, Rapid STAT, OrAlert.

46 Securetec Drugwipe, Draeger Drugtest 5000, Alere DDS2, Mavand Rapid Stat.

47 Dräger Drug Test 5000.

reported that DDT5000 was still a valuable tool in identifying possible DUI offenders, resulting in more than doubling the number of apprehended DUI offenders.

A Brazilian study (Scherer, et al., 2020) evaluated the analytical reliability of four point-of-contact devices[48] for the detection of cocaine and cannabinoids using oral fluid samples of Brazilian drivers. For cocaine detection (cut-off 10 ng/mL) sensitivity found were 100%, 86%, 100%, 83%, the specificity rates were 100% in all devices and accuracy 100%, 98%, 100% and 97%. For detection of cannabinoids, sensitivity was found to be 75%, 29%, 100%, 0%. For specificity rates were 100%, 100%, 100%, 94% and accuracy 78%, 89%, 100% and 100%. So, for cocaine, the devices all achieved reliability measures greater than 80% for cocaine detection, which is considered appropriate by international guidelines. However, the reliability for cannabinoid detections did not achieve the desirable parameters in three of the four devices tested.

Beirness & SmIth (2017) examined three point-of-contact oral fluid drug screening devices[49] to determine the suitability of such devices for potential use in the enforcement of drug-impaired driving in Canada. The devices were tested on their ability to determine the presence of cannabis, cocaine, amphetamine, methamphetamine, opioids, and benzodiazepines. Overall, the screening devices performed well (see. Considering all drugs/drug categories together, the screening devices collectively were determined to have a sensitivity of 0.874, indicating that in 87% of cases where a person had used one of the substances included in the screen, it was detected by the screening device. Looking at detection of specific drugs, the devices performed reasonably well in the detection of THC, cocaine, methamphetamine, and opioids, with sensitivity values >0.80 and specificity values >0.90. Performance of the screening devices was not as good in the detection of benzodiazepines and amphetamine.

Table 6.3 Performance measures (and 95% CI) for oral fluid screening devices by drug/drug category

	N=	Sensitivity	Miss rate	Specificity	False alarm rate	Positive predictive value	Accuracy
THC	323	0.869	0.131	0.955	0.045	0.922	0.923
		(0.789–0.918)	(0.079–0.207)	(0.917–0.973)	(0.022–0.086)	(0.853–0.961)	(0.886–0.948)
Cocaine	256	0.846	0.154	0.993	0.007	0.990	0.926
		(0.770–0.900)	(0.096–0.235)	(0.960–0.999)	(0.00–0.045)	(0.938–0.999)	(0.884–0.953)
Amphetamine	306	0.771	0.229	0.964	0.036	0.923	0.895
		(0.683–0.839)	(0.156–0.322)	(0.928–0.983)	(0.015–0.075)	(0.845–0.966)	(0.854–0.926)
Methamphe-tamine	306	0.840	0.160	0.965	0.035	0.965	0.899
		(0.776–0.889)	(0.109–0.227)	(0.920–0.985)	(0.013–0.084)	(0.915–0.987)	(0.858–0.929)
Opioids	301	0.899	0.101	0.931	0.069	0.795	0.924
		(0.805–0.950)	(0.036–0.164)	(0.891–0.957)	(0.041–0.112)	(0.787–0.943)	(0.913–0.968)
Benzodia-zepines	241	0.592	0.408	0.976	0.024	0.918	0.855
		(0.480–0.696)	(0.298–0.527)	(0.939–0.990)	(0.008–0.065)	(0.795–0.973)	(0.802–0.895)
All Drug Categories	641	0.874	0.126	0.932	0.068	0.965	0.892
		(0.838–0.903)	(0.097–0.162)	(0.886–0.961)	(0.039–0.114)	(0.940–0.980)	(0.865–0.915)

48 DDS2™, DOA MultiScreen™, Dräger Drug Test 5000™ and the Multi-Drug Multi-Line Twist Screen Device™ (MDML).

49 Alere DDS 2®, Dräger DrugTest 5000® and Securetec DrugWipe 6S®.

The table also provides an indication of the extent of generation of false-positives where a screening test will mistakenly indicate a person is positive for a specific drug or drug category. Sufficient performance on this indicator has been highlighted as an important factor in maintaining public support for road site testing (Ministry of Transport, New Zealand, 2019).

In the Canadian study, the overall false alarm rate (0.068) reveals that approximately 7% of drug-positive screening tests were not confirmed by laboratory analysis.

A study in Australia (Baldock, Palamara, Raftery, & Bailey, 2019), which probably has the longest tradition in performing roadside drug testing, reported low to very-low false-positive results in most Australian states (e.g. as low as one percent in some states). Another recent study of roadside drug testing devices[50] widely used in Australia (Arkell, et al., 2019) found the devices reported false-positive results for THC ranging between five and ten percent. The study further concluded that screening devices can be useful tools in detecting recent cannabis use, but confirmatory LC-MS/MS quantification of results is strongly advisable as two out of three devices did not demonstrate recommended >80% sensitivity, specificity and accuracy.

In a systematic review covering studies published from January 2003 and June 2019 it was concluded Illicit drug detection in oral fluid is similar to urine but oral fluid has a strong potential for the immediate detection of recent marijuana use compared to urine. In relation to cocaine and methamphetamine, the largest drugs detection window is obtained through urine analysis. Oral fluids cannot replace urine for most of the purposes of drug testing (Binhame Albini Martini, et al., 2020).

Overall, the accuracy of roadside drug testing devices currently available is considered medium to high based on evidence available. Screening devices can test for a limited number of drugs found present in drivers. Not all drugs commonly found in drivers can be detected with the same accuracy. There are also variations in differences in detection time between substances compared to blood. Furthermore, there are differences accuracy between devices, with no device found to have higher accuracy across all studies and all drugs.

The technology of oral fluid drug detection devices is improving, however, there is a residual risk of screening devices producing false positives. Despite continuing advances in the field, roadside screening devices do not have the sensitivity and specificity to be considered as comparable to laboratory testing. Roadside drug testing with screening devices using an oral fluid sample testing offers simple, rapid, non-invasive, observed specimen collection. It facilitates the detection and apprehension of drug-impaired drivers by providing reasonable grounds to make a demand for further confirmatory testing.

6.2.3 Costs of Tests and Analysers

The costs for the tests these are summarised in Table. This table also includes the cost of the readers/analysers.

Table 6.4 Unit Costs for Devices

Unit Cost	Devices
5-7 drug test cartridge	€10-€25
Reader/analyser	€2000-€4000

Sources: TØI, 2010; Cusack, Leavy, & Maguire, 2012; Davey, Armstrong, Freeman, & Sheldrake, 2017; NHTSA, 2017; Ministry of Transport, New Zealand, 2020.

These costs are estimates only. The actual costs will depend on several factors. The unit cost will normally decrease when purchasing larger quantities of a saliva sampler. For some devices a reader is an integrated part of the instrument to screen the oral fluid sample, implying an investment in addition to the current costs per saliva sampler test. The cost will also depend on the type and number of drugs screened from and whether the cassette or test cartridge is custom made or is similar to other jurisdictions.

50 Securetec DrugWipe®, 5 s (DW5s) and Dräger DrugTest® 5000 (DT5000).

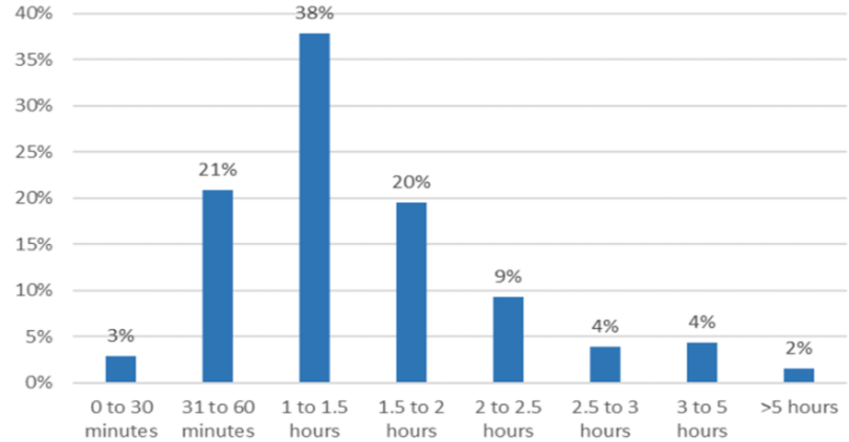
An oral fluid test in drug screening devices is much more expensive than an alcohol breath test. If the disposable materials are taken into account alone the cost vary between 5 -15 eurocents per piece for alcohol tests, compared to the 10-25 euro for a drugs test. However, if the overall costs are assessed (to include equipment purchase, depreciation, maintenance etc.) this differential is reduced to approximately 10 to 20 times more expensive than a roadside alcohol breath test, depending on whether or not the roadside drug test includes an electronic reader. The fact that the devices test for between 5-7 drugs rather than just a single drug as with alcohol should also be taken into account when considering costs (Cusack, Leavy, & Maguire, 2012).

Several reports produced for national administrations involved in traffic enforcement have identified the costs of Roadside Chemical Testing as a barrier for large(r) scale implementation (Cusack, Leavy, & Maguire, 2012) (Risk Solutions, 2017) (Abraham & Oberon, 2017) (National Transport Commission, 2018). These costs do not only involve the costs of the screening device, but also the time involved and follow-up costs.

It was already mentioned in this report that the time required to conduct a drug screening test takes about 10-15 minutes, while also some time is required to explain the procedure to the driver. This is more time compared to a alcohol breath test, which only takes a few minutes and where most drivers are also already familiar with. In addition, time restrictions apply evident in regards to transferring specimens to the necessary laboratory, as the time lapse between use, initial testing and confirmatory analysis affects the outcome of the measurement because the concentration of a drug will decrease with time.

A UK evaluation report found that about 32% of those producing positive saliva tests for THC (cannabis) returned blood analyses at or below the limit. This result is partially effected by the time between the screening and confirmatory analysis. About 1 in 5 samples are not taken until at least 2 hours after the initial saliva test.

Time between saliva test and blood sample being taken



Source: Risk Solutions, 2017. Base: 1,441; 18 Police Forces

This led to the recommendation the DfT should consider whether this can be addressed – perhaps through suggesting more police forces find ways of minimising the time between saliva testing and the taking of blood samples. The evaluation also recommended to regularly review the 'guard band' which deducts a certain amount from the analysis result to reflect analytical uncertainty. The report voiced concern over waning police enthusiasm for enforcing drug driving could if they perceive there is a relatively low chance of successful prosecution due to (a perception of) too high guard bands being applied.

Source: Evaluation of the new drug driving legislation, one year after its introduction. A report for Department for Transport.

Furthermore, an increased number of tests is likely to produce an increase in the number of drivers tested positive. With a rising number of positive roadside screening samples being sent to a laboratory for analysis, these cost also increase and so will the costs a prosecution due to an increasing number of drivers that are found positive after the confirmatory analysis.

Increasing drug-driving enforcement intensity naturally impacts upon policing resources. However, due to the higher cost this impact is much larger compared to alcohol enforcement. These higher costs limit the efficiency with which drivers can be tested and thus also the extent to which a deterrent effect can be achieved. As mitigating strategy evaluations in Australia and the Netherlands found roadside chemical testing for drugs tends to be more targeted than random. Although there is no formal 'targeting' of roadside testing for drugs, roadside check tend to focus on certain times of the week (e.g. weekend(nights)) and specific locations (e.g. nightlife, events).

In addition, another strategy looked at to reduce costs is using a 'collective purchasing agreement' for tests and analytic devices and consumables. However, currently there are variations in the legal frameworks and testing approaches applied between countries (and also between States when looking at Australia and the US). Without a harmonisation of these approaches it might be impossible to cater for the specific needs of each jurisdiction. No examples of such collective purchasing between European countries have been found yet.

Finally, there is hope that ever continuing technological development will result in possibilities which can increase efficient roadside chemical testing. For one, existing technologies might become cheaper to produce or new more cost efficient technologies might emerge. One such development could be the development of technology which would allow confirmatory analysis to take place at the roadside and/or increasing the reliability of screening devices to a level they can be applied directly for confirmatory analysis.

6.3 *Confirmation (evidential) Testing*

Most countries that have enacted drug driving testing methods use a combination of multiple testing methods to establish whether a driver is positive for any regulated drugs above the legal limit. In general such an approach could improve the reliability of drug testing, as the result is double checked. Such a firmer body of evidence is also considered important for both the application and acceptability of sanctions related to a drug-driving offence.

As described in the previous section, currently available roadside chemical tests are based on immunoassays and will give presumptive results and so the roadside result alone is not conclusive. The possibility that a false positive result will occur cannot not be ruled out when conducting roadside tests and where tests on devices have specificity levels of less than 100% this is inevitable (Cusack, Leavy, & Maguire, 2012). Because of this, there will always be a need to conduct a confirmatory drug analysis.

Chromatographic methods are generally used to confirm the presence of specific compounds in blood, hair, urine and OF. For legal purposes the gold standard is either gas chromatography (GC) or liquid chromatography (LC) linked to mass spectrometry (MS), increasingly used in tandem (MS-MS and LC–MS/MS) with stable, labelled, internal standards (Wolff, 2013) (Wolff, et al., 2017).

Several laboratories have published methods that detect a large series of different drugs in one procedure in a small sample volume, providing for the required capacity to detect the drugs included in drug driving legislation in most countries.

Blood is generally considered to be the "gold standard" for determining drug concentrations because it reflects the amount of active drug circulating in the body (Wille, et al., 2009) (Wolff, 2013) (Wolff, et al., 2017). In some countries such as Spain, France, Cyprus and most of the Australian states, oral fluid is also used for confirmation. Belgium was one of the first countries implementing an oral fluid sample for both screening and confirmation (Marillier & Verstraete, 2019 based on Royal Decree of September 7, 2010; Van der Linden, Wille, Ramírez-Fernandez, Verstraete, & Samyn, 2015).

However, OF tests cannot be used to give a precise prediction of the concentration of a drug in blood (or plasma or serum) and therefore prediction of possible drug effects (Wille et al, 2009) (Gjerde & Verstraete, 2010). It is well known that oral fluid-to-blood ratios vary from drug to drug, from person to person and even intra-individually (Bakke, et al., 2020) (Langel, et al., 2014) (Wille, et al., 2009), making evidential testing for a risk-based or pharmacological threshold using OF challenging.

At the same time, it can be noted that although research on the link between levels of substance in the driver's system and crash risk is growing (Crompton, 2018), there is still very little as compared to the knowledge of crash risk and alcohol consumption (see also section 4.2). Based on a perceived absence of such links (for several or all drugs), or at least lack of strong evidence in support of these links, in combination with overall prohibition of drug use, several countries have adopted a zero-tolerance approach (see Table 4.14). In fact, (Wolff, 2013) (Wolff, et al., 2017), identify that oral fluid screening is highly appropriate within such zero-tolerance approach, although more suited for "illicit drugs" rather than medicinal controlled drugs.

In addition to the argument related to lack of a firm risk-based relation, the use of oral fluid also holds a practical benefit as it is considered less-intrusive. Where oral fluid is used as matric for evidential testing, the 'lowest laboratory limit of detection' has been chosen as the cut-off. The DRUID project suggested cut-offs that can be applied. These are presented in Table 6.5 together with the cut-offs for laboratory confirmation applied in Australia and New Zealand, which use oral fluid for confirmation testing.

Table 6.5 Cut-offs for confirmation testing of oral fluid

	DRUID blood conc (μg/L)	DRUID oral fluid concentration (μg/L)	AS/NZ 4760:2019 Confirmation Standards
Cannabis (THC)	1	1	5
Methamphetamine	20	25	25
MDMA	20	25	25
Cocaine	10	-	25
Benzoylecgonine (BZE)	50	10	25
6-MAM (active metabolite of heroin)	10	5	10
Morphine, Codeine	-	-	25
Oxycodone	-	-	20

Source: DRUID,2012; AS/NZ 4760:2019.

Regardless whether blood or oral fluid is chosen as preferred matrix for confirmation testing, there remains a use impairment evidence. In a UK evaluation it was found that in some 1 in 8 cases blood could not be taken following a positive saliva test – while about a third of these were refusals, just over half were for medical reasons (Risk Solutions, 2017).

6.4 *Conclusions*

The main conclusions regarding technologies for enforcement of drug driving regulations in Europe are presented below:

- Roadside impairment testing for drugs has been widely applied across European countries. However, it requires well-trained staff and it is considered costly and time consuming. There is a limited number of trained staff. In addition, doubt is being raised over the effectiveness in detecting drug impaired drivers. There is a need to both improve the current practical implementation of impairment testing, for example by training additional staff to conduct RIT, and to introduce standard Roadside Chemical Testing in addition;
- Unlike for (breath) alcohol testing devices, there are no international or EU standards set out for drugs screening devices. To date, no complete type approval specification has been drawn up for these devices by either the OIML (International Organization for Legal Metrology) or CEN (European Committee for Standardization);
- Roadside drug testing with screening devices using an oral fluid sample testing offers simple, rapid, non-invasive, observed specimen collection. It facilitates the detection and apprehension of drug-impaired drivers by providing reasonable grounds to make a demand for further confirmatory testing. Oral fluid screening is compatible with a regulatory approach of in such zero-tolerance for drug-driving, especially in relation to "illicit drugs";
- Overall, the accuracy of roadside drug testing devices currently available is considered medium to high based on evidence available. Screening devices can test for a limited number of drugs found present in drivers. Not all drugs commonly found in drivers can be detected with the same accuracy. There are also variations in differences in detection time between substances compared to blood. Furthermore, there are differences in accuracy between devices, with no device found to have higher accuracy across all studies and all drugs;

- Although blood is generally considered to be the “gold standard” for determining drug concentrations, there are several countries that use oral fluid for confirmation (evidence) testing;
- The technology of oral fluid drug detection devices is improving, however, there is a residual risk of screening devices producing false positives. Despite continuing advances in the field, roadside screening devices do not have the same high level of sensitivity and specificity as laboratory testing (using blood as a matrix);
- Relatively high cost of screening devices and time required for the testing drivers, form a barrier for efficient large scale deployment of roadside drug-testing. Combined procurement may form a solutions to reduce costs, although issues over the alignment of specific needs to be overcome. There is hope that continuing technological development will result in possibilities which can increase efficient roadside chemical testing. For the moment, these are not there yet.

7 Technology for the prevention of impaired driving

The current chapter reviews technologies which can prevent impaired driving caused by alcohol or drugs. Two main technologies are assessed: alcohol interlocks and drowsiness and distraction recognition systems.

Alcohol interlock devices require a vehicle operator to provide a breath sample or use a finger touch sensor and prevent the vehicle ignition from operating if alcohol above a predefined threshold is detected. While technology may progress to a stage where a similar device could also be developed for screening for (some) drugs (see also chapter 6), currently only alcohol interlock systems exist.

A driver drowsiness and attention detection (DDR) system is a system that assess the driver's alertness through vehicle systems analysis and warns the driver if needed. Depending on the specific DDR system, DDR systems use vehicle systems to monitor erratic steering behaviour and or driver inattention (e.g. dozing, looking away from the road) and can provide a variety of warning signs to a driver in order to improve driving performance. Both alcohol and drugs can affect driving performance indicators (see sections 3.1 and 4.1), which can be detected by DDR systems.

7.1 *Alcohol interlocks*

7.1.1 Technological solutions

Alcohol interlock devices are automatic control systems which are designed to prevent driving with excess alcohol. They require a vehicle operator to provide a breath sample into an in-car analysing device or use a finger touch sensor before starting the ignition. In case no sample is provided or alcohol is detected above a predefined threshold operation of the vehicle is prevented by blocking the vehicle ignition for a short lock-out period.

The lock-out period lasts a few minutes for the first failed BAC test, and longer for any subsequent failed test. This allows the alcohol to dissipate from the mouth and gives the driver a chance to think about the reason for the failed test (TRT Trasporti e Territorio Srl, 2014).

There are devices on the market which continuously check drivers. In these devices, repeated sample testing are required within random intervals while driving. Drivers are signalled that a test is required within 10-15 minutes, leaving them time to find an appropriate location to stop the vehicle and provide another sample. In case no sample is provided, or a BAC value higher than the pre-set limit is detected, an alarm will sound and the driver is instructed to park the vehicle and turn off the engine. Alcohol interlock never stop a vehicle's engine while it is running.

Many devices are equipped with a data logging function, collecting information on the use of the interlock. This can include for example the number of attempts to provide a sample, failed attempts or warnings issues by the device, as well as (suspected) attempts to interfere with the device. Data can be stored on the device for on-site read-out or be transmitted electronically to a remote data management system. The data can be used to provide monitor the use of the device and feedback on driver behaviour. Such monitoring is a key element in many alcohol interlock programmes targeting DUI offenders.

While the above describes the basic features and functionalities of alcohol interlock devices, nowadays several types of alcohol interlock devices are on the market. A variety of (brand) names and techniques exist, with various technical elements being patented and unique to each system. New technologies are under development for potential future application. These technological developments particularly target the improvement of sensors, which allow more accurate, less intrusive measurement of BAC. These sensor technologies are similar to those applied in alcohol enforcement (screening) devices as described in chapter 6.

Furthermore, when discussing interlock technologies and functionalities, a distinction should be made between interlock devices for use in drink-driving offender programmes and those for general preventive use. As the former are imposed as a sanction following a drink-driving offence, their general requirements logically differ from those devices for all users, regardless of prior drink-driving history.

This distinction in focus between targeting drink-driving offenders versus general prevention can also be found in the technical standards that have been developed for alcohol interlock devices.

7.1.2 Technical standards

Early 2000's, the European Commission and the European Council started to investigate ways to lower the number of accidents due to driving under influence of alcohol. Around the same time, several European countries started to investigate the circumstances under which alcohol interlocks could be introduced (e.g. Finland prepared an offender program in 2004, Belgium and Norway prepared feasibility studies and Sweden used interlocks as a preventive measure). Following these first experiences with alcohol interlocks, there was an need for European Standards covering the technical requirements as well as providing guidance to implement alcohol interlock programs to provide a reasonable degree of performance in the context of the European legal framework. In 2003, the establishment of Task Force of the Technical Board 116-2 of CENELEC (CLC BTTF 116-2) was approved by the Technical Board of CENELEC.

Following the establishment, the CENELEC Alcohol Interlock Committee focused on creating universal technical standards and guidelines for the voluntary use of alcohol interlocks. The focus was initially on creating universal standards for the use of alcohol interlocks in offender programs. However, in recent years, the alcohol interlocks are required for other purposes (e.g. prevention) in several European countries. The attention of the committee shifted towards the optional use of alcohol interlock as a general preventive measure. This development ushered a shift in emphasis in the CENELEC standard, and several of the parts have been updated. The latest update (part 1) is adopting to more compulsory use imposed by law or company policy.

The European Standard covers alcohol interlocks to use them in an offender/rehabilitation program to monitor and/or control in a comparable way. This standard may also be used for alcohol interlocks intended for other applications. This European Standard is directed at test laboratories and manufacturers of alcohol interlocks. It defines requirements and test procedures for type testing. Several parameters (such as alcohol concentration or breath volume) are specified in this European Standard for the purpose of type testing according to this standard only.

The broad scope of engagement of the CENELEC Committee is reflected in the various standards, guidelines and other documents provided by the committee, as listed here:

1. **EN-50436-1**: Test methods and performance requirements for instruments for detection of BAC through exhalation of air from the test person. This includes:
    - measurement accuracy of the alcohol concentration;
    - environmental tests with different ambient temperatures and humidity;
    - tests of time to be ready;
    - durability tests with vibrations and dropping;
    - measures against circumvention and manipulation;
    - influence of other exhaled gases than alcohol;
    - long term behaviour;
    - electrical tests for supply voltage and durability against short-circuits;
    - electromagnetic compatibility and electrical disturbances;
    - content of the instructions for installation and use.

    Originally intended for offender programs, after revision in the CENELEC Committee, from 2020 it is combined with part 2;
2. **EN-50436-2**, Instruments having a mouthpiece and measuring breath alcohol for general preventive use. Now undergoing revision in the Committee, integrated in part 1;
3. **EN-50436-3**, Guidance for decision makers, purchaser and users, today operational together with standards within the EU and the EFTA countries;
    EN 50436-4, creating a standard for connectors for the electrical connections between the alcohol interlock and the vehicle. It provides a standardised digital interface that facilitates the fitting of (aftermarket) alcohol interlock devices in motor vehicles, including into modern highly integrated vehicles;
4. **EN 50436-5**, Instruments not having a mouthpiece and measuring breath alcohol for general preventive use, about emerging technologies with other functionalities. The issue was discussed in the CENELEC Committee in February 2010, but was put on hold. Following a new initiative from Sweden, work with this part has been renewed and a work group is preparing a new draft. Emerging technologies may also be calibrated to detect other drugs than alcohol, so there is a high actuality of this draft;

5. **EN 50436-6**, Data Security, related to the registry of the alcohol interlocks, how the data is to be handled in accordance with legal regulation of personal sensitive issues;
6. **EN 50436-7**, Connector, defines the content and layout of a document, that is needed to properly install an alcohol interlock into a vehicle. The technical requirements reflect requirements given in other parts of EN 50436 series of standards or standards refenced there. Reference to EN 50436-7 (2016) as applicable standard is included in the new Type Approval Regulation 2019/2144, which requires that vehicles of categories M and N from 6 July 2022 for new vehicle types and from 7 July 2024 for all new vehicles shall be equipped 'alcohol interlock installation facilitation'.

As mentioned above, Regulation (EU) 2019/2144 of the European Parliament and of the Council provides for such alcohol interlock installation facilitation in motor vehicles. Amongst others, it obliges vehicle manufacturers to provide an installation document with the necessary details for the installation. The proposed provisions are based on the existing EN 50436 standard.

In order to facilitate specialised and trained installers to install alcohol interlocks as straightforward as possible, without interference with the proper performance or maintenance of the vehicle and without impairing the safety and security of the vehicle, it is necessary to require vehicle manufacturers to make available on their websites a document with clear instructions for installation of the alcohol interlocks ('installation document' as described in EN 50436-7) in order to allow the technicians to properly install an alcohol interlock in a certain vehicle model. However, Annex II to Regulation (EU) 2019/2144 does not contain any reference to regulatory acts as regards alcohol interlock installation facilitation. At the same time, Appendix 3 of Annex X to Regulation (EU) 2018/858 sets requirements on access to information on security-related vehicle repair and maintenance information services. This information is only available to the independent operators that are authorised by accredited entities in accordance with Annex X to Regulation (EU) 2018/85.

Therefore, Commission Delegated Regulation (EU) 2021/1243 amends Annex II to Regulation (EU) 2019/2144 to include reference to Regulation (EU) 2021/1243, which includes the requirement for vehicle manufacturers to make the installation document accessible in accordance with Annex X to Regulation (EU) 2018/858. It also includes (among others) technical requirements, including that alcohol interlock installation facilitation shall allow the fitting or retrofitting of an alcohol interlock complying with European Standards EN 50436-1:2014 or EN 50436-2:2014 and that the vehicle system as regards alcohol interlock installation facilitation in each motor vehicle of categories M and N shall conform to the relevant vehicle model as laid down in the alcohol interlock installation document ('installation document'), conforming to European Standard EN 50436-7:2016.

7.1.3 Costs of alcohol interlocks

A review has been carried out of purchase alcohol interlocks in various countries. It is found purchase costs are varying between €700 and over €2.000, depending on the brand, model and country of purchase. In turn, the installation costs are approximately €70 to €200.

However, it is noted that installation of alcohol interlocks in most cases occurs as part of a drivers' participation in an alcohol interlock programme aimed at DUI-offenders or for general prevention. Additional costs are involved with the participation in these programmes. These are described in more detail in section 8.3.

7.2 ***Driver drowsiness and distraction recognition (DDR)***

Sensor technology is increasing in quite a rapid pace such that it is becoming possible to provide an estimate of the driver level of distraction or fatigue. A couple of manufacturers are already offering devices based upon this technology that provide warnings when the drivers shows signs of fatigue or distraction (Reed, et al., 2015). A DDR system is defined as follows in line with Regulation (EU) 2019/2144:

"A driver drowsiness and attention detection system is a system that assess the driver's alertness through vehicle systems analysis and warns the driver if needed."

Definitions of driver **fatigue**, **drowsiness** and **distraction** are clearly intertwined and related to this particular device. Brown (1994) defines fatigue as the inability or disinclination to continue an activity. In particular because the activity has been going on for too long. In many studies, drowsiness and fatigue are used interchangeable and 'driver drowsiness' is often considered a subcomponent of 'driver fatigue'. However, driver distraction (and/or inattention) are even broader and inconsistently defined. Regan, Hallett, & Gordon (2011) performed an extensive literature review and revealed that the following key elements are related to driver distraction:

- A diversion of attention away from driving, or safe driving;
- Attention is diverted toward a competing activity;
- The competing activity may compel or induce the driver to divert attention;
- An implicit, or explicit, assumption that safe driving is adversely effected.

The main focus of this study is to provide insight into the prevention of driving under influence of alcohol and drugs. According to the NHTSA[51], driver drowsiness could be similar to driving under influence of alcohol, because:

- The reaction time, awareness of potential hazards and attention will all get worse;
- Driving more than 20 hours without sleep is similar to driving with a BAC of 0.08% (limit in US, UK);
- Overall, the chance of being involved in a car crash is approximately three times higher in case you are driving fatigued.

In addition, Harrison & Fillmore (2011) show that secondary behaviours can become more distracting under the influence of alcohol.

The technological standards for the prevention of impaired driving on the basis of DDR will be described on the basis of studies on factory fitted DDR (Reed, et al., 2015) and retrofitting DDR (Ecorys & VTT, 2019). In addition, the approximated costs and performance will be discussed based upon a literature review (e.g. NHTSA, TRL and Ecorys).

7.2.1 Technological solutions

A broad range of technologies can be used to identify fatigue (and drowsiness). Monitoring systems usually follow the following technologies:

- Physiological measures: physiological measures by using camera-based monitoring devices (monitor the eyes) or sensors to measure other physiology;
- Physical measures: activities and body movement providing an indication of fatigue by using camera- or sensor-based devices;
- Behavioural indices: activities related to driving that deviate from 'normal' or safe parameters can be measured (e.g. steering wheel movements, acceleration, gear changes and others);
- Biomathematical models: measuring prior sleeping patterns, circadian thythm factors, time of day and working patterns.

Most of the systems that are on the market today are camera based solutions. However, as depicted above, some systems are able to detect driver inattention by using physiological measures. A couple of technologies will be discussed briefly after which a summary will be given on the state-of-the-art technologies.

Scientific studies found a relation between blink duration and the level of fatigue. The percentage of eyelid closure (PERCLOS) is a well-established approach to measure the level of fatigue in drivers (Xiong, Xie, & Wang, 2012). Therefore eye feature detection is a widely used metric that is used in several monitoring systems. Some of these systems are supported by other metrics, such as peak closing velocity (PCV), face features and head movements (Reed, et al., 2015).

Next to the main technology to detect the driver drowsiness – eye feature detection – there are systems that measure the heart rate feature by means of an electrocardiogram (ECG), measure the electrical activity in the brain by means of an electroencephalogram (EEG) and monitor

[51] https://www.nsc.org/road-safety/safety-topics/fatigued-driving.

electrodermal activity (EDA) in the skin. All techniques have a strong evidence base for drowsiness detection. There are however still several challenges to overcome (e.g. intrusiveness vs. non-intrusive and reactive vs. predictive).

7.2.2 Technical standards

The General Safety Regulation refers to two types of DDR systems with respective different introduction dates. Both systems are mandatory for all new M and N vehicles.

- Driver drowsiness and attention warning (DDR-DAD) will be made mandatory for all new approved types at 01/09/2021 and for new vehicles at 1/09/2023;
- Advanced driver distraction warning (DDR-ADR) will be made mandatory for all new approved types at 01/09/2023 and for new vehicles at 01/09/2025.

When it comes to retrofitting DDR systems, retrofit DDR ADR systems are not yet mature enough. Introduction of retrofit DDR is assumed to be possible at the same time as factory fitted versions available and established (Ecorys & VTT, 2019).

7.2.3 Costs of a DDR system

According to the review of systems by Reed, et al.(2015), the costs of a factory fitted DDR system has a broad range between €100 to over €10.000 per device. Systems on the lower end of the cost range are often camera-based systems, ECG and EDA monitors, whereas on the high end of the cost range are typically managed systems.

In case that the distraction monitoring will be based on additional driver-facing sensor hardware (based on Baum et al (2008)), the cost of mandatory installation per vehicle are estimated at €98 to €118. For retrofitting there are currently systems on the market that range from roughly €150 to €229.[52] [53]

7.2.4 Performance of DDR

NHTSA (2010) estimates that driver distraction might contribute to 16% of fatal collisions, 21% of all injurious collisions or 22% of all collisions in the US. In Germany, 26% of the injury collisions were caused by unintentional lane departure by distraction or inattentiveness (Hummel, Kuhn, Bende, & Lang, 2015). The implementation of these systems contribute to approximately 20% of the collisions. However, whether the costs outweigh the benefits depends on the target population, type and method of installation. According to the latest costs benefit analysis, the ratio of aftermarket systems is expected to be negative, while mandating new vehicles is expected to have a positive costs benefit ratio (Reed, et al., 2015).

52 https://www.ebay.com/Vuemate DI330a.

53 http://www.care-drive.com/product/driver-fatigue-monitor-mr688/http://www.care-drive.com/product/driver-fatigue-monitor-mr688/.

8 Alcohol interlocks programmes

This chapter provides more detailed information on alcohol interlock programmes. It provides an overview of the various types of and describes the current state of play in terms of adoption of these programmes in the EU, EFTA and other third countries. The chapter provides more detailed information on experiences and performance of the programmes in various countries. In addition, it provides an overview of the costs involved in running alcohol interlock programmes. Finally, the chapter provides an overview of (potential) barriers for implementation of alcohol interlock programmes.

8.1 *Overview of alcohol interlock programmes*

Alcohol interlock programmes are considered to be an effective measure in order to prevent driving under the influence of alcohol. This is among others reflected in a recent study by (VIAS, 2018) that showed that alcohol locks reduce the chance of a recidivism with at least 75%.

In general, three types of alcohol interlock programmes can be distinguished:

- Offender/rehabilitation programs: alcohol interlocks programmes for drink-driving offenders following by court or administrative rulings;
- Mandatory/preventive programs: general preventive alcohol interlocks programmes following by regulation or other agreements;
- Voluntary programs: interlocks programmes on a voluntary basis in order to assure the quality of transport services. Alcohol interlocks can also be purchased for voluntary private use. The commercial systems on the market are described in section 7.1.3.

Several countries have adopted or changed their alcohol interlock programme since 2014. Others are still considering possible measures. In 2019, France (La Sécurité Routière, 2019) and Lithuania (ETSC, 2019) announced to start offender/rehabilitation programmes, while the UK started a feasibility study to use alcohol interlocks in rehabilitation programmes (ETSC, 2019).

In contrast to countries that have adopted the use of alcohol interlocks, in the Netherlands – a relatively "early adopter" of such a programme – the High Court decided to suspend the programme on the basis of double punishment of offenders (see Annex 5 for detailed information).

Table 8.1 provides an up-to-date overview of the status of alcohol interlock programmes in ten EU Member States, in Norway and the United Kingdom. The following aspects of the current programmes are indicated:

- Legislation status: determines the legislative status by determining whether legislation is in preparation, under discussion in the Parliament, (being) implemented or adopted;
- Type of alcohol programme: indicates the different type of programme between offender/rehabilitation, mandatory/preventive and voluntary programs;
- Target group: describes for whom the alcohol interlock programme is meant;
- Duration: explicitly states the participation time (in months/years) of the programme;
- Costs: states the associated costs of the program (incl. purchase, installation, inspection, read-out, calibration, removal);
- Program specifics: defines the program specifics.

Table 8.1 Overview of alcohol interlock programmes in EU member states, Norway and the UK

Country	Legis-lation status	Type of alcohol interlock programme			Target group	Duration	Costs	Program specifics
		Offender / Rehabilitation	Mandatory / Preventive	Voluntary				
Austria	Law adopted	Yes		Yes	DUI offenders when half their driving ban is completed (only category B and BE drivers)	Half of their driving ban	Minimum is roughly €2.100 for six months	Pay for installation, rental, removal of the device and mentoring session (every 2 months)
Finland	Law adopted	Yes	Yes (school / day care transport)	Yes	Voluntary: DUI offenders Mandatory transport: municipal federation, school or institute	1−3 years for offenders (court decides)	The associated costs: €1.500 and €2.050 (incl. purchase, installation, inspection, read-out, calibration, removal)	Application of a specific driving license to the police by discussing their use of drugs, health effect and treatment options
Sweden	Law adopted	Yes	Yes (buses, specific trucks)	Yes	All DUI (of alcohol) offenders	1 or 2 years (dependent on the BAC level, diagnoses or recidivism)	1-year: €2.150 – € 2.700 2-years: €2.850 - €4.150	During the program: data transmission, doctors certificate Follow up: medical certificate
Netherlands	Programme suspended			Yes	Novice drivers with a BAC between 1.0-1.8 g/l Experienced drivers with a BAC between 1.3-1.8 g/l	24 months	Programme costs for 2 years are between €4.000 - € 5.000	the High Court decided in 2015 to stop imposing an alcohol interlock programme
Norway	Law adopted		Yes (buses and mini-buses	Yes	Busses and minibuses are obliged to have an alcohol interlock	Not limited	Purchase = € 800 euro Recurring = € 19,90 p/month	Local taxi companies are also 'voluntarily' implementing alcohol interlocks in their taxi cars, as part of company policy.
France	Law adopted	Yes	Yes (buses / coaches)	Yes	DUI offenders with a BAC level above 0.8 g/l	Min: vary from 6 months to 3 years Max: 5 years in case of an additional sentence	Average purchase cost of €1.300 euros or leasing at €30 - €100 p/month (excl. assembly and removal)	Possibility to reduce fines by the courts; Data read-out not possible
Belgium	Law adopted	Yes		Yes	DUI offenders with a BAC above 1.8 g/l DUI recidivist with a BAC above 1.2 g/l	Max: 3 years or for a lifetime	1-year: 2.981 2- years: € 4.243 3-years: € 5.517	The additional support program covers education, analysis of the alcohol interlock records, personal counselling and a closing conversation

Country	Legis-lation status	Type of alcohol interlock programme			Target group	Duration	Costs	Program specifics
		Offender / Rehabilitation	Mandatory / Preventive	Voluntary				
Denmark	Law adopted	Yes		Yes	Obliged use of an alcohol lock when BAC level of over 2.0 per mile or caught several times Voluntary use of an alcohol lock in case of BAC between 1.2 and 2.0 per mile; caught twice	Min: when the disqualification period expires Max: two years	Costs are between €3.400 and €3.600 (incl. alcohol lock, assembly, service, administration of log file, additional applications and educational course)	
United Kingdom	Feasibility study; pilot project			Yes	Participants recruited on a voluntary basis	Trial duration	The cost of the trial are absorbed by the manufacturer	The programme is not yet enforced and imposed by law.
Lithuania	Law adopted	Yes	Yes (shuttle/ school buses)	Yes	Low-risk DUI offenders: experienced drivers with a BAC between 0.4‰ to 1.5‰. Novice drivers with a BAC between 0.0 and 0.4‰ High-risk offenders: DUI offenders with a BAC level in excess of 1.5‰. Novice drivers with a BAC of over 0.4‰	High risk offenders are imposed with a driving disqualification between 1 and 3 years	Costs vary between €1.500 and €1.700 (incl. alcohol interlock, installation, calibration and rehabilitation course)	The offenders categorised as being high-risk are required to attend the rehabilitation course
Poland	Law adopted	Yes		Yes	First time DUI offenders and recidivists	Half of their driving ban	Costs vary between roughly €800 and €1.400	
Italy	Law in preparation			Yes				Amendments to Articles 125 and 186 of the highway code in order to make an alcohol lock feasible are in preparation

Source: ETSC (2020), Alcohol Interlocks in the EU https://etsc.eu/alcohol-interlock-barometer/.

8.2 *Review of experiences*

The last couple of years European active alcohol interlock programmes have been subject to changes. Programmes are extended or adjusted, new programmes are put in place and the evaluation of active alcohol interlock programmes have also matured. This section will cover an up-to-date review of recent experiences. Annex 5 presents a more detailed description of active alcohol interlock programmes at national level.

8.2.1 Offender/rehabilitation programmes for DUI offenders in EU Member States

In 2020, eight EU Member States have an active operating offender/rehabilitation programme in place for drink-driving offenders. The next section will provide a brief description concerning the main characteristics of these eight country specific programmes.

Sweden introduced in 1999 – as the first country in Europe – an alcohol interlock trial programme with the purpose of rehabilitating offenders. After extension of the trial for cars, buses and trucks (in 2003) and a law regarding a permanent program for DUI offenders (in 2012), more than a decade later (in 2012), roughly 80.000 commercial transport vehicles – trains, trams, ferries and ships – were equipped with an alcohol interlock (ETSC, 2014).

Sweden even went a step further in 2013 by running a pilot project 'Alco Gate'. Purpose of the trial was to control the maritime border and test technology. The Port of Gothenburg installed checkpoints for all buses and trucks entering the country. The driver needed to blow into a breathalyser to open the Alco Gate and enter the country.

In **Denmark**, the sanctions for drink driving have been changed several times since 2005. According to the most up-to-date information provided by the Danish Transport Authority, there are two schemes in place, a mandatory (obligation by court rulings) and voluntary (offenders choice) scheme. The conditions of these two schemes depend on the level of intoxication (BAC levels) and whether the offender has been caught multiple times (Ehlers, 2018).

Finland ran multiple trials from 2005 to 2008 regarding voluntary alcohol interlock use in commercial transport (Finnish Transport Safety Agency, 2012). Following these trials, the programme became permanent since July 2008. The programme is voluntary for offenders, in the sense that the offender can choose to apply for an alcohol interlock, instead of being banned from driving.

In **France**, since the orientation and programming law for the performance of internal security (Loppsi 2) of 2011, the installation of an alcohol interlock can be proposed by a judge to a person responsible for a traffic offense involving blood alcohol levels, as an alternative in particular to a license suspension. Today, an alcohol interlock can be imposed on drivers:

- by the prefect of the department as an alternative to the suspension of the driving license: since 2018 prefects in France can impose the obligation to drink driving offenders who committed a criminal DUI offence (BAC > 0.8 g / L) to drive with an alcohol interlock during the period until the offender has to appear in court as an alternative to a driving ban. (La Sécurité Routière, 2019). Since May 22, 2020, the maximum duration for this provision has been extended to one year. The court, when deciding on a final sanction, may decide to extend this obligation for a period of up to five years.
- after opinion of the medical commission: following withdrawal, suspension, cancellation of a driving license as a result of DUI offence, or following an alcohol interlock measure as an alternative to the suspension of the licence, the administrative medical commissions of prefectures can issue a provisional driving license on an experimental basis if the driver has an alcohol interlock installed, while accepting medico-psychological monitoring.
- by judicial decision at all stages of the procedure: the obligation to drive with an alcohol interlock can now be ordered by magistrates at all stages of the procedure (penal composition, additional penalty, alternative to imprisonment, as a modality of a suspension accompanied by a probation, a penal constraint or a modification of the sentence or as a security measure). It can be imposed in cases of a criminal DUI offence (BAC > 0.8 g / L), repeat DUI offenders and drivers who caused an accident while under influence of alcohol.

Only very few judicial decisions have been made to impose an alcohol interlock and these cases are mainly related to recidivism or alcohol-related accidents with fatalities or severe injuries.

Furthermore, prefects have proposed installation of an alcohol interlock in some 4,846 (1,5%) cases in 2019, among the more than 300,000 alcohol related offenders (not all the drivers accepted, but no official data exist on the actual number of interlock installations). (Mercier Guyon, 2020). It is expected that the number has gone up in 2020; in the first nine months of 2020, some 8,104 prefectural decrees restricting driving with an alcohol interlock have been proposed to offenders fined at the roadside by the police, leading to the effective installation of around 1,500 devices (ETSC, 2020).

Belgium started with an alcohol interlock offender programme in 2010. In the period before 2018, judges had the possibility, not the obligation, to impose the program for a 1 to 5 year period for offenders caught with a BAC above 0.8 g/l. However, since the start of the programme only a limited number of offenders have participated in the offender programme (in 2018 only 67 participants). The main reason for little interest so far is that judges were hesitant to impose an alcohol interlock programme.

From the 1st of July 2018, the Belgian legislator made the following regulatory changes:

- The judge is, in case of a first-time offender and a BAC above 1.8 g/l, obliged to impose an alcohol interlock. The judge has the possibility to waive the installation of alcohol interlock, but needs to explicitly motivate the reason. In that case, the fine will vary between 1.600 and 16.000 euros;
- The judge is, in case of recidivism and a BAC above 1.2 g/l, obliged to impose an alcohol interlock. Moreover, the recidivist loses the right to drive a car for 3 months, which is linked to multiple investigations (medical, psychological, theoretic and practical) (FOD Mobiliteit, 2020).

Following the (successful) trials performed in 2012 and 2013, **Austria** launched a voluntary rehabilitation programme for drink driving offenders in 2017. The programme offers offenders an option to get behind the wheel when half of their driving ban is completed with the prerequisite of having an alcohol interlock device installed.

In **Poland**, new regulatory measures came into force on 18th of May 2015, which touched upon the following:

- Severe punishments for drunk drivers: among other prison time, suspending the driving licence for life, fines between €1.100 – €2.200 (PLN 5.000 – 10.000);
- Driving under influence offenders will be obliged to install an alcohol interlock. In case the person is banned from driving because of a drunk driving offense they can apply for driving with an alcohol interlock after half of their sentence is fulfilled;
- Recidivists will be banned for life. However, these offenders can apply after 10 years of their sentence for driving with an alcohol interlock.[54] [55] [56]

Lithuania has become, as of the 1st of January 2020, the ninth EU Member State that has introduced an alcohol interlock as part of a rehabilitation programme. Since 2016, Lithuania has built experience with the use of alcohol interlock by fitting these devices in 80 school buses, shuttle buses in Vilnius and voluntary installation by several passenger and freight companies (ETSC, 2020). As of the 1st of January 2020 Lithuania took the next step by adjusting the Law on Road Traffic Safety and adding the definition of an alcolock and allowed imposing a restriction on driving without an alcolock (Lietuvos Respublikos susisiekimo ministerija, 2020).

8.2.2 Preventive/mandatory programmes in EU Member States and Norway

Several countries (i.e. Finland, Sweden, France and Lithuania) have – either apart from their offender/rehabilitation programme – a preventive/mandatory alcohol interlock programme in place for specific types of vehicles (e.g. school transport, buses, coaches and trucks). However, Norway is the first country with a broader preventive alcohol interlock programme. The development of these programmes and recent developments are described as follows.

[54] https://etsc.eu/poland-seventh-eu-country-to-require-interlocks-for-convicted-drink-drivers/.
[55] https://www.premier.gov.pl/en/news/news/stricter-punishments-for-drivers-since-18-may.html.
[56] https://www.motofakty.pl/artykul/blokada-alkoholowa-przepisy-zastosowanie-i-skutecznosc.html.

Preventive/mandatory programme development in Norway

Following an alcohol interlock seminar in 2007, the Government Minister of Transport and Communication established a working group to prepare a practical and political platform for an offender program, largely based on the Swedish model. The initial strategy included both offender programs, and compulsory use as a proactive instrument for preventing driving cars under the influence of alcohol. The following target groups for such a measure are selected:

1. School buses in particular and buses in general;
2. Taxi and other passenger vehicles;
3. Transport Fleet sector;
4. Construction Operations;
5. Heavy transport sector;
6. General preventative use of alcohol interlocks in passenger cars.

Following the legislation process, from January 1st 2019, it is mandatory to have alcohol interlocks in buses and minibuses in Norway. The Law is open for all vehicles doing transport for payment, but in the sub-law (forskrifter) it has been limited to buses and minibuses, with option for expansion later on. This means that in 2023 all buses and minibuses on Norwegian roads – both new and old – need to be equipped with alcohol interlocks.

All Norwegian providers of alcohol interlocks with certificates in compliance with the CENELEC Standard EN 50436, are represented in the Norwegian Alcohol Interlock Committee, NEK/NK BTTF 116-2. It secures that all alcohol interlocks installed in Norwegian vehicles comply with the standard, following the procedures of implementation, installation, use, service, maintenance and follow up of users, with reference to the Standard. These technological standards are in more detailed discussed in section 9.1 of the report.

Other developments concerning preventive/mandatory programmes in Europe

In **Finland** the Ministry of Transport recommended in 2006 to use alcohol interlocks in professional school and day care transport. In total, 17 municipalities had been using alcohol interlocks for this purpose until 2008. Since 2011, the Finish regulators adopted a rule that imposed transport organised by a municipality, school or institute to be equipped with an alcohol interlock. This applies for the transportation of pupils and related to day care (Löytty & TRAFI, 2016).

8.2.3 Voluntary programmes in EU Member States and EFTA countries

Besides the offender and mandatory programmes in EU Member States and in EFTA countries, almost all of these countries are also supporting the voluntary use of alcohol interlock (for some vehicles types). Recent insights and characteristics of these programmes will be shared in the following section.

The **Norwegian** programme focussed on the mandatory application of alcohol interlocks in buses and minibuses, the new regulation also developed the use of voluntary alcohol interlocks in an unexpected direction. After the implementation of the mandatory programme in January 2019, the Norwegian Taxi Association[57] was disappointed to be left out, and has requested mandatory use of alcohol interlocks also for taxis.

A significant number of local taxi companies, are now implementing alcohol interlocks in their taxi cars, as company policy. The same is the case with transport companies, both commuter and heavy trucks. Contractors of transports do more and more include demand for alcohol interlocks in contracts with transport companies.

Apart from these developments with regard to offender/rehabilitation, mandatory and preventive programs there are other developments with regard to alcohol interlock programmes. These will be briefly touched upon in the following section.

[57] The Norwegian Taxi Association is represented in NEK/NK BTTF 116-2, Alcohol Interlocks for Motor Vehicles.

8.2.4 Other developments regarding alcohol interlock programmes

The **Netherlands** was one of the first countries that implemented an offender/rehabilitation programme. From the 1st of December 2011, multiple programmes, target groups and criteria were identified (Blom, Blokdijk, & Weijters, 2019). In 2014, the alcohol interlock programme (ASP) was evaluated on the following aspects:

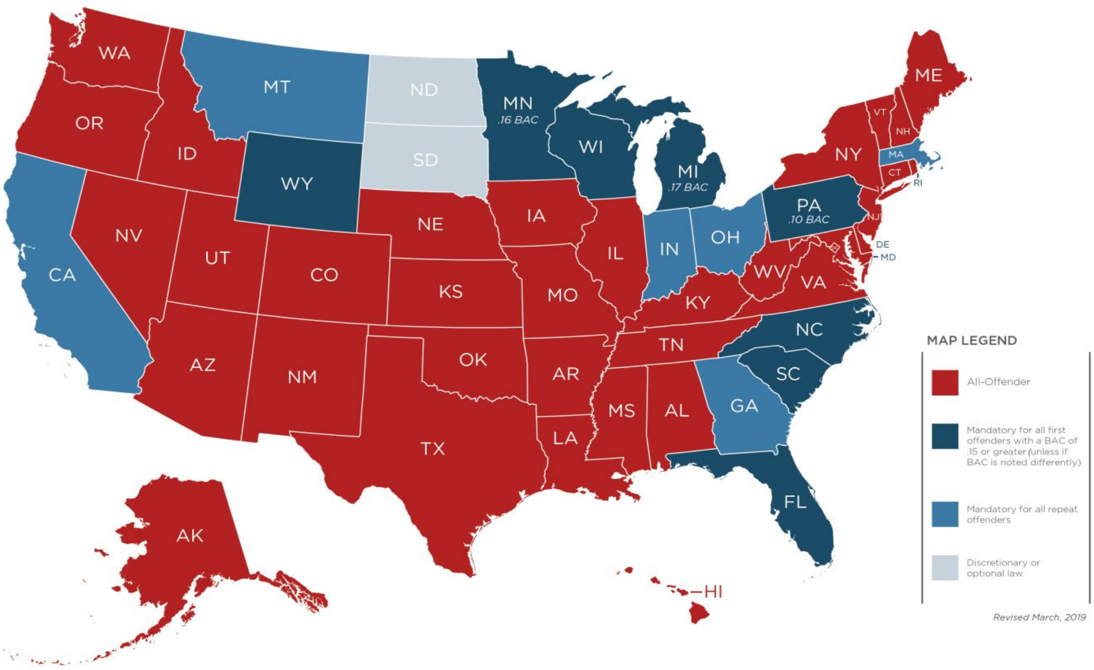
- Participation rates;
- Experience of the stakeholders;
- Relationship of the AIP to criminal law;
- Effects on road safety.

After the evaluation, the High Court decided in 2015 to stop imposing ASP's. The main argument for this was double sanctioning (administrative and regulatory sanction) and the lacking possibility to adjust for personal circumstances, which according to the Court led to inequality and arbitrariness. As a result, the Dutch Ministry of Transport and Environment cancelled the programme as of September 2016 (Goldenbeld, 2017) (Blom, Blokdijk, & Weijters, 2019) (Council of State Ruling 201400944/1/A1).

In 2018, the **Swiss parliament** has voted to cancel the planned introduction of alcohol interlocks for drink-driving offenders in Switzerland in a move described by Swiss road safety experts as 'incomprehensible'. They have evaluated the measure extensively and concluded on the basis of costs that the programme should be cancelled (ETSC, 2018).

Many states in the **United States** (US) have adopted alcohol interlock programmes. In 2019, 34 states and Washington, D.C. require alcohol interlocks for all drunk driving offenders, meaning that an arrested or convicted drunk driver must use an interlock in order to drive during a court or driver license agency license suspension. Furthermore, every state in the US has some type of ignition interlock law on the books (MADD, 2019). Of the 16 states that do not mandate alcohol interlocks for all drunk drivers, all but Massachusetts offer some type of alcohol interlock use for first-time offenders.

Figure 8.1 States with alcohol interlock programmes in the US



Some 22 states and the District of Columbia have compliance-based removal as part of their interlock laws, meaning an interlock user must prove sobriety before exiting use of the device. Drivers who refuse an alcohol breath test can also be required to drive with an alcohol interlock. In 2016, the U.S. Supreme Court affirmed states' rights to charge suspected drunk driving offenders for refusing an alcohol breath test for which a warrant was not obtained. In 33 states an alcohol interlock now required or refusals to take a breath test is criminalised, eliminating the incentive for a suspected drunk driver to refuse a test.

Every state or territory in **Australia** has its own alcohol interlock programme in place. This also means that the rules, regulations and procedures vary from state to state. Many of these programmes opt for an offender programme in case of recidivism. Typical for the alcohol programmes in the US and Australia is the possibility for people in financial hardship to participate in the alcohol interlock programme at a reduced cost (e.g. in New South Wales (Australia) concession card holders pay 35% of the full cost).

8.3 *Costs of alcohol interlock programmes*

In section 7.1.3 costs of alcohol interlock devices were already briefly discussed. As mentioned in that section the costs of (installation of) an alcohol interlock device are most often only part of the costs incurred since most drivers using an alcohol interlock are participating in an alcohol interlock programme.

The following costs are typically associated with using an alcohol interlock in an alcohol interlock programme:

- **Introduction costs**: e.g. costs associated with application, installation and administration
- **Recurring costs**: e.g. maintenance, inspection, service costs and (in some programmes) periodic medical examinations;
- **Closing and other costs:** e.g. consist of removal of the alcohol interlock, application procedure and finally a sobriety check.

In the following section, a more detailed costs assessment for the different cost elements is provided. The information is retrieved from the alcohol interlock programmes in Europe (see Annex 5).

Figure 8.2 Main cost components of alcohol interlock programmes

Introduction costs	Recurring costs	Closing and other costs
Purchase of an alcohol interlock;	Maintenance	Removal
Administration;	Inspection	Application procedure
Conditional driver's license;	Service	Sobriety check
Installation;		Educational courses (e.g. evaluation, lessons, training)
		(Periodic) Medical examinations

Introduction costs

The first cost element of an alcohol interlock programme, called introduction costs, mainly consist of the purchase and installation of alcohol interlock. Information and/or assumption on the following relevant introduction cost elements are obtained during the study:

- Purchase of an alcohol interlock: the purchase costs are varying between €700 (Norway) and over €2.000 (Austria and Denmark);
- Installation: the installation costs are according to manufacturer's approximately €70 to €200. The exact costs of installation depend on the vehicle characteristics (model, technical features, shipping costs and additional fees);
- Application of a alcohol interlock;
- Administration;
- Issuing an conditional driver's license.

In European countries, the introduction costs for a participant in an alcohol interlock programme range between € 900 - € 3,000. In most programmes these costs are carried by the participant. If cost price figures are used, this is explicitly indicated in Table 8.2.

The purchase costs may decrease in the future due to a developing technology and production on a larger scale according to Ecorys (2014), TRT (2014) and (VIAS, 2018).

Recurring costs

The second costs element are periodic recurring costs. The main recurring cost component is related to periodic maintenance and service costs. Information and/or assumptions on the following relevant recurring cost elements are obtained during the study:

- Maintenance (e.g. calibration);
- Inspection (e.g. device check and visual inspection);
- Service (e.g. download of data / data transmission, breath tests).

The average recurring costs of an alcohol interlock programme varies between **€ 30** and **€ 100 per month**.

Closing, follow-up and other costs

The third, and final, costs component are the closing, follow-up and other costs due to participation of an alcohol interlock programme. The main costs element are related to the support programs (e.g. educational course or medical checks), which are dependent on the type of programme. Information and/or assumptions on the following closing cost elements are obtained during the study:

- Application procedure;
- Sobriety check;
- Education course: part of the Dutch alcohol interlock programme is a mandatory educational course. The costs of such a course consist of imposition costs (€415) and actual course costs (dependent on the number of courses) between €232 and €618;[58]
- (Periodic) medical checks (e.g. doctors certificate);
- Removal of the alcohol interlock.

Note: replacement costs as a result of damage or destruction can results in hundreds or even thousand(s) of euros. The financial responsibility depends on the purchase terms or the car insurance. The replacement costs are left out of the cost analysis.

The closing and follow-up costs, related to the removal of alcohol interlock, are approximately **€ 50 and € 150**. Other costs consists of broad variety of costs elements, which will be described in the following section.

Other costs

Part of the final costs component, other costs, are dependent on the practical implementation of the programme (e.g. duration and intensity). Examples of these costs elements are educational courses, training and lessons and (periodic) medical checks. Offender/rehabilitation programmes in the Netherlands and Belgium obliged the offender to participate in education course, with an approximated costs of over €1.000.

A medical examination can be performed at the start of the program (introduction costs) and in the form of recurring costs. Tests in Spain showed that the total costs of medical examination will increase the programme costs with approximately **€ 800** from € 1.200 to € 2.000 (Traffic Injury Research Foundation, 2009). In Sweden, four medical examinations are required. According to Ecorys (2014), the estimated costs equalled € 672.

[58] https://www.cbr.nl/nl/onveilig-rijgedrag/nl/cursus-alcohol-en-verkeer/kosten-en-betaling.htm.

Table 8.2 Overview of the costs related to an alcohol interlock programme

Alcohol interlock programme	Introduction costs	Recurring costs	Closing and other costs	Total average costs
Austria[59]	€1.800 - €2.800		€600	€2.400 - €3.400
Finland[60]	€1.320 – €1.590	€50 – €120	€130 – €330	1-year: €2.400 2-year: €3.840 3-year: €4.320
Sweden[61]	€420	€168	€784	1-year: €2.150 – €2.700 2-years: €2.850 - €4.150
Netherlands[62] [63]	€360	€111 - € 127 p/month	€1.120	2-year: € 4.000 - €5.000
Norway	€880	€35 p/month		€1.440
France	€1.300	€100 p/month		
Belgium*	€2.514 - €4.030		€ 565 - € 1.210	€3.100 - €3.800
Denmark[64]	€ 2.840 - €3.140	€150 p/month	€430	
Lithuania	€1.300 - €1.500	€50 p/month	€85 - €115	
Poland	€760 - €1.285	€10 p/month	€45	

* These are cost price figures, but the participant pays a reduced tariff (VIAS (2019))[65].
** The total average costs figures are retrieved by calculated the average costs of the above-mentioned programmes.

Table 8.2 presents the estimated costs of an alcohol interlock programme. Based on the overview table, the costs of an alcohol interlock programme are ranging between **€1.000** and over **€3.000 per year**. This is in line with a report by Finnish Transport Safety Agency (2012), Ecorys (2014) and TRT (2014).

In general, programmes impose the participant with all the associated costs. However, there are examples of programmes that give an incentive to participate in the programme by means of cost subvention or by shortening the driving ban. The cost overview also shows that there is substantial difference between either different costs components and country programmes. Especially other costs, appear to be very dependent on the practical implementation of the programme.

While this section described the costs of an alcohol interlock programme, the associated costs related to policy options are described in chapter 10, which also provides cost-benefit analysis of different alcohol interlock policy options.

8.4 *Barriers for implementation of alcohol interlock programmes*

Many European countries have adopted (or are preparing) an alcohol interlock programme compared to a decade ago. Still several barriers have to be removed in the years to come. Regarding the acceptance and implementation of alcolocks for drink driving offenders, the following factors play an important role and should be addressed accordingly:

- Legislative barriers: opposition by the criminal justice system;
- Technical barriers: malfunctions of the alcohol device;
- Socio-economic barriers: costs and social barriers of alcolock programmes to participants;
- Political barriers: political resolutions.

59 (Traffic Injury Research Foundation, 2014)
60 https://etsc.eu/wp-content/uploads/Analysis-of-Finnish-legislation-on-alcohol-interlocks-TRAFI-Marita-L%C3%B6ytty.pdf.
61 https://etsc.eu/wp-content/uploads/Drink-Driving-in-Sweden-Swedish-Transport-Agency.pdf.
62 https://www.draeger.com/library/content/leasepakketten-3752-nl.pdf.
63 (Kartal Knol, 2015)
64 https://alkolaas.dk/priser-alkolaasordning/.
65 https://www.vias.be/nl/particulieren/alcoholslot/wat-is-de-kostprijs-van-een-alcoholslot/.

A couple of striking examples of barriers are retrieved from current alcohol interlock programme experiences and from ex-post evaluations in the Netherlands, Belgium, Switzerland, Sweden and Norway.

8.4.1 Legislative barriers: conflicts between administrative and criminal law

In the Netherlands, alcohol interlocks were introduced under administrative law in December 2011. It targeted first time offenders driving with BAC between 1.3-1.8 g/L and recidivists (second offence BAC limit ≥ 0.8 g/L.). Drivers were offered the choice to participate in an alcohol interlock programme or having a driving ban for a period of five years. The alcohol interlock programme involved being only allowed to drive in a vehicle fitted with an alcohol interlock for a period of at least two years and having to participate in a motivation/training programme.

When the decision participate in the interlock programme, the driver was responsible to have the alcohol interlock installed, pay for its participation in the programme (the costs were around € 4,500) and apply for a driver's license with code 103 "driving with an alcohol interlock".

The driving ban and/or participation in the interlock programme were administrative sanctions administered by the Central Office of Driving Certification (CBR). At the same time, DUI offences can also be prosecuted and sanctioned by the justice system. Drivers with a driver’s license B can be allowed to drive with an alcohol interlock until the date of the trial (within a maximum of six months), in which a judge can decide to impose a driving ban. In that case, a driver would be excluded from continuing the alcohol interlock programme. The cost paid to participate in the programme would not be refunded.

Since the launch of the programme, there we several court cases filled by drivers who were found guilty of DUI offences claiming the impact of an alcohol interlock was disproportionally heavy, too expensive and not taking into account personal circumstances. Finally, two court rulings in 2015 ushered in the end of the alcohol interlock programme.

In a ruling (HR March 3, 2015, ECLI: NL: HR: 2015: 434) the Supreme Court in essence stated that imposing the alcohol interlock and criminal prosecution involves a double punishment. This meant that the Public Prosecution Service would not be admissible in the prosecution for drink-driving, if the CBR had already imposed the alcohol interlock program.

A ruling of the Division administrative law of the Council of State (ABRvS March 4, 2015, ECLI: NL: RVS: 2015: 622) found that imposing an alcohol interlock under conditions set in the regulations of 2011, could be considered disproportionate in some cases, not taking account of personal circumstances of the driver, and its imposition to violate the prohibition of arbitrariness.

Following the rulings the Dutch Ministry of Transport and Environment suspended the programme as of September 2016. An ex-ante impact assessment of inclusion of the alcohol interlock as a sanction within criminal law (Significant, 2015) had shown that, even if the costs of the interlock programme were paid by the government, effectiveness of the programme would be low. The report considered that judges would be more often inclined to impose a conditional driving ban rather than an alcohol interlock for drivers caught with a BAC < 1.5‰. This group constituted some 50% of the cases. From the other 50% of offenders it was assumed a maximum of 50% would participate, since the measure is not suited for everyone, such as drivers who have access to a car, but do not own it (e.g. company cars) and who do not have permission to install an interlock from the owner, or persons who do not own a car at all. As a result, the number of interlocks imposed on drivers was considered too low. In addition, the government took into account that research (SWOV, 2016) had shown the alcohol interlock program can be an effective way to prevent people from DUI, but that the effect of the alcohol interlock on recidivism is limited to duration of the program. Moreover, while the alcohol interlock system does create an extra barrier to driving with alcohol, it cannot prevent people who have drunk too much to drive another vehicle (Minister van Justitie en Veiligheid and Minister van Infrastructuur en Waterstaat, 2018).

8.4.2 Technical barriers: malfunctions

Next to the legislative barriers, the technology of alcohol interlocks is developing in a rapid pace. Still some technical barriers are in place that may prevent future uptake of alcohol interlocks usage.

The Netherlands extensively evaluated the alcohol interlock programmes in 2013-2014. The experiences (also regarding technical functionalities) are gathered in a survey and interviews (Ministry of Infrastructure and Environment, 2013). The following main (technical) aspects are pointed out by the interviewees:

- Difficulty of reading the display (especially with the sun reflection);
- Starting the alcohol interlock takes quite some time when the weather is cold;
- The beep triggers a startle reaction;
- The re-tests (when driving) follow within a short time frame;
- Difficult to get the hang of the breath technique (could be due to shortness of breath, asthma, etc);
- Finally, 50% of the respondents (86 out of 191) indicated regular malfunctions, such as a defect display, error messages, different results within a short term frame and others.

According to the ETSC complex and various connection methods for newer cars are still a barrier to for wider uptake of alcohol interlocks (ETSC, 2017). To resolve these technical barriers, cooperation between the automotive industry and device manufacturers remains essential.

8.4.3 Socio-economic barriers: costs and social barriers of alcohol interlock programmes to participants

The third barrier is related to a more 'practical' barriers that prevent further participation in either rehabilitation/offender or voluntary programs is related to socio-economic aspects. The main socio-economic barrier is related to the costs (installation, maintenance and monitoring) for participation in an alcohol interlock. Programme evaluations in Belgium, Netherlands, Switzerland and Sweden all touch upon the same barrier: high participation costs.

In **Sweden** a large questionnaire (1.100 respondents) issued to both participants and non-participants showed the main reasons for eligible drivers not to participate in the alcohol interlock programme are the costs of the program (64%), the image of being seen as alcoholics (37%) or they didn't absolutely need a license (26%) (VTI, 2016).

In addition, roughly 11% of the participants in the Netherlands dropped out of alcohol interlock programme because they did not fulfil the payment on time (Ministry of Infrastructure and Environment, 2013). As mentioned in the section on legal barriers, court rulings in the **Netherlands** criticised the severity of alcohol interlocks as a penalty in case of some individuals.

Clearly the most frequently mentioned socio-economic barrier of an alcohol interlock are related to the relatively high participation costs. However, several other barriers affect the participation in both offender/rehabilitation and voluntary programmes, such as:

- Image of the alcohol interlock;
- Communication between the court and the support program institutions;
- Refusal of breath or blood test and privacy.

This perspective is also shared outside of Europe. A study of the impact of mandatory versus voluntary participation of the Canadian Alberta Ignition Interlock Program showed that the (potential) participants indicated the costs of installation and maintenance, together with the irritation and shame, as the main barrier to participate (Voas, Tippetts, Marques, & Beirness, 2000).

In contrast, the Norwegian Alcohol Interlock Committee presented the Alcohol Interlock as an instrument for quality assurance in the transport, than as a punitive instrument. This cleared stigma for user of alcohol interlocks in Norway, and it was early on accepted by professional drivers.

8.4.4 Political barrier(s): political resolutions

Finally, political reasons - intertwined with many of the above-mentioned barriers - could also impose a barrier for further uptake of alcohol interlocks. In the Netherlands (Minister van Justitie en Veiligheid and Minister van Infrastructuur en Waterstaat, 2018) and Switzerland (Der Bundesrat, 2017) such barriers contributed to the decision not to continue, respectively, start with an alcohol interlock programme. At the same time, these barriers have not deterred various other countries to instate alcohol interlock programmes. In addition, resolutions requesting the fitting of alcohol interlocks have been adopted in the European Parliament and the Nordic Council.

In its resolution of 27 September 2011 on European road safety 2011-2020 (P7_TA(2011)0408), the European Parliament called on the Commission to develop its proposals into an action programme (including a set of measures, timeline for implementation, monitoring instruments to check effectiveness and a mid-term evaluation) (paragraph 1). The resolution also called on the Commission to support the development of techniques for apprehending drivers under the influence of drugs and medicines which influence their fitness to drive (paragraph 47). Additionally, the resolution recommended that fitting of alcohol interlocks – with a small, scientifically-based range of tolerance for measurement – to all new types of commercial passenger and goods transport vehicles would be made compulsory (paragraph 73). A similar request has been included in the European Parliament resolution of 14 November 2017 on saving lives: boosting car safety in the EU (P8_TA(2017)0423).

Closely resembling the resolution of the European Parliament, the Nordic Council, the official body for formal inter-parliamentary co-operation between Denmark, Finland, Iceland, Norway, Sweden, the Faroe Islands, Greenland and Åland, adopted a resolution in November 2012 recommending the installation of alcohol interlocks. The Nordic Council recommends the Member Countries to:

- Implement alcohol interlocks for commercial and professional drivers in the Nordic Countries, Faeroe Island, Greenland and Åland;
- Implement alcohol interlocks for persons convicted for driving under influence of alcohol;
- Do research of alcohol interlocks in all types of motor vehicles for General Prevention Purpose.

The Nordic Council resolution has been adopted unanimously, which indicates the willingness of politicians to make these decisions, given the factual basis. So far, Finland and Norway have started legislation processes for mandatory use of alcohol interlocks in specific groups of vehicles. Denmark, Finland, Norway and Sweden have alcohol interlock programmes for offenders.

8.4.5 Barriers for harmonisation

Previous evaluations (e.g. Spit, et al, 2014) identified three barriers to increased implementation of alcohol interlocks in a harmonised fashion:

- National variation in the way CENELEC standard were applied, for example in relation to data security requirements;
- Lack of harmonisation of codes on driving licenses, making it difficult to check if a driver is required to drive with an interlock once the driver is abroad;
- Variations in BAC levels across countries, making it difficult to operate the interlock in accordance with variations of BAC limits across countries (e.g. an interlock set at a cut-off limit of BAC 0.5 g/L would allow a driver to drive with an above-limit BAC in a country with a limit of 0.2 g/L).

While some of these barriers remain, progress in removing them has also been made. Section 7.1 describes progress made in the coordination and development of harmonised standards through CENELEC. Furthermore, the harmonised driving licence code ‘69’ for drivers only allowed to drive vehicles equipped with an alcohol interlock was introduced in the EU in 2017. Such a clear code on the driving licence for participants of an alcohol interlock programme makes it easier for police officers to detect misuse while checking the driving licence when drivers enter across borders.

Finally, progress has been made in the harmonisation of BAC limits, as described in section 3.5.1. However, differences still remain between countries within various driver groups, mainly in novice and professional (e.g. truck and bus) drivers. In particular, in professional transport - an international, highly competitive economic sector – imposing different requirements for installing and driving with alcohol interlocks could affect the competitive position of drivers. In the best case, interlocks could become a symbol of quality and reassurance (especially in preventive schemes), but it could also present a limitation for and a cost difference between companies and drivers.

9 Potential safety benefits of alcohol interlocks programmes

This chapter explains the potential (safety) effect of the use of alcohol interlock devices. The effectiveness of requiring specific target groups to drive with an alcohol interlock will be discussed. It involves professional drivers, high-BAC offenders and young drivers. This chapter provides the key assumptions that will form input for the CBA, which will be presented in chapter 10.

9.1 *Offender/rehabilitation programme*

In 2020, eight European Member States had an offender/rehabilitation programme in place (i.e. Austria, Finland, Sweden, France, Belgium, Denmark, Poland and Lithuania). Trials of the first programme started in 1999 in Sweden. Lithuania is the last country (from 1st of January 2020 onwards) that modified the Law on Road Traffic Safety in such a way that it allowed imposing a restriction on driving without an alcohol interlock. On the basis of the experiences in these countries the safety effects (benefits) will be retrieved.

Safety effects of offender programmes

The safety effects (benefits) of offender programmes will be determined on the following aspects:

1. Total number of alcohol-related fatalities;
2. Road safety effect of alcohol interlocks;
3. Penetration level of alcohol interlock offender programmes.

Total number of alcohol-related fatalities

- The share of alcohol use and road safety is presented in detail in chapter 2 and shows there are approximately 3.000 alcohol-related fatalities annually in Europe. The share of alcohol-related fatalities that can be derived from this analysis varies from 18-25% (Table 3.12);
- The majority of drivers involved in serious and fatal accidents are drivers with a high BAC level (≥1.3 g/L). The DRUID project indicates that this holds for roughly 75% of these serious and fatal accidents. These high-BAC offenders are causing roughly 11% (15% * 75%) of the alcohol-related fatalities;
- Therefore, the majority of the offender/rehabilitation programmes focus on recidivists and high-BAC offenders. For example in Belgium, for offenses committed from 1 July 2018, the court is even obliged to impose an alcohol interlock on drivers with a BAC of a least 1.8 g/L, unless the judge chooses not to impose an alcohol interlock and explicitly motivates this. Also serious repeat offenders with a BAC of a least 1.2 g/L who are caught twice within three years are obliged to have an alcohol interlock. In France, offenders with a BAC over 0.8g/L are given the option to install an alcohol interlock instead of a driving ban. In case of recidivism an alcohol interlock will be made obligatory. Same holds for Denmark, where the sanction depends on the BAC level of the offender and whether the offender has been caught multiple times (Ehlers, 2018).

Road safety effect of alcohol interlocks (for heavy offenders)

- Recent findings reported in VIAS Institute (2018) shows that alcohol interlocks reduce the chance of recidivism with 75%. This is in line with a cost-benefit analysis by (SWOV, 2009) assumed that the alcohol interlock programmes are 75% more effective in reducing recidivism than suspension of the driving license;
- The overall net effectiveness of alcohol interlock are assumed to reduce the chance of recidivism with 75%.

Penetration level of alcohol interlock offender/rehabilitation programmes

The penetration level of alcohol interlock offender/rehabilitation programmes either depends on (1) the share of heavy offenders that are arrested by the police and (2) the share of arrested heavy offenders that participate in an alcohol interlock programme.

Share of (heavy) offenders that are arrested by the police

- The percentage of people who have been detected as having an alcohol concentration above the permitted threshold is low. Six countries (Ireland, Poland, Finland, Estonia, Hungary and Sweden) did not exceed 1%, and other three (Cyprus, Slovenia and Italy) did not exceed 3%;
- Similar results were also obtained during the TISPOL checks. The exception is the United Kingdom, where police sobriety checks in 2018 detected 9% of people who exceeded the 0.8 g/L limit;
- The results of the DRUID study show that 0.39% of the drivers were driving with a high BAC of 1.2 g/L or higher.

Share of arrested heavy offenders that participate an offender/rehabilitation programme

- In the previous part, the share of (heavy) offenders that are arrested by the police are assessed, but only a part of these offenders will also apply in the alcohol interlock programme. The participation share depends on several variables, such as the regulatory basis of the sanction;
- In Table 9.1 the penetration rates of the active alcohol interlock offender/rehabilitation programmes are presented;
- In Sweden, the alcohol interlock programme is open for all driving under influence offenders. The goal of the permanent program was to achieve a higher participation rate than the trial period (i.e. 11%). Three studies have been evaluating the alcohol interlock programme and concluded this goal have been reached as the participation rate is equal to 30%. Over 80% (83%) of the participants also completed the program;
- For the purpose of this study the assumption is made that the participation rates vary between 10% and 70%;
- The magnitude of the participation rate assumption is in line with participation rates reported by Elder et al. in 2011 (1%-63%; median 13%).

Table 9.1 Penetration level of alcohol interlock programmes

Country	Penetration rate (yearly and/or total)
Austria	Offender / rehabilitation: roughly 150 – 200 per year (228 participants in June 2018) (ETSC, 2020) (UDV / GDV, 2020)
Finland	Offender / rehabilitation: 500 - 2.000 participants per year (Ehlers, 2018)
	Mandatory: roughly 10.000 buses and child carriers
Sweden	Offender / rehabilitation: 2.000 participants per year and roughly 3.000 people are currently driving with an alcohol interlock (UDV / GDV, 2020) (ETSC, 2020)
	Mandatory: 80.000 commercial transport vehicles
France	Offender / rehabilitation: roughly 1500 devices in the first 9 months (ETSC, 2020)
	Mandatory: roughly 40.000 buses and child carriers (UDV / GDV, 2020)
Belgium	Offender / rehabilitation: 265 participants per year As per October 2020 there were 757 interlocks installed. While in the period 2015-2018, the number fluctuated between 9 and 23, there were 166 interlock installed in 2019 and 590 in 2020 (newmobility.news, 2020) (ETSC, 2020)
Denmark	Offender / rehabilitation: 70 participants yearly (450 participants in total) (UDV / GDV, 2020)
Poland	No information on system installations available, but only on offences/crimes: Offence: 94, 303 and 21 in respectively 2017, 2018 and 1st half of 2019; Crime: 609, 2.180 and 840 in respectively 2017, 2018 and 1st half of 2019; (ETSC, 2020)
Lithuania	Mandatory: 80 school buses (Lietuvos Respublikos susisiekimo ministerija, 2019)
Netherlands	Offender / rehabilitation: 5.200 drivers (between 2011 to 2015)
Norway	No information available

Summary of the findings and assumptions

To following key findings and assumption are retrieved from research and will be used in the remainder of this study:

- Less than 1% of the driving population is detected as having an alcohol concentration above the permitted threshold;
- Some 7.5%-10% of the high-BAC offenders are expected to be caught;
- The penetration level of offenders in alcohol interlock programmes is uncertain, but expected to vary between 10% and 70%;
- The share of alcohol-related fatalities that can be derived from this analysis varies from 10% – 20%, of which high-BAC offenders are responsible for roughly 11% (15% * 75%) of the alcohol-related fatalities;
- The overall net effectiveness of alcohol interlock are assumed to reduce the chance of recidivism with 75%.

9.2 *Professional drivers: goods vehicles*

Mandatory alcohol interlock programmes for professional drivers currently exist in 3 European countries: Sweden, Finland and France (see Table 9.1). In Sweden, the largest fleet (roughly 80.000 commercial transport vehicles) are fitted with an alcohol interlock. In Finland and France alcohol interlock are fitted in respectively 10.000 and 40.000 buses and child carriers.

Safety effects of professional drivers programmes

The safety effects (benefits) of alcohol interlock programmes for professional drivers will be determined on the following aspects:

- Total number of alcohol-related fatalities related to commercial vehicles (i.e. heavy goods vehicles, buses and coaches);
- Road safety effect of alcohol interlocks;
- Penetration level of alcohol interlock programmes for commercial vehicles.

Data regarding the total number of alcohol-related fatalities has been be gathered for all countries from the Road Safety Observatory. This database contains historical data on the fatalities as reported by transport mode in all EU countries.[66]

Total number of alcohol-related fatalities related to commercial vehicles

According to the latest PIN Flash Report, 3.310 fatalities were recorded in 2018 in crashes with heavy goods vehicles (HGVs). This equals roughly 14% of all road fatalities. The PIN Flash Report also provides an indication of the number of fatalities in which buses and coaches were involved. In 2018, roughly 2.630 fatalities were recorded with buses and coaches. This is equal to 11% of all road fatalities (Adminaité-Fodor & Jost, 2020).

Road safety effect of alcohol interlocks

Scientific evidence (backed by statistics) about the share of alcohol-related fatalities of commercial vehicles is sparse. There are no scientific studies that focus on the alcohol-related incidents with either taxi drivers or school buses. For the purpose of this study, the effectiveness of alcohol interlocks (and potential road safety effect) for truck drivers will be estimated. Several studies have been consulted to estimate alcohol usage among truck drivers and thus the effectiveness of an alcohol interlock.

Based upon the findings from European- and national studies and statistics, alcohol use among truck drivers is expected to range between negligible (0%) and 20%. By taking into account (small) underreporting bias, the share of alcohol-related fatalities among truck drivers is expected

[66] CARE (2020), https://ec.europa.eu/transport/road_safety/specialist/observatory/statistics/charts_figures_archive_en.

between 2.5% and 15% of all truck fatalities (Ekström & Forsman , 2018) (Adminaité-Fodor & Jost, 2020).

A study by the American NSDUH on self-reported use of alcohol provides basis to assume that alcohol use among drivers of buses and coaches is roughly 4 times lower than for truck drivers. For buses and coaches, the number of alcohol-related fatalities in buses an coaches ranges between 0.6% and 1.9%.[67]

Penetration level of alcohol interlock programmes for commercial vehicles

The penetration level of alcohol interlock for commercial vehicles depends on the share of commercial vehicles that participate in an alcohol interlock programme. Currently, Sweden, Finland and France have an alcohol interlock programme for professional drivers. The penetration level of these alcohol interlock programmes is presented in Table 9.1.

In addition, we assume that almost none of these professional drivers will be trying to manipulate or disable the device. In case they do, this will almost certainly result in dismissal if they are caught. Therefore, we use a compliance of 100% in CBA calculations.

We estimate that between 50% and 75% of the alcohol-related crashes with trucks and buses could have been avoided if all truck and bus drivers were sober.

Summary of the findings and assumptions

The following key findings and assumptions will be used in assessing the effect of alcohol interlocks being installed in commercial vehicles:

- The number of HGV related road fatalities in the European Union is estimated at 3.310 according to the 2018 data from the latest ETSC PIN Flash Report, which equals roughly 14% of all road fatalities. The share of alcohol-related truck fatalities compared to all truck fatalities ranges between 2.5% and 15%;
- The number of bus/coach related road deaths in the European Union is estimated at 2.630 (ETSC, 2020), which is equal to 11% of all road fatalities. The share of alcohol-related bus fatalities in all bus/coach related fatalities ranges from 0.6 to 1.9%;
- Between 50% and 75% of the alcohol-related road deaths can be avoided with an alcohol interlock.

9.3 *Preventive programs*

Theoretical assessment and practical experience of these preventive programs have concluded, the effectiveness of alcohol interlocks, when used as a preventive measure, depends on several aspects:

- The shifting perspective of alcohol interlocks as a preventive measure. Relevant questions in this respect are: How did the perspective change the last decade? What is the acceptancy of alcohol interlock by the drivers?
- The avoidance of alcohol-related road fatalities. How many of the alcohol-related road deaths could have been avoided if no alcohol had been used?
- The cost development of an alcohol interlock – such as purchase, installation, maintenance – depends on the (widespread) adoption of alcohol interlocks.

Shifting perspective alcohol interlocks as a general preventive measure

Proactive measures involve the installation of alcohol interlocks in vehicles to their use in traffic by anyone under the influence of alcohol.

[67] Calculated by dividing the share of alcohol-related fatalities among truck drivers (range 2.5%-7.5%) with a factor four.

When alcohol interlock programmes emerged some two decades ago, their focus was on DUI offenders. As punitive measure, installation of an alcohol interlocks would allow drivers to continue to drive, while at the same time reducing the chance of a repeat offence by allowing offenders to drive only when an interlock has been installed in their vehicle. However, alcohol interlock programmes targeting offenders, do not prevent accidents caused drivers committing their first DUI-offence. It cannot entirely prevent drink-driving by known DUI-offenders either. There will always be offenders who ignore driving ban or use another vehicle than the one in which an alcohol interlock is installed.

Installing alcohol interlocks in all vehicles is an effective way to prevent DUI. Simply by the fact that the vehicle is impossible to start, or be set in motion, without an accepted test of BAC of the driver. In such an approach the alcohol interlock, moves from being a punitive instrument for DUI into a measure of general prevention, targeting the general driving population or segments of this population. In particular, professional drivers and vehicles involved in passenger transport and transportation of goods, especially when using buses, coaches and HGVs, have been identified as target for installation of alcohol interlocks. Voluntary installation of alcohol interlocks could be promoted as an instrument and sign of quality assurance in professional transport. In some cases alcohol interlocks have also been promoted as health precautions, as it may be utilised to reduce problems related to alcohol consumption in general within transport companies, commercial drivers, and all other who will use a motor vehicle as part of their jobs.

Avoidance of alcohol-related road fatalities

The avoidance of alcohol-related road fatalities initially starts with the number of alcohol-related road fatalities that could be avoided. On the basis of literature studies the share of alcohol-related road fatalities has been retrieved per vehicle type (see Table 9.2). These findings also show a large variation between vehicle types.

Table 9.2 Share of alcohol-related road fatalities on European roads for different vehicle types

	Min	Max
Passenger cars	19,5%	26,6%
Buses and coaches	0,6%	1,9%
Light commercial vehicles	2,5%	20,0%
Heavy goods vehicles	2,5%	15,0%

Table 9.2 shows that the share of alcohol-related road fatalities is substantial, which makes alcohol one of the main factors to cause road fatalities. However, this does not immediately imply that all these road fatalities could have been avoided if an alcohol interlock was used. Other aspects such as road conditions, weather at the time of the accident, distractions, avoiding of safety gear and many others could have contributed or were even the decisive factor.

Literature reviews on the effectiveness of the alcohol interlock have found interlocks to reduce recidivism in drink driving, varying from 40 to 95%, while installed (e.g., Houwing, 2016; Spit et al., 2014; Silverans et al, 2006; Willis, Lybrand, & Bellamy, 2004). In a more recent literature review (Nieuwkamp, Martensen, & Meesmann, 2017) built on findings from meta-analysis by (Elder, et al., 2011) and four additional studies (Assaily & Cestac, 2014; Ma et al., 2016; Voas et al., 2013; Voas et al., 2016) to conclude that installing an alcohol interlock reduces recidivism risk by 75%. However, in a follow-up period after the alcohol interlock is removed, recidivism risk is only decreased by 7% compared to the control group. That difference is not statistically different from those who had not installed an alcohol interlock.

Based on the above sources, we assume that between 50% and 75% of the alcohol-related crashes could have been avoided if drivers were sober (i.e. drive with an alcohol interlock).

Cost development of an alcohol interlock

Finally, the cost of an alcohol interlock depend upon the penetration rate of alcohol interlocks in Europe. The current costs of an alcohol interlock in the active offender programmes in Europe are retrieved from desk research and elaborately discussed in section 8.3 and Annex 5. In line with these findings, the cost development of an alcohol interlock are estimated as follows (Table 9.3).

Table 9.3 Estimated costs development of alcohol interlocks in policy scenarios compared to costs of alcohol interlocks in the reference scenario (PO 0)

Cost components (in %)	PO 0		PO 1		PO 2		PO 3		PO 4		PO 5	
	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max
Introduction costs	100	100	50	50	25	25	25	25	100	100	25	25
Recurring costs (p/time)	100	100	100	100	100	100	100	100	100	100	100	100
Closing and other costs	100	100	-	-	-	-	-	-	100	100	-	-

It is assumed in the reference scenario (PO 0) that the costs of alcohol interlocks remain at similar levels as those incurred in current interlock programmes. The implementation of any of the policy options would result in a larger demand. This could provide economies of scale and result in a reduction of the price of alcohol interlocks.

In addition, with a developing technology and demand for alcohol interlocks possibly increasing outside Europe, the costs of devices may come down even further in the future. Thereby the costs to society of any widespread preventive use will reduce. Such a cost reduction would affect both the cost in the reference scenario (PO O) as well as in the scenarios where a policy option is implemented.

9.4 *Young / novice driver program*

The active alcohol interlock programmes in Europe focus primarily on alcohol offenders by targeting high-BAC offenders and recidivist. There are no known preventive measures for the usage of alcohol interlocks for young drivers. In the following section, the safety effects (benefits) of preventive use of alcohol interlocks by novice drivers will be determined on the basis of the following aspects:

- Total number of road fatalities by novice drivers;
- Estimated number of alcohol-related road fatalities by novice drivers;
- Road safety effect of alcohol interlocks for novice drivers.

Total number of road related fatalities by novice drivers

As discussed in section 3.2, young and novice drivers have a higher crash risk because of immaturity, exposure, lack of experience and impairment. On average, the risk of a young driver being killed in a road accident is 1.6 times the risk of an average member of EU countries.

In 2016, according to the latest information from the yearly Traffic Basic Facts, 3.280 young people fatalities are recorded in all European member states. This means that young people are represented in 13% of all the road fatalities in Europe. On a positive note, the absolute and relative share of young people involved in road fatalities has been decreasing from over 7.000 accidents (equal to 17%) in 2007 to 3.280 (equal to 13%) in 2016.

Historical national data on the share of road fatalities in which young drivers are involved compared to the total population reflects a clear overrepresentation of young drivers. Whereas the average European share of young drivers in all accidents ranges from 17% to 27%, the share of this age group in Europe in the total population ranges from 10% to 15% (Janitzek, 2008).

Based upon these statistics it is concluded that young drivers are still (over)represented in the number of road fatalities. In the following section, the involvement of young and novice drivers in alcohol-related crashes will be further analysed.

Estimated number of alcohol-related road fatalities by novice drivers

During the EC SafetyNet project (between 2005 and 2008), an accident causation databases has been formed that contained over 1.000 road accidents in Germany, Italy, the Netherlands, Finland, Sweden and the UK (Björkman, et al., 2008). According to the analysis, the most frequent causes for young drivers/riders are listed. The top 5 most frequent causes for road accidents are as follows:

- Inadequate plan - Insufficient knowledge;
- Faulty diagnosis - Information failure (driver/environment or driver/vehicle);
- Observation missed – Distraction;
- Observation missed - Faulty diagnosis;
- Inadequate plan - Under the influence of substances.

Within the EC SafetyNet project, researchers also compared the accident causes between young drivers (18 to 24 years old) and a reference group (30 to 59 years old) and several European countries. In general, this analysis clearly showed that young drivers are overrepresented in single car crashes, fatal alcohol-related crashed and accidents in the weekends. However, in Sweden young drivers are slightly underrepresented in alcohol-related accidents (SafetyNet, 2009). In the past, several other national studies have also looked into the cause for fatal accidents among youngsters or present statistics on the number of alcohol-related road fatalities by novice drivers.

In the Netherlands between 2012 and 2014 in 22% of all road fatalities young drivers (mainly young men) were involved, while this group represents only 10% of all the driving license holders. These accidents are mainly caused by inexperience and the larger effect of alcohol on driving behaviour (SWOV, 2016) (Blomberg R. D., Peck, Moskowitz, Burns, & Fiorentino, 2005) (Keall, Frith, & Patterson, 2004) (Peck, Gebers, Voas, & Romano, 2008).

For the purpose of this study, several national studies have been thoroughly analysed in order to provide an estimate on the number of alcohol-related road fatalities by novice drivers.

- Share of road fatalities in which young drivers under the influence of alcohol compared to all road fatalities;
- Share of alcohol-related fatalities in which young drivers are involved compared to all alcohol-related fatalities.

These findings are presented in Table 9.4.

Table 9.4 Estimated number of alcohol-related road fatalities by novice drivers

Country	Country (abb)	Share of road fatalities with involvement of young driver (<25 year) under influence of alcohol	Share of alcohol-related fatalities with involvement of a young driver (<25 year)
Ireland	IR	8%	29%
Spain	ES	4%	9%
Portugal	PT	2%	8.5%
France	FR	6%	10%
Czech Republic	CZ	0.7%	7.5%
Romania	RO	Not available	27%
United Kingdom	UK	4.3%	17%
Belgium	BE	Not available	12.5%
Luxembourg	LU	2.3%	14.6%
Range		0.7% - 8%	7.5% - 29%

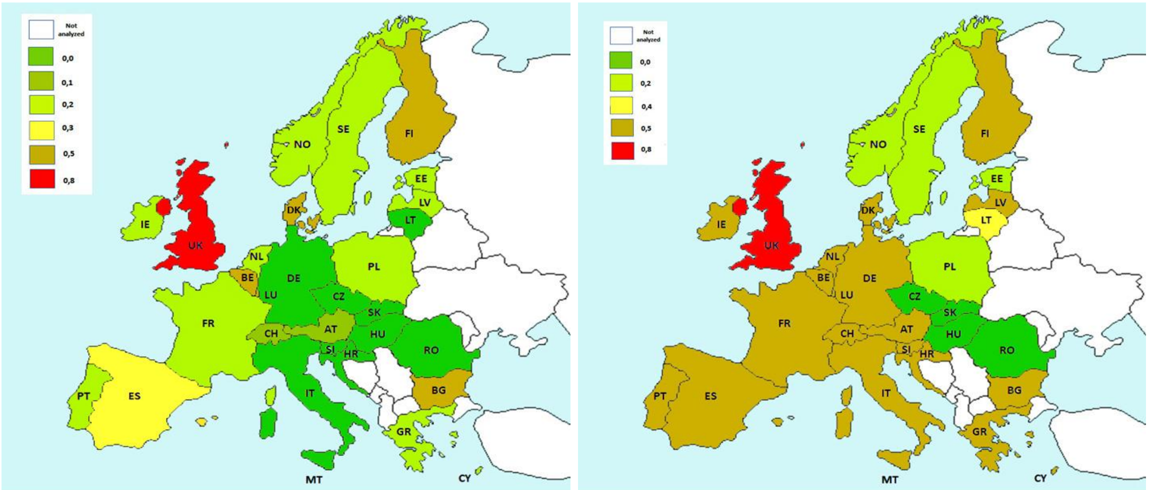
Sources: (Autoridade Nacional de Segurança Rodoviária (ANSR), 2020) (BESIP, 2020) (INTCF, 2019) (ONISR, 2020) (Road Safety Authority, 2020) (Minist`ere de la Mobilité et des Traveaux public, 2020).

Road safety effect of alcohol interlocks for young drivers

The current measures for preventing young drivers to drive under influence of alcohol focus either on setting lower BAC levels and stricter criteria to be obtained in an alcohol interlock-based programme.

In Figure 9.1, the standard BAC legal limit is compared with the BAC limit for inexperienced drivers (often young drivers). In general, international studies show that lowering the alcohol limit for young drivers leads to a reduction of driving under influence and consequently to less alcohol-related accidents (SWOV, 2018).

Figure 9.1 Standard BAC legal limit (left figure) versus BAC legal limit (g/L) for inexperienced drivers (right figure) across Europe



Source: (European Commission, 2021), Information and data from national expert panel (see annex 1).

Another measure that has been obtained in Member States in order to prevent driving under influence for young drivers are stricter criteria for being obtained in the offender/rehabilitation programme. In the Netherlands, the alcohol interlock programme could be imposed on novice drivers with a BAC of respectively 1.0‰ – 1.8‰, while experienced drivers could face an alcohol interlock when caught with a BAC between 1.3‰ – 1.8‰.

The alcohol interlock programme in Lithuania classifies low and high risk offenders and also distinguished between experienced and young drivers. Low-risk offenders (drivers with over two years of driving experience) face an alcohol interlock in case they are caught with a BAC level between 0.4‰ to 1.5‰. For novice drivers with up to 2 years of driving experience a BAC level between 0.0 and 0.4‰ is applicable. High-risk offenders are novice drivers in excess of 0.4‰ BAC, while for other drivers the BAC level of exceeding 1.5‰ is applied as a threshold.

Several measures have been taken to prevent young drivers from driving under influence and some have been more effective than others. The precise road safety effect of alcohol interlocks for young drivers is difficult to assess. In line with the previous assumption, we estimate that between 50% and 75% of the alcohol-related crashes could have been avoided. The following caveats have been made in international research:

- Different beliefs concerning the effectiveness of alcohol interlock between parents and users. While parents perceive the alcohol interlock as an effective strategy, users have mixed views on the effectiveness;
- It has even been suggested that young drivers could use other drugs if the ignition interlock prevented them from drinking.

Summary of the findings and assumptions

- In 2016, according to the latest information from the yearly Traffic Basic Facts, 3.280 young people fatalities are recorded in all European member states. This means that young people are represented in 13% of all the road fatalities in Europe. The share of this age group in Europe in the total population ranges from 10% to 15%;
- The share of road fatalities with involvement of young driver (<25 year) under influence of alcohol compared to the total number of road fatalities ranges between 0.7% to 8%. By only looking at the alcohol-related traffic fatalities, roughly 7.5% to 29% of all alcohol-related fatalities involve a young driver (<25 year);
- Between 50% and 75% of the alcohol-related road deaths can be avoided with an alcohol interlock.

10 Mandating alcohol interlocks

In accordance with Regulation (EU) 2019/2144, from 6 July 2022 onwards new motor vehicles of categories M and N shall be equipped with:

- 'alcohol interlock installation facilitation': a standardised interface that facilitates the fitting of aftermarket alcohol interlock devices in motor vehicles;
- 'driver drowsiness and attention warning': a system that assesses the driver's alertness through vehicle systems analysis and warns the driver if needed.

For the latter, benefits of mandating ex-factory fitting and of retrofitting have been assessed in recent studies by respectively Reed, et al. (2015) and Ecorys & VTT (2019). The current chapter reviews policy options mandating alcohol interlock installation. In this context, it is noted that the European Parliament adopted P8_TA-PROV(2017)0423 in November 14th 2017, in which it urges the use of alcohol interlocks for professional drivers and for drivers who have caused a traffic accident under the influence of alcohol.

This chapter builds on assumptions about costs and benefits described in chapters 8 and 9 and presents the results from the cost-benefit analysis of both ex-factory (section 10.1) and retrofitting (section 10.2) policy options. The first three policy options involve the mandatory installation of alcohol interlock devices in passenger cars, buses and coaches and heavy goods vehicles. Scenarios have been reviewed for cases where vehicles are ex-factory fitted (PO1a, PO2a and PO3a) and where all vehicles are equipped with an alcohol interlock (PO1b, PO2b and PO3b). Costs and benefits have also been assessed for a fourth and a fifth policy option, which involve mandatory installation of an alcohol interlock for respectively high-BAC offenders and novice drivers. In section 10.3 the impact of several assumption on the robustness of the CBA results will be tested in a sensitivity analysis.

10.1 *Policy options for ex-factory fitting alcohol interlocks*

10.1.1 Policy option 1a: mandatory ex-factory installation of alcohol interlocks for passenger vehicles

The first policy option envisages a situation in which all passenger cars are fitted ex- factory with alcohol interlocks. This means that, after regulation has been adopted, all new passenger cars will be equipped with an alcohol interlock device. Before describing the associated costs and benefits in depth, the main assumptions regarding costs and benefits are presented in Table 10.1.

Table 10.1 Assumptions used for CBA of policy option 1a – mandatory ex-factory installation of alcohol interlock in passenger vehicles

Indicators	Input
General	
Total number of passenger vehicles in EU	265,427,000
Number of factory fitted passenger vehicles in EU	141,818,000 (7 year period)
Period of preparation	5 years
Lifetime of the alcohol interlock	7 years
Costs	
Costs of preparing European legislation	2 mln
Costs of preparing legislation for Member States	2 mln euro per Member State
Introduction costs of an interlock (e.g. purchase and installation)	€ 675 - € 875
Recurring costs (e.g. maintenance and operational costs of an interlock)	€ 80 - € 100 per year
Safety effect	
Potential reduction in alcohol-related accidents involving drink-driving by passenger car drivers	• Low = 50% • High = 75%
External accident costs per fatality	€ 2.9 mln
External accident costs per serious injury	€ 465,000

Costs

The first cost component in the analysis are costs related to European and nation legislation. Mandatory installation of alcohol interlock in passenger cars requires additional meetings, technical and operational harmonisation of the European and national regulation. These costs of preparing European and national legislation are estimated at 2 million euro (both for Member States and the Commission). The preparation period is estimated to take roughly 5 years. Furthermore, it is assumed ex-factory installation of interlocks will not be mandated before July 2024, when all new vehicles shall be equipped with 'alcohol interlock installation facilitation' in accordance with Regulation 2019/2144. The time period considered over which costs (and benefits) are calculated is 7 years, which should coincide with the average lifetime of an alcohol interlock device. Therefore, the time horizon applied in the CBA is from 2026 to 2032 (equal to alcohol interlock lifetime).

The second costs component, cost information of alcohol interlocks, are retrieved from current data on the European alcohol interlock programmes (see section 8.3 and Annex 5). However, the average introduction costs are expected to decrease due to the substantial market increase as a result of all new passenger cars being fitted with alcohol interlock. Recent cost figures in Norway confirm that the price of alcohol interlock potentially decreases due to a larger market. For the purpose of this study, the maximum decrease of introduction costs has been estimated at 50% (in both the minimum and maximum scenario). This does not hold for the recurring costs (e.g. maintenance, inspection, data read out, etc.), which remains constant at €80 (minimum) - €100 (maximum) per year. Maintenance and inspection are expected to take place annually.

Benefits

Benefits of alcohol interlocks on road safety are expressed in avoided road fatalities and injuries. These are monetised by applying the value of statistical life (VOSL). In order to estimate the number of avoided road fatalities, it is assumed that the potential reduction of alcohol-related accidents when passenger cars are equipped with alcohol interlock varies between 50% and 75%. It is assumed that despite having an alcohol interlock not all alcohol-related accidents can be prevented, due to intended and unintended misuse of the device and non-compliance with the obligation to install and use the interlock. The potential reduction of alcohol-related casualties and serious injuries is monetised by using the value of statistical life. The unit values (for both fatalities and serious injuries) are deduced from the Handbook External Costs of Transport (CE Delft, 2019). The results from the cost-benefit analysis are presented in Table 10.2.

Table 10.2 Costs and benefits of policy option 1a – mandatory ex-factory installation of alcohol interlock in passenger vehicles

Costs	
Total costs of preparing legislation	€ 58 mln
Total introduction costs (i.e. purchase and installation)	€ 74 bln - € 96 bln
Total recurring costs (i.e. maintenance and service)	€ 22 bln - € 28 bln
Safety effects	
Annual safety effect (measured in road deaths avoided)	465 – 1,167 fatalities[68]
Annual safety effect (measured in serious injuries avoided)	12,073 – 30,277 injuries
Total safety benefits	€ 33 bln - € 83 bln
Benefit-cost ratio (BCR)	0.27 – 0.86

The benefit to cost ratio ranges from a negative (0.27) to positive (0.86) under the previously explained assumptions. The results are sensitive to the following assumptions:

- Introduction cost of an alcohol interlock;
- Effectiveness of an alcohol interlock;

These 'key' assumptions and their impact on the robustness of the CBA results will be tested in section 10.3.

[68] Note: the potential reduction of alcohol-related fatalities has been corrected by the number of prevented fatalities in the baseline, mandatory installation of alcohol interlock in buses and coaches (PO2) and heavy goods vehicles (PO3). This results in the net potential effect (measured in fatalities) for passenger cars.

10.1.2 Policy option 2a: mandatory ex-factory installation of alcohol interlocks in buses and coaches

Policy option 2a follows a similar CBA approach. In this policy option the mandatory ex-factory installation of alcohol interlocks in all new buses and coaches has been simulated. The main assumptions for this analysis are outlined in Table 10.3.

Table 10.3 Assumptions used for CBA of policy option 2a – mandatory ex-factory installation of alcohol interlocks in buses and coaches

Indicators	Input
General	
Total number of buses/coaches in EU	979,000
Number of factory fitted buses and coaches in EU	496,000 (7 year period)
Period of preparation	5 years
Lifetime of the alcohol interlock	7 years
Costs	
Costs of preparing European legislation	2 mln
Costs of preparing legislation for Member States	2 mln euro per Member State
Introduction costs of an interlock (e.g. purchase and installation)	€ 1,000 – € 1,300
Recurring costs (e.g. maintenance and operational costs of an interlock)	€ 80 - € 100 per year
Safety effect	
Potential reduction in alcohol-related accidents involving drink-driving by buses and coaches	• Low = 50% • High = 75%
External accident costs per fatality	€ 2.9 mln
External accident costs per serious injury	€ 465,000

Costs

The costs estimation related to the technical and operational harmonisation of the European and national regulation builds upon the same assumptions as described in policy option 1a. Also the time horizon applied in the CBA is from 2026 to 2032. The introduction and recurring costs of an alcohol interlock have a similar basis (see section 8.3 and Annex 5). The total market for buses and coaches is, in terms of vehicles, smaller than the passenger vehicle market. It is assumed that the introduction costs of interlock devices will decrease with 25% (in both the minimum and maximum scenario). Recurring costs are assumed to be constant at €80 - € 100 per time and are taking place annually.

Benefits

The benefits, avoided road fatalities and injuries, are based upon several assumptions. First, the effectiveness of alcohol interlocks in reducing alcohol-related accidents of buses and coaches varies between 50% and 75%. Not every alcohol-related accident can be prevented by means of an alcohol interlock due to malfunctions, misuse, etc. Second, by using the VOSL the potential reduction of alcohol-related casualties and serious injuries is monetised.

The results from the cost-benefit analysis are presented in Table 10.4.

Table 10.4 Costs and benefits of policy option 2a – mandatory ex-factory installation of alcohol interlocks in buses and coaches

Costs	
Total costs of preparing legislation	€ 58 mln Euro
Total introduction costs (i.e. purchase and installation)	€ 349 mln - € 454 bln
Total recurring costs (i.e. maintenance and service)	€ 78 mln - € 98 mln
Safety effects	
Annual safety effect (measured in road deaths avoided)	1 – 3 fatalities
Annual safety effect (measured in serious injuries avoided)	16 – 76 injuries
Total safety benefits	€ 44 mln - € 208 mln
Benefit-cost ratio (BCR)	0.07 – 0.43

Mandatory ex-factory installation of alcohol interlocks does not generate sufficient safety benefits to cover the costs. The BCR varies between 0.07 to 0.43 under the previously explained assumptions. The main reason for the negative BCR lies with the low number of road deaths that can be prevented. For buses and coaches the number of alcohol-related road fatalities varies between 0.6% and 1.9% of all road fatalities in which buses and coaches are involved (see section 9.3. for more details).

The results are sensitive to the following assumptions:

- Introduction cost of an alcohol interlock;
- Effectiveness of an alcohol interlock.
- These 'key' assumptions and their impact on the robustness of the CBA results will be tested in section 10.3.

10.1.3 Policy option 3a: mandatory ex-factory installation of alcohol interlocks in heavy goods vehicles

In the third policy option, a situation has been simulated where heavy goods vehicles (HGV's) are factory fitted with an alcohol interlock with the aim of reducing road fatalities. In Table 10.5 the main assumption regarding costs and benefits are outlined.

Table 10.5 Assumptions used for CBA of policy option 3a – ex-factory installation of alcohol interlocks in heavy goods vehicles

Indicators	Input
General	
Total number of heavy goods vehicles in EU	7,828,000
Number of factory fitted heavy goods vehicles in EU	3,952,000
Period of preparation	5 years
Lifetime of the alcohol interlock	7 years
Costs	
Total costs of preparing legislation	2 mln
Costs of preparing legislation for Member States	2 mln euro per Member State
Introduction costs of an interlock (e.g. purchase and installation)	€ 1,000 - € 1,300
Recurring costs (e.g. maintenance and operational costs of an interlock)	€ 80 - € 100 per year
Safety effect	
Potential reduction in alcohol-related accidents involving drink-driving by heavy goods vehicles	• Low = 50% • High = 75%
External accident costs per fatality	€ 2.9 mln
External accident costs per serious injury	€ 465,000

Costs

In section 8.3 and Annex 5, the cost information from the European alcohol interlock programmes is presented. On that basis, the average introduction costs are estimated between € 1.000 and € 1.300. In the policy option, all HGV's in Europe will be ex-factory fitted with an alcohol interlock. This increases the market with roughly 4 million HGV's over a 7 year period. As a result, the costs are expected to decrease with 25% (in both the maximum and minimum scenario). Recurring costs are assumed to remain constant at €80 to € 100 and take place at an annual frequency. Again, the time horizon applied in the CBA is from 2026 to 2032.

Benefits

Similar to the policy option 1a and 2a, the most important assumptions regarding the safety effect (benefits) are:

- The effectiveness of alcohol interlocks in reducing alcohol-related accidents of HGVs varies between 50% and 75%;
- Alcohol-related fatalities and serious injuries are monetised by using the value of statistical life (VOSL) derived from the Handbook External Costs of Transport (CE Delft, 2019).

The results from the cost-benefit analysis are presented in Table 10.6.

Table 10.6 Costs and benefits of policy option 3a – Mandatory ex-factory installation of alcohol interlocks in heavy goods vehicles

Costs	
Total costs of preparing European legislation	€ 58 mln
Total introduction costs (i.e. purchase and installation)	€ 3.0 bln - € 3.9 bln
Total recurring costs (i.e. maintenance and service)	€ 619 mln - € 773 mln
Safety effects	
Annual safety effect (measured in road deaths avoided)	11 – 97 fatalities
Annual safety effect (measured in serious injuries avoided)	279 – 2,515 injuries
Total safety benefits	€ 764 mln - € 6.9 bln
Benefit-cost ratio (BCR)	0.16 – 1.87

The BCR varies between a rather negative (0.16) to a clear positive (1.87) result. The main reason for the rather wide bandwidth lies partly with the uncertainty related to the share of alcohol-related accidents in which heavy goods vehicles are involved. The absolute number of accidents in which HGV's are involved is larger than accidents in which e.g. buses and coaches are involved. However, the literature is uncertain about the share of alcohol-related HGV fatalities on European roads. The findings vary between roughly 2.5% and 15% of the HGV accidents (details are outlined in section 9.3.). The results are, next to these findings, sensitive to the following assumptions:

- Introduction costs of an alcohol interlock;
- Effectiveness of an alcohol interlock.
- These 'key' assumptions and their impact on the robustness of the CBA results will be tested in section 10.3.

10.2 *Policy options for ex-factory and retrofitting alcohol interlocks*

10.2.1 Policy option 1b: mandatory installation alcohol interlocks in all passenger vehicles, including retrofitting

In this policy option 1b, the mandatory installation in all passenger cars is analysed. Not just new passenger cars will be required to install alcohol interlock device, but also existing vehicles will be required to retrofit an alcohol interlock . For this option, a cost-benefit approach has been carried out. The main assumptions – separated into general, costs and safety assumptions – are presented in Table 10.7.

Table 10.7 Assumptions used for CBA of policy option 1b – mandatory installation of alcohol interlock in all passenger vehicles (ex-factory and retrofitting)

Indicators	Input
General	
Total number of passenger vehicles in EU (in 2026)	271,843,000
Number of passenger vehicles in EU fitted with an alcohol interlock	394,299,000 (over 7 year period)
Period of preparation	5 years
Lifetime of the alcohol interlock	7 years
Costs	
Costs of preparing European legislation	2 mln
Costs of preparing legislation for Member States	2 mln euro per Member State
Introduction costs of an interlock (e.g. purchase and installation)	€ 675 - € 875
Recurring costs (e.g. maintenance and operational costs of an interlock)	€ 80 - € 100 per year
Safety effect	
Potential reduction in alcohol-related accidents involving drink-driving by passenger car drivers	• Low = 50% • High = 75%
External accident costs per fatality	€ 2.9 mln.
External accident costs per serious injury	€ 465.000

Costs

With regard to the cost estimation, the policy option requires additional meetings, technical and operational harmonisation of the European and national regulation. The costs of preparing European and national legislation has been set at 2 million euro (both for Member States and the Commission). This preparation period is estimated to take 5 years to materialise. The time horizon applied in the CBA is from 2026 to 2032.

The introduction costs of an alcohol interlock are retrieved from actual data on the European alcohol interlock programmes (see section 8.3. and Annex 5). However it is assumed that, due to the substantial market increase, the average introduction costs will decrease with a maximum of 50% (in both the minimum and maximum scenario). This does not hold for the recurring costs, which remain constant at € 80 - € 100 per time. Maintenance and inspection is expected to take place annually.

Benefits

For this policy option, it is assumed that the potential reduction of alcohol-related accidents involving drink-driving by passenger car drivers will be between 50% and 75% effective. This is the same as in policy option 1a mandating only ex-factory installation of alcohol interlocks. There is no reason to assume differences in driving behaviour between drivers of users of new and existing vehicles.

The potential reduction of alcohol-related casualties and serious injuries is monetised by using the value of statistical life (VOSL). The unit values (for both fatalities and serious injuries) are deduced from the Handbook External Costs of Transport (CE Delft, 2019).

The results from the cost-benefit analysis are presented in Table 10.8.

Table 10.8 Costs and benefits of policy option 1b – mandatory installation of alcohol interlock in all passenger vehicles (ex-factory and retrofitting)

Costs	
Total costs of preparing legislation	€ 58 mln
Total introduction costs (i.e. purchase and installation)	€ 209 bln - € 270 bln
Total recurring costs (i.e. maintenance and service)	€ 90 bln - € 113 bln
Safety effects	
Annual safety effect (measured in road deaths avoided)	1,217 – 3,955 fatalities[69]
Annual safety effect (measured in serious injuries avoided)	31,575 – 102,631 injuries
Total safety benefits	€ 90 bln - € 293 bln
Benefit-cost ratio (BCR)	0.24 – 0.98

The cost-benefit analysis provides a range from a negative 0.29 to 0.98 benefit to cost ratio (BCR) under the previously explained assumptions. The results are sensitive to the following assumptions:

- Introduction cost of an alcohol interlock;
- Effectiveness of an alcohol interlock;
- These 'key' assumptions and their impact on the robustness of the CBA results will be tested in section 10.3.

[69] Note: the potential reduction of alcohol-related fatalities has been corrected by the number of prevented fatalities in the baseline, mandatory installation of alcohol interlock in buses and coaches (PO2) and heavy goods vehicles (PO3). This results in the net potential effect (measured in fatalities) for passenger cars.

10.2.2 Policy option 2b: mandatory installation of alcohol interlocks in all buses and coaches

In policy option 2b, a similar CBA approach has been carried out. The policy option simulates the mandatory installation of alcohol interlocks in buses and coaches in the European Union. The main assumptions for this analysis are outlined in Table 10.9.

Table 10.9 Assumptions used for CBA of policy option 2b – mandatory installation of alcohol interlock in all buses and coaches (ex-factory and retrofitting)

Indicators	Input
General	
Total number of buses/coaches in EU (in 2026)	1,017,000
Number of buses and coaches in EU fitted with an alcohol interlock	1,444,000 (over 7 year period)
Period of preparation	5 years
Lifetime of the alcohol interlock	7 years
Costs	
Costs of preparing European legislation	2 mln
Costs of preparing legislation for Member States	2 mln euro per Member State
Introduction costs of an interlock (e.g. purchase and installation)	€ 1,000 – € 1,300
Recurring costs (e.g. maintenance and operational costs of an interlock)	€ 80 - € 100 per year
Safety effect	
Potential reduction in alcohol-related accidents involving drink-driving by buses and coaches	• Low = 50% • High = 75%
External accident costs per fatality	€ 2.9 mln
External accident costs per serious injury	€ 465,000

Costs

When it comes to technical and operational harmonisation of the European and national regulation, the same assumption as described in policy option 1b are estimated. The investments of fitting an alcohol interlock in buses and coaches are estimated on the basis of actual data on the European alcohol interlock programmes (see section 8.3. and Annex 5). Although, the average introduction costs will probably decrease due to the increasing market (roughly 979.000 buses and coaches). It is assumed that introduction costs decrease with 25% (in both the minimum and maximum scenario). The recurring costs (covering service and maintenance) remain constant at €80 - € 100 per time. The recurring costs take place annually.

Benefits

For this policy option, it is assumed that the potential reduction of alcohol-related accidents involving drink-driving by buses and coaches will be between 50% and 75% effective. Not every alcohol-related accident can be prevented by means of an alcohol interlock (e.g. malfunctions, misuse, etc).

The potential reduction of alcohol-related casualties and serious injuries is monetised by using the value of statistical life (VOSL) derived from the Handbook External Costs of Transport (ECOT)[70]. The results from the cost-benefit analysis are presented in Table 10.10.

[70] CE Delft (2019), Handbook on the external costs of transport.

Table 10.10 Costs and benefits of policy option 2b – mandatory installation of alcohol interlock in all buses and coaches (ex-factory and retrofitting)

Costs	
Total costs of preparing legislation	€ 58 mln Euro
Total introduction costs (i.e. purchase and installation)	€ 1.1 bln - € 1.4 bln
Total recurring costs (i.e. maintenance and service)	€ 337 mln - € 421 mln
Safety effects	
Annual safety effect (measured in road deaths avoided)	2 – 11 fatalities
Annual safety effect (measured in serious injuries avoided)	58 – 277 injuries
Total safety benefits	€ 166 mln - € 789 mln
Benefit-cost ratio (BCR)	0.09 – 0.53

The mandatory preventive installation of alcohol interlocks does not generate sufficient safety benefits to cover the costs. The BCR ranges from 0.09 to 0.53 under the previously explained assumptions. The main reason for the BCR being lower than 1, lies with the low number of alcohol-related road fatalities in which buses and coaches are involved.

The results are sensitive to the following assumptions:

- Introduction cost of an alcohol interlock;
- Effectiveness of an alcohol interlock.
- These 'key' assumptions and their impact on the robustness of the CBA results will be tested in section 10.3.

It should be noted that several European countries are already mandating ex-factory installation of alcohol interlocks in (a part of) their fleet. For instance, Finland, France and Lithuania are fitting buses and child carriers.

10.2.3 Policy option 3b: mandatory installation of alcohol interlocks in all heavy goods vehicles

The third policy option mandates installation of an alcohol interlock in heavy all goods vehicles (HGV's). New vehicles are to be supplied ex-factory with an alcohol interlock, while vehicles in the currently active fleet are to be retrofitted with an alcohol interlock. The main general, costs and safety related assumptions for this analysis are outlined in Table 10.11.

Table 10.11 Assumptions used for CBA of policy option 3b – mandatory installation of alcohol interlock in all heavy goods vehicles (ex-factory and retrofitting)

Indicators	Input
General	
Total number of heavy goods vehicles in EU (in 2026)	8,357,000
Number of heavy goods vehicles in EU fitted with an alcohol interlock	11,774,000 (over 7 year period)
Period of preparation	5 years
Lifetime of the alcohol interlock	7 years
Costs	
Total costs of preparing legislation	2 mln
Costs of preparing legislation for Member States	2 mln euro per Member State
Introduction costs of an interlock (e.g. purchase and installation)	€ 1,000 - € 1,300
Recurring costs (e.g. maintenance and operational costs of an interlock)	€ 80 - € 100 per year
Safety effect	
Potential reduction in alcohol-related accidents involving drink-driving by heavy goods vehicles	• Low = 50% • High = 75%
External accident costs per fatality	€ 2.9 mln
External accident costs per serious injury	€ 465,000

Costs

The basis for determining the investments in an alcohol interlock in HGV's are provided by the actual data on the European alcohol interlock programmes, which are outlined in section 8.3. and Annex 5. The average introduction costs are estimated to decrease - due to the increasing market of over 7 million HGV's – with 25%. This applies to both the minimum and maximum scenario. The recurring costs (covering service and maintenance) remain constant at €80 - € 100 per time at are assumed to take place at an annual frequency.

Benefits

As in policy option 1b and 2b, it is assumed that the potential reduction of alcohol-related accidents involving drink-driving by heavy goods vehicles will be between 50% and 75% effective. While the involvement HGV in alcohol-related accidents is different from that of passenger vehicles and buses and coaches, it is assumed the share of drivers not using or incorrectly using the alcohol interlock is no different between the driver categories once their use in mandated in all vehicles.

The potential reduction of alcohol-related casualties and serious injuries caused by the use of the alcohol interlock is monetised by using the value of statistical life (VOSL) derived from the Handbook External Costs of Transport (CE Delft, 2019).

The results from the cost-benefit analysis are presented in Table 10.12.

Table 10.12 Costs and benefits of policy option 3b – mandatory installation of alcohol interlocks in heavy goods vehicles

Costs	
Total costs of preparing European legislation	€ 58 mln
Total introduction costs (i.e. purchase and installation)	€ 9.7 bln - € 12.5 bln
Total recurring costs (i.e. maintenance and service)	€ 2.8 bln - € 3.6 bln
Safety effects	
Annual safety effect (measured in road deaths avoided)	41 – 372 fatalities
Annual safety effect (measured in serious injuries avoided)	1,074 – 9,662 injuries
Total safety benefits	€ 594 mln - € 5.3 bln
Benefit-cost ratio (BCR)	0.19 – 2.19

The BCR varies between a rather negative (0.19) to a clear positive (2.19) result. Literature findings show that the share of alcohol-related HGV fatalities on European roads is rather uncertain. The findings vary between roughly 2.5% and 15% of the HGV accidents (see section 9.3.).

Additionally, the results are sensitive to the following assumptions:

- Introduction costs of an alcohol interlock;
- Effectiveness of an alcohol interlock;
- These 'key' assumptions and their impact on the robustness of the CBA results will be tested in section 10.3.

10.2.4 Policy option 4: mandatory installation of alcohol interlocks for high-BAC offenders

In the fourth policy option, the situation where there are measures in place at a European level to harmonise sanctions for high-BAC offenders is simulated. It should be noted because of its specificity, alcohol interlocks in this policy option being a sanction for a dui-offence, it touches upon the MS competence for enforcement, which the Commission has never proposed to address.

The analysis of the current alcohol interlock programmes across Member States in this report has revealed a wide variety of implementation arrangements between countries, which would make reaching a harmonised approach complex, although, at least in theory, not impossible.

In this policy option 4 it is assumed all Member States provide the opportunity for a high BAC offender (≥ 1.3 g/l) to participate in an alcohol interlock programme. The assumptions used in for calculating the benefits and costs of this option are presented in Table 10.13.

Table 10.13 Assumptions used for CBA of policy option 4 – mandatory installation of alcohol interlocks high-BAC offenders

Indicators	Input
General	
Total number of drivers in Europe	roughly 300 mln
Total number of high-BAC offenders in EU	roughly 3 mln
Probability of high-BAC offenders to be caught	7.5% - 10%
Participation of high-BAC offenders	10% - 70%
Period of preparation	4 years
Period of the alcohol interlock programme	3 years
Costs	
Costs of preparing European legislation	2 mln euro
Costs of preparing legislation for Member States	2 mln euro per Member State
Introduction costs of an interlock (e.g. purchase and installation)	€ 1,350 - € 1,750
Recurring costs (i.e. maintenance and operational costs of an interlock)	€ 80 - € 600 per year
Closing and other costs (i.e. support program, removal of an interlock)	€ 70 - € 1.000
Safety effect	
Potential reduction (effectiveness) of an alcohol interlock compared to suspension of the driving licence	18,75%
External accident costs per fatality	€ 2.9 mln
External accident costs per serious injury	€ 465,000
Annual mobility benefit per participant	€ 1,120

Costs

The associated costs of alcohol interlock programmes for high-BAC offenders are derived from the actual (active) European alcohol interlock programmes (see section 8.3. and Annex 5). The investments in an alcohol interlock are equal to € 1.350 and € 1.750. There is wide range of practices when it comes to the frequency of data read-outs and inspections. Whereas Poland and Finland are not performing data read-outs (only annual calibration), in France and Belgium data readout are obliged every one to two months. Other countries find themselves somewhere in the middle. Therefore, the recurring costs vary between € 80 (annual) and €600 (every two months) per year. Same reasoning holds for the closing and other costs related to the alcohol interlock programme. Several countries are offering a specific rehabilitation program (including medical examination, education, coaching), while others do not.

Benefits

The potential reduction of alcohol-related accidents in which high-BAC offenders are involved depends on the either the probability of high-BAC offenders to be caught and (in case they are caught) their participation rate.

Another important assumption is the (net) effectiveness of the alcohol interlock device in reducing the number or road deaths. The effectiveness of an alcohol interlock compared to suspension of a driving license is estimated at 18.75% (Spit, Houwing, Hagenzieker, Mathijssen, & Modijefsky, 2014).

Finally, the potential reduction of alcohol-related casualties and serious injuries is monetised by using the value of statistical life (VOSL) derived from the Handbook External Costs of Transport.

The results from the cost-benefit analysis are presented in Table 10.14.

Table 10.14 Costs and benefits of policy option 4 – mandatory installation of alcohol interlocks high-BAC offenders

Costs	
Total costs of preparing European legislation	€ 58 mln
Total introduction costs (i.e. purchase and installation)	€ 59 mln - € 714 mln
Total recurring costs (i.e. maintenance and service)	€ 3 mln - € 245 mln
Total closing and other costs (i.e. support program, removal)	€ 3 mln - € 408 mln
Safety and mobility effects	
Annual safety effect (measured in road deaths avoided)	4 – 47 persons
Annual safety effect (measured in serious injuries avoided)	93 – 1.211 injuries
Total safety benefits	€ 121 mln - € 1.6 bln
Total mobility benefits	€ 66 mln - € 617 mln
Benefit-cost ratio (BCR)	0.13 – 17.79

Simulating this policy option shows a negative (0.13) and strongly positive (17.79) benefit to cost ratio (BCR). The results are rather sensitive to several assumptions:

- Introduction costs of an interlock (e.g. purchase and installation);
- Probability of high-BAC offenders to be caught and participation of high-BAC offenders
- (Net) effectiveness of an alcohol interlock;
- These 'key' assumptions and their impact on the robustness of the CBA results will be tested in section 10.3.

10.2.5 Policy option 5: mandatory installation of alcohol interlocks for young drivers

The fifth policy option simulates a situation where all young drivers are mandated to drive with an alcohol interlock. As there are (currently) no comparable alcohol interlock programmes in place that target these young drivers, limited evidence on the practical implementation of such a programme can be found. This makes the simulation to a certain extent somewhat theoretical in nature. For this policy option, the costs and benefits are (within a bandwidth) determined on the basis of several key assumptions. In Table 10.15, these assumptions are presented and allocated to general, costs and benefits related assumptions. More detailed background on the target group – young drivers – and the potential safety benefits of an alcohol interlock are presented in section 9.4. of this report.

Table 10.15 Assumptions used for CBA of policy option 5 – mandatory installation of alcohol interlocks for young drivers

Indicators	Input
General	
Total number of drivers in Europe	roughly 300 mln
Number of young persons in Europe	10.1%
Share of young persons in Europe with a drivers licence	50% - 75%
Number of young drivers in Europe	15 to 23 mln
Period of preparation	5 years
Period of the alcohol interlock programme	7 years (min)
Costs	
Costs of preparing European legislation	2 mln euro
Costs of preparing legislation for Member States	2 mln euro per Member State
Introduction costs of an interlock (e.g. purchase and installation)	€ 1,000 - € 1,300
Recurring costs (i.e. maintenance and operational costs of an interlock)	€ 80 - € 100 per year
Closing and other costs (i.e. removal of an interlock)	€ 70 - € 100
Safety effect	
Traffic casualties by young drivers on European roads caused by alcohol	7.5% - 29%
Potential reduction in alcohol-related accidents involving drink-driving by young drivers	• Low = 50% • High = 75%
External accident costs per fatality	€ 2.9 mln
External accident costs per serious injury	€ 465,000

Costs

As in the previous policy options, this policy option also requires harmonisation of European and national regulations. These costs (e.g. preparing European legislation and national legislation) are estimated at 2 million euro. The preparation period is estimated to take roughly 5 years to materialise.

The associated costs (separated into introduction, recurring and closing costs) are based upon actual costs information of the European alcohol interlock programmes (see section 8.3. and Annex 5). As this policy option simulates a situation where 15 to 23 million young drivers will be mandated to drive with an alcohol interlock, the market substantially increases. In line with the previous policy option, we have estimated the introduction costs to decrease by 25% (in both scenarios). Recurring costs are expected to remain constant at €80 - €100 due to the relatively high(er) share of operational costs to inspect alcohol interlock and will take place annually. Finally, closing costs for removal of an interlock are estimated between €70 and €100.

Benefits

The benefits of the policy option depends on (1) the share of alcohol-related traffic casualties caused by young drivers, (2) the potential reduction of alcohol-related accidents and (3) external accident costs per fatality/serious injury. The first has been estimated on the basis of several national studies (see section 9.4.). The second is estimated at 50% and 75% due to the fact that not all alcohol-related accidents can be prevented by means of an alcohol interlock. The third component monetises the number of prevented fatalities and serious injuries by using the VOSL from the Handbook External Costs of Transport.

Table 10.16 Costs and benefits of policy option 4 – mandatory installation of alcohol interlocks for young drivers

Costs	
Total costs of preparing European legislation	€ 58 mln
Total introduction costs (i.e. purchase and installation)	€ 22 bln - € 42 bln
Total recurring costs (i.e. maintenance and service)	€ 4 bln - € 8 bln
Total closing and other costs (i.e. removal)	€ 0.7 bln - € 1.4 bln
Safety and mobility effects	
Annual safety effect (measured in road deaths avoided)	128 – 1.035 persons
Annual safety effect (measured in serious injuries avoided)	3.331 – 26.857 injuries
Total safety benefits	€ 10 bln - € 78 bln
Benefit-cost ratio (BCR)	0.19 – 2.91

The BCR ranges between 0.19 (negative) and 2.91 (positive) outcome. The main reason for the rather wide bandwidth is due to the uncertainty related to the share of alcohol-related accidents in which young drivers are involved. These findings vary between 7.5% and 29%. The results are, next to these findings, sensitive to the following assumptions:

- Introduction costs of an alcohol interlock;
- Effectiveness of an alcohol interlock;
- These ‘key’ assumptions and their impact on the robustness of the CBA results will be tested in section 10.3.

10.3 *Sensitivity analyses*

In this section, three sensitivity analyses are performed to measure the impact of certain key assumptions on the robustness of the CBA results. The specific assumption changes will be briefly described. The results for the different policy options in the costs benefit analysis will be tested for sensitivity by changing the following assumptions:

- **Sensitivity analysis 1**: the introduction costs of an alcohol interlock (i.e. purchase and installation) are assumed to decrease in every policy option to € 675 (minimum scenario) and €875 (maximum scenario);
- **Sensitivity analysis 2**: the effectiveness of an alcohol interlock is estimated between 50% and 75% in every policy option. This sensitivity analysis simulates the situation that an alcohol interlock is for 90% (minimum scenario) to 100% (maximum scenario) effective;

- **Sensitivity analysis 3**: the probability of high-BAC offenders to be caught and the participation of high-BAC offenders in the programme divers strongly between country/programme. The third sensitivity analysis simulates a situation where the probability to be caught doubles to 15% (minimum scenario) and 20% (maximum scenario) compared to our base assumption. At the same time, the minimum participation of high-BAC offenders in European programs increases to 50% (minimum scenario) and remains 70% (maximum scenario).

Table 10.17 and Table 10.18 present the results from the sensitivity analyses on cost, benefits and the BCR of the various policy options.

Table 10.17 Sensitivity analysis –policy options PO1a, PO2a, PO3a

		PO1a	PO2a	PO3a
Base assumptions	Costs	€96 bln - €124 bln	€486 mln - €610 mln	€3.7 bln – €4.7 bln
	Benefits	€33 bln - €83 bln	€44 mln – €208 mln	€764 mln – €6.9 bln
	Benefit-cost ratio	0.27 – 0.86	0.07 – 0.43	0.16 – 1.87
Sensitivity 1	Costs	€96 bln - €124 bln	€372 mln - €462 mln	€2.8 bln – €3.5 bln
	Benefits	€33 bln - €83 bln	€44 mln – €208 mln	€764 mln – €6.9 bln
	Benefit-cost ratio	0.27 – 0.86	0.09 – 0.56	0.22 – 2.48
Sensitivity 2	Costs	€96 bln - €124 bln	€486 mln - €610 mln	€3.7 bln – €4.7 bln
	Benefits	€63 bln - €110 bln	€79 mln – €277 mln	€1.4 bln – €9.2 bln
	Benefit-cost ratio	0.51 – 1.14	0.13 – 0.57	0.29 – 2.49

To conclude, the three factory fitted policy options are robust for the two sensitivity analysis. In practice, this means that the BCR does not change from negative (<1) to positive (>1) or vice versa. This means in practice that the minimum scenario becomes slightly less negative, but remains negative in all scenario. In case of a positive BCR in the maximum scenario, this becomes even more positive in the sensitivity analysis.

The only exception is perceived in policy option 1a and sensitivity analysis 2. The BCR in the maximum scenario becomes positive compared to a negative bandwidth when applying base assumption. The other policy options are robust in terms of the BCR bandwidth.

Table 10.18 Sensitivity analysis – policy options PO1b, PO2b, PO3b, PO4 and PO5

		PO1b	PO2b	PO3b	PO4	PO5
Base assumptions	Costs	€299 bln - €383 bln	€ 1.5 bln - €1.9 bln	€13 bln – €16 bln	€123 mln - €1.4 bln	€27 bln – €52 bln
	Benefits	€90 bln - €293 bln	€166 mln – €789 mln	€3 bln – €27 bln	€188 mln – €2.2 bln	€10 bln – €78 bln
	Benefit-cost ratio	0.24 – 0.98	0.09 – 0.53	0.19 – 2.19	0.13 – 17.79	0.19 – 2.91
Sensitivity 1	Costs	€299 bln - €383 bln	€1.1 bln - €1.4 bln	€9.7 bln – €12.3 bln	€ 94 mln – €1 bln	€20 bln – €38 bln
	Benefits	€90 bln - €293 bln	€166 mln – €789 mln	€3.1 bln – €27.5 bln	€188 mln – €2.2 bln	€10 bln – €78 bln
	Benefit-cost ratio	0.24 – 0.98	0.12 – 0.69	0.25 – 2.85	0.18 – 23.37	0.25 – 3.94
Sensitivity 2	Costs	€299 bln - €383 bln	€ 1.5 bln - €1.9 bln	€13 bln – €16 bln	€123 mln - €1.4 bln	€27 bln – €52 bln
	Benefits	€198 bln - €392 bln	€299 mln - €1.1 bln	€5.5 bln – €36.7 bln	€162 mln - €2.1 bln	€17 bln - €104 bln
	Benefit-cost ratio	0.52 – 1.31	0.16 – 0.70	0.34 – 2.92	0.16 – 22.05	0.34 – 3.88
Sensitivity 3	Costs	N/A	N/A	N/A	€123 mln – €1.4 bln	N/A
	Benefits	N/A	N/A	N/A	€1.9 bln – €4.4 bln	N/A
	Benefit-cost ratio (BCR)	N/A	N/A	N/A	1.32 – 35.58	N/A

The results for all vehicles (PO1b, PO2b and PO3b) show a similar pattern for sensitivity analysis 1 and 2 compared to factory fitting policy option (see Table 10.17). In short, the BCR is robust for all policy options, with the only exception being PO1b in the second sensitivity analysis. Overall, the BCR does not change from negative (<1) to positive (>1) when adjusting certain key assumptions.

The third sensitivity analysis does show positive BCR in both the minimum and maximum scenario. This means that increasing the probability of high-BAC offenders to be caught as well as the participation of high-BAC offenders in the programme leads to positive ratio of benefits and costs from a welfare point of view.

11 Conclusions and Recommendations

11.1 *Findings related to alcohol in traffic*

- Despite the fact that progress has been made in reducing the number of road fatalities related to alcohol, the number of fatalities is still significant with almost 2750 fatalities in the EU in 2018 according to national statistics. The vast majority of the accidents in which drink driving is involved, namely 75%, is caused by a small group of high-BAC offenders.

- In reality the overall fatality figure is almost certainly higher. Furthermore, the downward trend in the number of fatalities related to alcohol has slowed down in recent years.

- Based on national statistics, the share of alcohol-related fatalities in total road fatalities was 15% in the EU27 in 2018. It is estimated the actual share lays between 19% - 26%. This bandwidth is slightly lower compared to findings of a European Commission funded study, which estimated the share of road fatalities with involvement of alcohol in the EU27 for 2011 at 20-28%.

- There is a widespread believe national statistics in most countries underreport the number of road fatalities with alcohol involvement. Not all countries use the same definition for alcohol-related road fatalities (e.g. definition by the European project SafetyNet). In addition, not all active road users involved in a road collision that resulted in road death or serious injury are systematically tested for alcohol.

- Scientific literature supports the conclusion that a BAC of 0.05% impairs faculties required in the operation of a vehicle. Furthermore, for many faculties it has been found they are increasingly impaired with an increasing BAC level. Faculties required for more complex tasks being impaired at lower BAC levels than most skills required to perform simpler tasks. For some, impairment from alcohol can begin with BACs as low as 0.01 or 0.02%. However, relationships between BAC and impairment of higher level driving functions are less well understood, with mixed research findings on the influence of specific skills.

- Since the publication of the EU Recommendation (2001/115/EC) BAC limits in the EU have further harmonised. At least 8 countries have introduced a lower BAC level for divers and 14 for novice and professional drivers after publication of the Recommendation.

- Currently, EU Member States, as well as Switzerland and Norway, have a legal BAC limit of 0.5 g/L or lower. Furthermore, 24 of the analysed 30 European countries apply lower BAC (0.0-0.3 g/L) for inexperienced drivers. In addition, most European countries have a BAC limit for professional drivers of 0.3 g/L or lower.

- Research has shown lowering BAC limits to 0.5 g/L has been effective in reducing road fatalities in the European countries, but it is stressed the effectiveness is also determined by (increased) enforcement of and awareness raising on these limits.

- There is limited evidence to support that lowering the BAC-limit from 0.5 g/L to 0.2 g/L or lower results in large reductions in road fatalities. Differences in social perceptions and awareness related to risks and acceptability of drinking and driving and of enforcement are all believed to result in differences in drink driving and accidents with alcohol involvement.

- Public surveys show consistent high support for the introduction of a (near) zero BAC limit for young or novice drivers.

- Available data (13 countries) shows the number of police sobriety checks per 1000 inhabitants increased by 25% in Europe between 2010 and 2019. This increase largely occurred until 2014 and has remained at a similar level since. It should also be noted there are large differences between countries, with several countries actually reducing enforcement intensity. European surveys (19 countries) show 76% of respondents consider that the police enforcement of drink-driving traffic rules is not sufficient.

- A wide variety of legal sanctions for drink driving is applied in European countries and there are large differences between countries in the choice of sanctions and how these are applied. There are many indications that the majority of drivers are not aware of penalty level that they are facing for driving above the legal alcohol limit.

11.2 *Recommendations related to alcohol in traffic*

- The goal of eliminating drink driving deaths and serious injuries by the 2050s requires effective measures. Consideration could be given to the development of a specific catalogue of recommendations for preventive solutions targeting drink driving.

- Effective prevention policy requires reliable, periodically updated data. It is therefore necessary to revise and harmonise the existing definitions relatively quickly, to define the scope of data that would be required and to agree on how to collect it. The data collected should make it possible to assess the effectiveness and efficiency of the solutions implemented and to make international comparisons.

- In order to draw confident conclusions about the impairment effect of alcohol on driving, especially more complex driving behaviour, more research would be required. On the one hand, further research could focus on the replicability of results of several potentially useful tests and their predictive validity of actual driving impairment. On the other hand, future endeavours could go beyond the normal performance measures and look into patterns of behavioural reactions in more complex driving scenarios, scenarios that one encounters in everyday driving.

- There are differences in enforcement and sanctions applied across Europe to prevent and manage drink driving. Very limited up-to-date information is available about the impacts of these differences. Research into the effects of these variations in policies and their execution, could help create better understanding of key success factors of effective strategies. Based on this, recommendations on regulations and their effectuation could be provided. A similar solution has been attempted in the United States by empowering the National Committee on Uniform Traffic Laws and Ordinances to prepare a model DWI (Driving While Intoxicated) law. This model included BAC testing, BAC test refusals, higher penalties for high-BAC drivers, administrative licence revocation hearing procedures, and many other proposals. States can use the NCUTLO model as a reference point in reviewing their laws. It may be worth considering whether this experience could also be used in Europe. Such action could be building on the EC Recommendation on Enforcement in the field of Road Safety (2004/345/EC).

11.3 *Findings on alcohol interlocks*

- In order to combat the negative effects of alcohol use in traffic, an increasing number of Member States have introduced the possibility for offenders to continue driving once being caught, but only if an alcohol interlock is installed in their vehicle.

- In 2020, eight EU Member States have an active operating offender/rehabilitation programme in place for drink-driving offenders.

- Several countries (i.e. Finland, Sweden, France, Lithuania and Norway) have – either apart from their offender/rehabilitation programme – a preventive/mandatory alcohol interlock programme in place for specific types of vehicles (e.g. school transport, buses, coaches and trucks).

- Evaluations show interlocks are an effective means of avoiding recidivism, especially when accompanied with intensive guidance and/or control. A structural change of behaviour can only be achieved with a more comprehensive treatment intervention. Experience also shows that the effect is not lasting, and reduces quickly once participation in the programme has ended, especially if guidance and support have been limited.

- High costs, including costs incurred for guided/supervised participation, are a key barrier for drivers to enter in a (offender/rehabilitation) interlock programme. costs of an alcohol interlock programme should be kept at a reasonable level for reasons of equal access and overall effectiveness. Some countries have therefore opted to apply a "low-supervision" approach. Especially in the later cases, no reliable data is available to assess the effectiveness due to recent introduction of the programme or limited monitoring. It therefore remains to be seen how the two approaches compare in terms of overall (cost) effectiveness.

- Despite progress in harmonisation of BAC limits, differences still remain between countries. In particular, in professional transport - an international, highly competitive economic sector – imposing different requirements for installing and driving with alcohol interlocks could pose barriers for competition.

- Experience from Norway shows preventive interlock schemes can be introduced successfully in dialogue with the transport sector.

- Cost-benefit analysis have been carried out for EU-wide implementation of mandatory alcohol interlocks, targeting five specific groups: all passenger car drivers, all buses and coaches, all heavy goods vehicles; high-BAC offenders; young/novice drivers.
  - The cost assessment obtained in the CBA is derived from cost information of the alcohol interlock programmes in Europe. These costs include introduction (e.g. installation and purchase), recurring (e.g. maintenance and inspection) and closing (e.g. removal) and other costs (such as medical examinations and/or support program).
  - The benefits of the policy options are determined on the basis of several target groups (e.g. high BAC, professional drivers and young drivers) and their involvement in alcohol-related traffic accidents. The (potential) benefits are monetised in prevented fatalities and serious injuries.

- The cost-benefit analysis shows that in the maximum scenario applying an alcohol interlock is considered cost-effective in four out of the five policy options (BCR > 1) and for three out of five when looking at the middle value. In that case, programmes targeting HGVs, high-BAC offenders and young/novice drivers score positive. Applying several assumptions on the basis of existing literature leads to a wide bandwidth between the minimum and maximum scenario. When "negative" assumptions are applied no scenario would result in a positive BCR. Negative is hyphenated as one of the factors which could reduce the effectiveness of interlocks is an autonomous reduction of alcohol-related road fatalities, or a current low rate. The latter is the case for buses and coaches. Within this category very few alcohol-related fatalities occur. Still there is high public support for alcohol interlocks to be applied in buses and coaches. Mandatory installation of alcohol interlocks for high-BAC offenders – has the highest benefit to cost ratio (BCR).

- By looking at the absolute number of fatalities the largest potential to reduce traffic fatalities can be achieved by mandatory installation in passenger cars (between 1.217 and 3.955) and mandatory installation for young drivers (between 128 and 1.035).

11.4 *Recommendations on alcohol interlocks*

- Action could be taken to further promote the adoption of a 0.2 g/L BAC limit for professional drivers across Member States and other countries. Adoption of the same BAC limit would facilitate introduction of alcohol interlocks without risk of significant adverse effects on competition. Differences in the cut-off levels of alcohol interlocks based on variations of BAC limits for professional drivers would make it difficult for drivers to operate with a single vehicle in multiple countries that require use of interlocks but with different cut-off levels. This could distort competition between transport operators.

- Via their procurement policy, public authorities could promote the use of interlocks through the requirement of having an interlock in the vehicles they purchase or in the vehicles used for the provision of publicly procured services (e.g. (public) transport, waste collection, courier service etc.).

- Promote the use of alcohol interlocks in HGVs and by high-BAC offenders. The use of interlocks in buses and coaches could also be considered, this could support the familiarisation with interlocks and promote a safety culture.

11.5 *Findings related to drugs in traffic*

- The use of drugs, including medicines can have negative impact on several driving skills, such as attention, tracking, reaction time, information processing, perception, psychomotor skills, visual function, divided attention tasks, cognitive and executive functions, car following, lane keeping, speed control and emergency manoeuvres. However, large variations in impact have been found between individual drugs, combination of drugs, duration of use and between users. Much is still unclear about these variations.

- Prevalence of drugs in traffic is becoming more apparent. The share of persons driving under the influence of drugs in the general driving population is estimated between 2-5% based on roadside and self-report survey data. On some days and times (e.g. weekend, nights, holidays) this share can increase to an estimated 27% on average. THC and benzodiazepines are most observed.

- Findings from research suggest increased risks of accident involvement, including with injuries or fatalities, related to drug-driving involving some drugs. Increased risks have been found for amphetamines in particular, but also for cocaine and benzodiazepines. The majority of estimates indicate that the increase in risk is lower than twofold, thus far less than for alcohol. The increase in accident risk is largest for fatal accidents. However, findings are inconsistent, in particular for THC. Many studies are based on a small sample size, are difficult to compare and have been criticised for lack of methodological rigour.

- The share of fatalities with drug involvement has increased in almost all European countries over the past decade. In 2018 (the last year in which it was possible to collect data from a larger number of countries (N=16), around 1,020 people died in drug-related road accidents, which represents 6% of all deaths in road accidents in these countries. Extrapolating this share to the EU27, this would result in some 1,360 drug-related driving fatalities for the EU27. At the same time, epidemiological studies of traffic fatalities at national level have found higher shares of fatalities with involvement of drugs. It is roughly estimated this share of fatalities with involvement of drugs (including medicines) is at least 15-25%. However, it should be noted that, much more than for alcohol, definitions and methodologies applied to trace and record drug-related fatalities differ between countries.

- Three types of legislation exist to regulate driving under influence of drugs: "impairment" legislation, "per se" legislation and the "two-tier" approach that combines both. The impairment approach is executed in 14 European countries, zero-tolerance or '*per se'* limits in 9, and a combination of these two approaches into a two-tier system – in 7. There is no strong evidence on differences in impacts between these approaches on the number of drugged drivers in traffic or on drug-related accidents and fatalities. In addition, little is known about the effects of applying stricter norms or thresholds on deterrence of driving under the influence of drugs.

- In most countries (in 26 out of analysed 30) the police have the right to stop drivers randomly for drug-driving checks. However, it seems that despite the legal basis, random checks on the presence of drugs in the body are rarely carried out in Europe.

- Enforcement intensity (i.e. number of checks per 1 000 inhabitants) has been increasing in the past decade, but their intensity is still very low, considering the average intensity of alcohol checks in European countries (n=13) is almost 200 times higher. Some 13% of drivers in the ESRA survey expected they would be stopped by police and checked for driving under the influence of drugs.

- The sanctions for drug-driving offences vary between countries, and in the majority of European countries they are similar to sanctions for drink driving. In most countries there is no differentiation of penalties according to the type of drug or its concentration in the human body. In such a situation it is the judge who decides about the penalty.

- Roadside impairment testing for drugs has been widely applied across European countries. However, it requires well-trained staff and it is considered costly and time consuming. There is a limited number of trained staff. In addition, doubt is being raised over the effectiveness in detecting drug-impaired drivers. There is a need to both improve the current practical implementation of impairment testing, for example by training additional staff to conduct RIT, and to introduce standard Roadside Chemical Testing in addition.

- Unlike for (breath) alcohol testing devices, there are no international or EU standards set out for drugs screening devices. To date, no complete type approval specification has been drawn up for these devices by either the OIML (International Organization for Legal Metrology) or CEN (European Committee for Standardization).

- Roadside drug testing with screening devices using an oral fluid sample testing offers simple, rapid, non-invasive, observed specimen collection. Confirmation analysis is highly recommended.

- Overall, the accuracy of roadside drug testing devices currently available is considered medium to high based on evidence available. Screening devices can test for a limited number of drugs found present in drivers. Not all drugs commonly found in drivers can be detected with the same accuracy. There are also variations in differences in detection time between substances compared to blood. Furthermore, there are differences in accuracy between devices, with no device found to have higher accuracy across all studies and all drugs.

- Although blood is generally considered to be the "gold standard" for determining drug concentrations, there are several countries that use oral fluid for confirmation (evidence) testing. Oral fluid screening is compatible with a regulatory approach of zero-tolerance for drug driving, especially in relation to "illicit drugs".

- Relatively high cost of screening devices and time required for the testing of drivers form a barrier for efficient large-scale deployment of roadside drug testing. There is hope that continuing technological development will result in possibilities which can increase efficient roadside chemical testing. For the moment, these are not there yet.

11.6 ***Recommendations related to drugs in traffic***

- In order to improve the knowledge of prevalence of drugs in traffic it is recommended to

    - Promote the adoption of a common definition of drug driving fatalities and the manner in which these are recorded, similar to provisions made for alcohol. This could include alignment of minimum range of drugs tested for;
    - Carry out an / promote performance of an epidemiological study, preferably across European countries and applying the same methodology (e.g. follow-up study of the DRUID study, which more than 10 year after the study was conducted still is the main source of information for main studies an policies prepared since).

- Expanding the research on drugs, in particular psychoactive medicines and NPS in relation to driving impairment and accident risk. In addition, conduct monitoring and evaluation of effectiveness of drug driving policies and enforcement. Develop a comprehensive policy on drug-driving based evidence collected from (abovementioned) research efforts.

- Facilitate development of guidelines for police to assess the most efficient and effective locations and times to deploy their roadside testing unit for random drug testing.

- Promote the development of international standards for drug screening devices and continue to support R&D in technologies which can improve functionalities of these devices

- Investigate options to promote joined procurement as a solution to reduce costs. This could also involve investigating an approach to purchasing drug testing equipment and to consider developing a national guideline that sets out both the roadside drug testing and the laboratory testing procedures that produce accurate test results and admissible evidence in court.

12 Bibliography

Abraham , M., & Oberon, N. (2017). *Driving under the influence of drugs - baseline measurement.* Amsterdam: DSP-groep.

Achermann Stürmer, Y., Meesmann, U., & Berbatovci, H. (2019). *Driving under the influence of alcohol and drugs. ESRA2 Thematic report Nr. 5. ESRA project (E-Survey of Road users' Attitudes).* Bern, Switzerland: Swiss Council for Accident Prevention.

Adminaite, D., Jost, G., Stipdonk, H., & Ward, H. (2018). *An overview of road death data collection in the EU.* Brussels: European Transport Safety Council.

Adminaité-Fodor, D., & Jost, G. (2020). *PIN Flash Report 39: how to improve the safety of goods vehicles in the EU.* Brussels: ETSC. Récupéré sur https://etsc.eu/wp-content/uploads/PIN-FLASH39_FINAL.pdf

Albalate, D. (2006). Lowering Blood Alcohol Content Levels to Save Lives: The European Experience (December 1, 2006). XREAP No. 2006-07, Available at SSRN: https://ssrn.com/abstract=1852252 or http://dx.doi.org/10.2139/ssrn.1852252.

Allsop, R. (2015). *Saving Lives by Lowering the Legal Drink-Drive Limit.* London: RAC Foundation. Récupéré sur https://www.racfoundation.org/assets/rac_foundation/content/downloadables/saving_lives_by_lowering_legal_drink-drive_limit_Allsop_December_2015.pdf

Arkell, T., Kevin, R., Stuart, J., Lintzeris, N., Haber, P., Ramaekers, J., & McGregor, I. (2019, Oct). Detection of Δ 9 THC in oral fluid following vaporized cannabis with varied cannabidiol (CBD) content: An evaluation of two point-of-collection testing devices. *Drug Test Anal, 11*(10), 1486-1497.

Atchison, L. (2017). *Preventing drug driving in Europe: policy measures for national and EU action.* European Transport Safety Council. Brussel: European Transport Safety Council (ETSC). Récupéré sur http://etsc.eu/preventing-drug-driving-in-europe/

Autoridade Nacional de Segurança Rodoviária (ANSR). (2020). *EXAMES TOXICOLÓGICOS RELATÓRIO 2019.* Lisbon: Autoridade Nacional de Segurança Rodoviária .

Bakke, E., Høiseth, G., Furuhaugen, H., Berg, T., Arnestad, M., & Gjerde, H. (2020, October). Oral Fluid to Blood Concentration Ratios of Different Psychoactive Drugs in Samples from Suspected Drugged Drivers. *Ther Drug Monit., 42*(5), 795-800. doi:10.1097/FTD.0000000000000760. PMID: 32251151

Baldock, R., Palamara, P., Raftery, S., & Bailey, T. (2019). *Optimising Drug Driving Regimes.* sydney: Austroads.

Barone , R., Pelletti , G., Garagnani, M., Giusti , A., Marzi, M., Rossi, F., . . . Pelotti , S. (2019, Dec.). Alcohol and illicit drugs in drivers involved in road traffic crashes in Italy. An 8-year retrospective study. *Forensic Sci Int.*, 305:110004.

Bartl , G., & Esberger, R. (2000). Effects of lowering the legal BAC-limit in Austria. *International Conference on Alcohol, Drugs and Traffic Safety, 22–26 May.* Stockholm.

Beck, O., Ullah, S., & Kronstrand, R. (2019). First evaluation of the possibility of testing for drugged driving using exhaled breath sampling. *Traffic Injury Prevention, 20*(3), 238-243. doi:10.1080/15389588.2019.1584397

BESIP. (2020). *Alkohol a jiné návykové látky. Dílčí cíl Národní strategie bezpečnosti silničního provozu 2011-2020.* Praha / Brno: BESIP – Ministerstvo dopravy / CDV.

Binhame Albini Martini, M., Beltrami Dias Batista, T., Welter Henn, I., Tolentino da Rosa de Souza, P., Vieira, A., & Azevedo-Alanis, L. (2020). Whether drug detection in urine and oral fluid is similar? A systematic review. *Critical Reviews in Toxicology, 50*(4), 348-358. doi:10.1080/10408444.2020.1751062

BIVV. (1999). Invloed van geneesmiddelen op de rijvaardigheid. . Brussels: BIVV.

Björkman, K., Fagerlind, H., Aust,, M., Liljegren , E., Morris, A., Talbot, R., . . . Verschragen, A. (2008). *SafetyNet Deliverable 5.8; In-depth accident causation database and analysis report.*

Blencowe, T., Pehrsson, A., Lillsunde, P., Vimpari, K., Houwing, S., Smink, B., . . . Verstraete, A. (2011, May 20). An analytical evaluation of eight on-site oral fluid drug screening devices using laboratory confirmation results from oral fluid. *Forensic Science International, 208*(1-3), 173-9.

Blom, M., Blokdijk, D., & Weijters, G. (2019). *Recidive na maatregelen rijvaardigheid en geschiktheid.* Den Haag: Wetenschappelijk Onderzoek- en Documentatiecentrum (WODC). Récupéré sur https://repository.wodc.nl/bitstream/handle/20.500.12832/238/Cahier_2019-20_Volledige_tekst_tcm28-420582.pdf?sequence=2&isAllowed=y

Blomberg, R. D., Peck, R. C., Moskowitz, H., Burns, M., & Fiorentino. (2005). *Crash Risk of Alcohol Involved Driving: A Case-Control Study.* Stamford, CT: Dunlap and Associates, Inc.

Blomberg, R., Peck, R., Moskowitz, H., Burns, M., & Fiorentino, D. (2009, 08 01). The Long Beach/Fort Lauderdale relative risk study. *Journal of safety research, 40*(4), 285-92. doi:10.1016/j.jsr.2009.07.002

Borenstein, M., Hedges, L., Higgins, J., & Rothstein, H. (2009). *Introduction to Meta-Analysis.* Chichester, UK: John Wiley & Sons, Ltd.

Bosker, W. M., Kuypers, K. P., Conen, S., Kauert, G. F., Toennes, S. W., Skopp, G., & Ramaekers, J. G. (2012). MDMA (ecstasy) effects on actual driving performance before and after sleep deprivation, as function of dose and concentration in blood and oral fluid. *Psychopharmacology*(222), 367–376.

Brion, M., Meunier, J.-C., & Silverans, P. (2019). *Alcohol achter het stuur: de stand van zaken in België. Nationale gedragsmeting 'Rijden onder invloed van alcohol' 2019.* Brussel: Vias institute – Knowledge Centre Road Safety.

Brown, I. D. (1994). Driver Fatigue. *Human Factors, 36*(2), 298-314. doi:10.1177/001872089403600210

Canadian Centre on Substance Use and Addiction. (2019). *Drug Per Se Laws - Policy Brief.* Canadian Centre on Substance Use and Addiction (CCSA).

CE Delft. (2019). *Handbook on the external costs of transport.* Delft.

Clarkson, J. E., Gordon, A., & Logan, B. (2004, Oct). Lorazepam and Driving Impairment. *Journal of Analytical Toxicology, 28*(6), 475-80.

Commission, E. (2001). Commission Recommendation of 17 January 2001 on the maximum permitted blood alcohol content (BAC) for drivers of motorised vehicles. *2001/115/EC*.

Compton, R. (2017). *Marijuana-Impaired Driving - A Report to Congress.* Washington, DC: National Highway Traffic Safety Administration.

Compton, R. P., & Berning, A. (2015). Drug and Alcohol Crash Risk. Dans J. Lacey, T. Kelley-Baker, A. Berning, E. Romano, J. Yao, C. Moore, . . . R. Compton, *Drug and Alcohol Crash Risk: a case-control study* (pp. 39-62). Washington, DC: National Highway Traffic Safety Administration.

Council of State Ruling 201400944/1/A1, ECLI:NL:RVS:2015:622. Récupéré sur https://www.raadvanstate.nl/uitspraken/@99070/201400944-1-a1/

Cusack, D., Leavy, P., & Maguire, R. (2012). *Report on Roadside Drug Testing and Equipment and Related Matters .* Medical Bureau of Road Safety - An Lia-Bhiúró um Shábháilteacht ar Bhóithre. Dublin: Medical Bureau of Road Safety.

Dahlgren, K., Sagar, K., Smith, R., Lambros, A., Kuppe, M., & Gruber, S. (2020, March 1). Recreational cannabis use impairs driving performance in the absence of acute intoxication. *Drug and alcohol dependence, 208*, 107771. doi:https://doi.org/10.1016/j.drugalcdep.2019.107771

Davey, J., Armstrong, K., Freeman, J., & Sheldrake, M. (2017). *Roadside Drug Testing Scoping Study.* CARRS - Centre for Accident Research & Road Safety.

Declues, K., Perez, S., & Figueroa, A. (2016, November). A 2-Year Study of Δ 9-tetrahydrocannabinol Concentrations in Drivers: Examining Driving and Field Sobriety Test Performance,. *J Forensic Sci., 61*(6), 1664-1670.

Deits, C., Ng Boyle, L., & Morrison, J. (2011). DRIVING PERFORMANCE OF DRUG-IMPAIRED BUS DRIVERS. *Proceedings of the Sixth International Driving Symposium on Human Factors in Driver Assessment, Training and Vehicle Design, June 27-30* (pp. 454-460). Lake Tahoe: Public Policy Center, University of Iowa.

Der Bundesrat. (2017). *Evaluation von Via sicura. Bericht des Bundesrats in Erfüllung des Postulats 16.3267 der Kommission für Verkehr und Fernmeldewesen des Ständerats vom 14. April 2016.* Bundesamt für Strassen ASTRA, Bern.

Desapriya, E., Shimizu, S., Pike, I., & Smith, D. (2007, 01 01). Impact of lowering the legal BAC limit to .03 on teenage drinking and driving related crashes in Japan. *Nihon Arukōru Yakubutsu Igakkai zasshi = Japanese journal of alcohol studies & drug dependence, 41*(6), 513-27.

Dixon, P., Clark, T., & Tiplady, B. (2009, May). Evaluation of a roadside impairment test device using alcohol. *Accid Anal Prev, 41*(3), 412-8. doi:10.1016/j.aap.2009.01.001

Downey, L., AC, H., Porath-Waller, A., Boorman, M., & Stough, C. (2016, January). The Standardized Field Sobriety Tests (SFST) and measures of cognitive functioning. *Accid Anal Prev., 86*, 90-98. doi:10.1016/j.aap.2015.10.019

Drummer, O., & Yap, S. (2016, Aug). The involvement of prescribed drugs in road trauma. *Forensic science international, 265*, 17-21. doi:10.1016/j.forsciint.2015.12.050

Dupont, E., Martensen, H., & Silverans , P. (2010). *Verlaagde alcohollimiet voor onervaren bestuurders en voor bestuurders van grote voertuigen: 0,2‰.* Brussel: Belgisch Instituut voor de Verkeersveiligheid BIVV, Observatorium voor de Verkeersveiligheid.

Ecorys & VTT. (2019). *Ecorys & VTT (2019), Study on the feasibility, costs and benefits of retrofitting advanced driver assistance to improve road safety.*

Ehlers, P. (2018). Drink Driving policies from Denmark. *SMART policies for tackling drink driving, Thursday 21st June 2018.* Athens: ETSC and Road Safety Institute Panos Mylonas. Récupéré sur https://etsc.eu/wp-content/uploads/Drink-Driving-policies-from-Denmark-Pernille-Ehlers-Danish-Road-Safety-Council.pdf

Ekström, C., & Forsman , Å. (2018). *Förekomst av alkohol och droger hos förare av lastbil och buss som varit inblandade i dödsolyckor och olyckor med svåra personskador.* VTI. Göteborg: VTI. Récupéré sur https://www.diva-portal.org/smash/get/diva2:1270712/FULLTEXT02

Elder, R. W., Voas, R., Beirness, D., Shults, R. A., Sleet, D. A., Nichols, J. L., . . . Task Force on Community Preventive Services. (2011, March). Effectiveness of ignition interlocks for preventing alcohol-impaired driving and alcohol-related crashes: a Community Guide systematic review. *Am J Prev Med., 40*(3), 362-76. doi:10.1016/j.amepre.2010.11.012

ETSC. (2014). *TACKLING DRINK DRIVING: CASE STUDY: Alco Gates in Sweden.* Brussels: European Transport Safety Council. Récupéré sur https://etsc.eu/wp-content/uploads/2014_06_smart_factsheet_alco_gate_sweden.pdf

ETSC. (2017, June 23). *ETSC website*. Récupéré sur News: Alcohol interlock programmes finally get a boost in France: https://etsc.eu/alcohol-interlock-programmes-finally-get-a-boost-in-france/

ETSC. (2018, February 27). *ETSC news Swiss cancellation of alcohol interlock programme will make road safety targets harder to reach*. Récupéré sur ETSC: https://etsc.eu/swiss-cancellation-of-alcohol-interlock-programme-will-make-road-safety-targets-harder-to-reach/

ETSC. (2019, July 20). *ETSC website*. Récupéré sur https://etsc.eu/uk-government-to-review-potential-of-alcohol-interlocks/

ETSC. (2019, April 2). *https://etsc.eu/lithuania-alcohol-interlock-programme-launching-in-january/*. Récupéré sur https://etsc.eu/lithuania-alcohol-interlock-programme-launching-in-january/

ETSC. (2020). *Alcohol Interlocks in Europe. .* Brussel: European Transport Safety Council.

ETSC. (2020, January 1). *ETSC news*. Récupéré sur ETSC: https://etsc.eu/lithuania-launches-alcohol-interlock-programme/

European Commission. (2020). *EU road safety policy framework 2021-2030 - Next steps towards 'Vision Zero'.* Directorate-General for Mobility and Transport . Luxemburg: Publications Office of the European Union. doi:10.2832/391271

European Commission. (2021). *European Commission > Transport > Road Safety > Going abroad*. Récupéré sur European Commission: https://ec.europa.eu/transport/road_safety/going_abroad/search_en.htm

European Commission, Directorate General Mobility and Transport. (2020). Consulté le 01 2021, sur https://ec.europa.eu/transport/media/news/2020-06-11-road-safety-statistics-2019_en.

Eurostat. (2020). *Victims in road accidents by NUTS 2 regions.* Consulté le January 2021, sur https://ec.europa.eu/eurostat/web/products-datasets/-/tran_r_acci

Fauls, I., & Irwin, J. D. (2009). Drink driving and drug driving enforcement strategies in Australia. Dans *Young impaired drivers: the nature of the problem and possible solutions* (pp. 204-212). Washington, DC: Transportattion Research Board.

Fell, J. C., & Scherer, M. (2017, December). Estimation of the Potential Effectiveness of Lowering the Blood Alcohol Concentration (BAC) Limit for Driving from 0.08 to 0.05 Grams per Deciliter in the United States. *Alcoholism, Clinical and Experimental Research, 41*(12), 2128-2139. doi:https://doi.org/10.1111/acer.13501

Ferreira, D., Boland, J., Phillips , J., Lam, L., & Currow, D. (2018). he impact of therapeutic opioid agonists on driving-related psychomotor skills assessed by a driving simulator or an on-road driving task: A systematic review. *Palliative Medicine, 32*(4), 786-803.

Finnish Crash Data Institute (OTI). (2020). *OTI-päihderaportti 2020. Liikenneonnettomuuksien tutkijalautakuntien vuosina 2014–2018 tutkimat kuolemaan johtaneet onnettomuudet.* Helsinki: Finnish Crash Data Institute (OTI).

Finnish Transport Safety Agency. (2012). *Adoption of the alcohol interlock and its effects in professional transport.* Helsinki: Trafi Publications. Récupéré sur http://www.trafi.fi/filebank/a/1335444574/1729c59ef5035edfaa4ecdddbbaa06fe/9550-Trafin_julkaisuja_5-2012_-__Adoption_of_the_alcohol_interlock_and_its_effects_in_professional_transport.pdf

Fishbain, D. A., Cutler, B., Rosomoff, H. L., & Steele Rosomoff, R. (2003, June). Are Opioid-Dependent/Tolerant Patients Impaired in Driving-Related Skills? A Structured Evidence-Based Review. *Journal of Pain and Symptom Management, 26*(6), 559-577.

FOD Mobiliteit. (2020). Récupéré sur Government of Belgium website: https://mobilit.belgium.be/nl/wegverkeer/rijbewijzen/alcoholslot

Forsman, A. (2015). *Alcohol, drugs and medicines among killed drivers of passenger cars - Year 2005-2013.* Linköping: VTI.

Fournier, R., Willis, M., Zaouk, A., Strassburger, R., & Spicer, R. (2019). Assessing System Implementation Readiness of the Driver Alcohol Assessing System Implementation Readiness of the Driver Alcohol Detection System For Safety (DADSS) To Reduce Alcohol-Impaired Driving in a Real-World Driving Pilot Deployment Project. *Proceedings Of The 26th International Technical Conference On The Enhanced Safety Of Vehicles.*

Gentili, S., Solimini, R., Tittarelli, R., Mannocchi, G., & Busardò, F. P. (2016). A Study on the Reliability of an On-Site Oral Fluid Drug Test in a Recreational Context. *Journal of Analytical Methods in Chemistry, Article ID 1234581*.

Gentili, S., Solimini, R., Tittarelli, R., Mannochchie, G., & Busardò, F. (2016). A Study on the Reliability of an On-Site Oral Fluid Drug Test in a Recreational Context. *J Anal Methods Chem., 1234581*. doi:10.1155/2016/1234581

Giorgettia, R., Marcotulli, D., Tagliabracci, A., & Schifano, F. (2015). Effects of ketamine on psychomotor, sensory and cognitive functions relevant for driving ability. *Forensic Science International, 252*, 127-142.

Gjerde, H., & Verstraete, A. (2010, Feb.). Can the prevalence of high blood drug concentrations in a population be estimated by analysing oral fluid? A study of tetrahydrocannabinol and amphetamine. *Forensic Science International, 195*(1-3), 153-9. doi:10.1016/j.forsciint.2009.12.011

Gjerde, H., Strand, M., & Mørland, J. G. (2020). Driving Under the Influence of Non-Alcohol Drugs — Epidemiological Studies. Dans A. Jones, J. Morland, & R. Liu, *Alcohol, Drugs, and Impaired Driving. Forensic Science and Law Enforcement Issues.* CRC Press.

Goldenbeld, C. (2017). The Dutch Alcohol Interlock Programme: The rise and fall of a promising road safety measure. *Safe & Sober Talk, Alcohol Interlocks: Towards a European approach for the fight against drink driving? 10 July 2017, Belgrade.*

Goldenbeld, C., Torfs, K., Vlakveld, W., & Houwing, S. (2020, October). Impaired driving due to alcohol or drugs: International differences and determinants based on E-Survey of Road Users' Attitudes first-wave results in 32 countries. *IATSS Research, 44*(3), 188-196.

Gomes, T., Juurlink, D., Antoniou, T., Mamdani, M., Paterson, J., & van den Brink, W. (2017). Gabapentin, opioids, and the risk of opioid-related death: A population-based nested case–control study. *PLoS Medicine, 14*(10), e1002396. doi:10.1371/journal.pmed.1002396

Haghpanahan, H., Lewsey, J., Mackay, D. F., McIntosh, E., Pell, J., & Jones , A. (2019, January 26). An evaluation of the effects of lowering blood alcohol concentration limits for drivers on the rates of road traffic accidents and alcohol consumption: a natural experiment. *The Lancet, 393*(10169), 321-329. doi:https://doi.org/10.1016/S0140-6736(18)32850-2

Harmon, D., Haas, A., & Peterkin, A. (2021, Feb). Experimental tasks of behavioral risk taking in alcohol administration studies: A systematic review. *Addict Behav.*, 113:106678.

Harrison, E., & Fillmore, M. (2011). Alcohol and distraction interact to impair driving performance. *Drug and alcohol dependence, 117*(1), 31–37. doi:https://doi.org/10.1016/j.drugalcdep.2011.01.002

Hayley , A., Downey , L., Green, M., Shiferaw, B., Kenneally, M., Keane, M., . . . Shehabi , Y. (2019, Sept/Oct). riving Simulator Performance After Administration of Analgesic Doses of Ketamine With Dexmedetomidine or Fentanyl. *J Clin Psychopharmacol., 39*(5), 446-454.

Hlastala, M., Polissar, N., & Oberman, S. (2005, May). Statistical evaluation of standardized field sobriety tests. *J Forensic Sci., 50*(3), 662-9.

Howard, E., Harris, A., & McIntyre, A. (2020). *Effectiveness of Drink Driving Countermeasures, National Policy Framework.* Sydney: Austroads Ltd.

Hummel, T., Kuhn, M., Bende, J., & Lang, A. (2015). Advanced driver assistance systems. *German Insurance Association Insurers Accident Research, 6*(1), 1–63.

Institórisa, L., Hidvégi, E., Dobos, A., Sija, É., Kereszty, É. M., Tajti, L. B., . . . Varga, T. (2017, Jume). The role of illicit, licit, and designer drugs in the traffic in Hungary. *Forensic Science International, 275*, 234-241. doi:10.1016/j.forsciint.2017.03.021

INTCF. (2019). *Hallazgos Toxicológicos en Victimas Mortales de Accidente de Trafico.* Instituto Nacional de Toxicología y Ciencias Forenses (INTCF). Ministerio de Justicia .

INTCF. (2019). *Hallazgos Toxicológicos en Victimas Mortales de Accidente de Trafico 2019.* Madrid: Instituto Nacional de Toxicología y Ciencias Forenses. Ministerio de Justicia.

Irwin, C., Iudakhina, B., Desbrow, B., & McCartney, D. (2017). Effects of acute alcohol consumption on measures of simulated driving: A systematic review and meta-analysis. *Accident Analysis and Prevention, 102*, 248-266.

Janitzek, T. (2008). *Young Drivers and Recidivist Offenders .* Brussels: European Transport Safety Council.

Jongen, S., Vuurman, E., Ramaekers, J., & Vermeeren, A. (2016). The sensitivity of laboratory tests assessing driving related skills to dose-related impairment of alcohol: A literature review. *Accident Analysis and Prevention, 89*, 31-48.

Kartal Knol, A. (2015). *Het alcoholslotprogramma. Blazen in bestuur of straf?* Amsterdam.

Keall, M. D., Frith, W. J., & Patterson, J. D. (2004). The influence of alcohol, age and number of passengers on the night-time risk of driver fatal injury in New Zealand. *Accident Analysis & Prevention, 36*(1), 49-61.

Kervick, A. (2020, 09 08). Alcohol, Drugs and Driver Fatalities: Examining 2013-2017 coronial data. *NOTM Resaech seminar 2020*.

Kintz, P., Mathiaux, F., Villéger, P., & Gaulier, J.-m. (2015, July). Testing for drugs in exhaled breath collected with ExaBreath® in a drug dependence population: comparison with data obtained in urine after LC-MS/MS analyses. *Therapeutic Drug Monitoring, 38*(1).

Kintz, P., Mura, P., & Jamey, C. (2017). Detection of ∆9-tetrahydrocannabinol in exhaled breath after cannabis smoking and comparison with oral fluid. *Forensic Toxicol, 35*, 173–178. doi:10.1007/s11419-016-0333-x

Kiryakova, T., Goshev, M., Mileva, B., Nikolov, D., Christov, A., & Alexandrov, A. (2018, 01 01). TRAFFIC ACCIDENTS UNDER THE INFLUENCE OF PSYCHOACTIVE SUBSTANCES -A STATISTICAL STUDY. *Science & Research, 2*(2).

Kriikku, P., Wilhelm, L., Jenckel, S., Rintatalo, J., Hurme, J., Kramer, J., . . . Ojanperä, I. (2014, June). Comparison of breath-alcohol screening test results with venous blood alcohol concentration in suspected drunken drivers. *Comparative Study Forensic Sci Int, 239*, 57-69. doi:10.1016/j.forsciint.2014.03.019

Kuypers, K., Legrand, S.-A., & Ramaekers, J. (2012). A case-control study estimating accident risk for alcohol, medicines and illegal drugs. *PLoS One, 7*(8), e43496.

La Sécurité Routière. (2019, March 12). *https://www.securite-routiere.gouv.fr/*. Récupéré sur La Sécurité Routière: https://www.securite-routiere.gouv.fr/actualites/generalisation-du-dispositif-dinstallation-dun-ethylotest-anti-demarrage-comme-possible

Lacey, J., Brainard, K., & Snitow, S. (2010). *Drug Per Se Laws: A Review of Their Use in States.* Pacific Institute for Research and Evaluation. Washington, DC: NHTSA.

Lacey, J., Kelley-Baker, T., Berning, A., Romano, E., Ramirez, A., Yao, J., . . . Compton, R. (2016). *Drug and Alcohol Crash Risk: A Case-Control Study.* Washington, DC: National Highway Traffic Safety Administration.

Lane, S. (2004). Alcohol Effects on Human Risk Taking. *Psychopharmacology, vol 172*(no 1), 68-72.

Langel, K., Gjerde, H., Favretto, D., Lillsunde, P., Øiestad, E., Ferrara, S., & Verstraete, A. (2014, May). Comparison of drug concentrations between whole blood and oral fluid. *Drug Test Anal., 6*(5), 461-71. doi:10.1002/dta.1532

Leblud, J. (2017). *Driving Under the Influence: Legal and Illegal Drugs, European Road Safety Decision Support.* developed by the H2020 project SafetyCube. Consulté le 06 12, 2020, sur www.roadsafety-dss.eu

Leung, J. (2013). *Alcohol impairment project - Lowering Legal Adult Blood Alcohol Concentration (BAC), Cost Benefit Analysis.* Auckland, New Zealand: Safer Journeys.

Li, Z., Li, X., Zhao, X., & Zhang, Q. (2019). Effects of Different Alcohol Dosages on Steering Behavior in Curve Driving. *Human Factors, 61(1)*, 139–151.

Liakoni, E., Dempsey, D., Meyers, M., Murphy, N., Fiorentino, D., Havel, C., . . . Benowitz, N. (2018, Nov). Effect of γ-hydroxybutyrate (GHB) on driving as measured by a driving simulator. *Psychopharmacology (Berl), 235*(11), 3223-3232.

Lietuvos Respublikos susisiekimo ministerija. (2019, December 31). *News - Ministry of Transport and Communications*. Récupéré sur Ministry of Transport and Communications: https://sumin.lrv.lt/lt/naujienos/nuo-2020-metu-galimybe-anksciau-atgauti-vairuotojo-pazymejima

Lietuvos Respublikos susisiekimo ministerija. (2020). *Ministry of Transport and Communications*. Récupéré sur Government of Lithuania website: https://sumin.lrv.lt/lt/naujienos/nuo-2020-metu-galimybe-anksciau-atgauti-vairuotojo-pazymejima

Löytty, M., & TRAFI. (2016). Feedback and analysis of Finnish legislation and interlock. *ETSC Safe & Sober: Alcohol Interlocks: towards a European approach for the fight against drink-driving?* Ljubljana: ETSC.

Macaluso, G., Theofilatos, A., Botteghi, G., & Ziakopoulos, A. (2017). *Law and enforcement: Random and selective breath tests.* European Road Safety Decision Support System, developed by the H2020 project SafetyCube. Consulté le 10 01, 2020, sur www.roadsafetydss.eu

MADD. (2019). *REPORT TO THE NATION 2019. CAMPAIGN TO ELIMINATE DRUNK DRIVING.* Irving, Texas: MADD National Office.

Mäkinen, T., Zaidel, D., Andersson, G., Biecheler-Fretel, M., Christ, R., Cauzard, J., . . . Vaa, T. (2003). *raffic enforcement in Europe: effects, measures, needs and future.* Espoo, Finlands: VTT.

Marillier, M., & Verstraete, A. (2019, May/June). Driving under the influence of drugs. *WIREs Forensic Science, 1*(3), e1326. doi:https://doi.org/10.1002/wfs2.1326

Martin, J.-L., Gadegbeku, B., Wu, D., Viallon, V., & Laumon, B. (2017). Cannabis, alcohol and fatal road accidents. *PLoS ONE, 12*(11), e0187320. doi:doi.org/10.1371/journal.pone.0187320

Martin, T., Solbeck, P., Mayers, D., Langille, R., Buczek, Y., & Pelletier, M. (2013). A Review of Alcohol-Impaired Driving: The Role of Blood Alcohol Concentration And Complexity of the Driving Task. *Journal of Forensic Sciences, 58 (5)* , 1238-1250.

Mercier Guyon, C. (2020). Drink driving and Interlock. *Safe and Sober Webinar, 7 December 2020.* ETSC.

Michon, J. A. (1985). A critical view of driver behavior models. What do we know, what should. Dans L. E. (Eds.), *Human behavior and traffic safety* (pp. 485-525). New York: Plenum press.

Miller, G., van Wagoner, R., Bruno , B., Husk, J., Fedoruk, M., & Eichner, D. (2019, Nov 30). nvestigating oral fluid and exhaled breath as alternative matrices for anti-doping testing: Analysis of 521 matched samples. *J Pharm Biomed Anal.*, 176:112810. doi:10.1016/j.jpba.2019.112810

Minist`ere de la Mobilité et des Traveaux public, L. (2020). *Bilan des accidents de la route 2019.* Luxembourg: Minist`ere de la Mobilité et des Traveaux public, Luxembourg. Récupéré sur www.mmtp.gouvernement.lu

Minister van Justitie en Veiligheid and Minister van Infrastructuur en Waterstaat. (2018, March 7). BRIEF VAN DE MINISTERS VAN JUSTITIE EN VEILIGHEID EN VAN INFRASTRUCTUUR EN WATERSTAAT Aan de Voorzitter van de Tweede Kamer der Staten-Generaal . *Tweede Kamer, vergaderjaar 2017–2018, 29 398, nr. 588*.

Ministry of Infrastructure and Environment. (2013). *Evaluatie alcoholslotprogramma : tussentijdse resultaten en aanbevelingen : hoofdrapport.* Rijkswaterstaat. The Hague: Ministry of Infrastructure and Environment. Récupéré sur https://puc.overheid.nl/rijkswaterstaat/doc/PUC_144840_31/

Ministry of Transport, New Zealand. (2019). *Discussion Document Enhanced Drug Impaired Driver Testing.* Wellington: Ministry of Transport, New Zealand.

Ministry of Transport, New Zealand. (2020). *Regulatory Impact Assessment: Updated Impact Statement: Enhanced drug driver testing.* Auckland: Ministry of Transport, New Zealand.

Miyata, A., Iwamoto, K., Kawano, N., Kohmura, K., Yamamoto, M., Aleksic, B., . . . Ozaki , N. (2015, Jun). he effects of acute treatment with ramelteon, triazolam, and placebo on driving performance, cognitive function, and equilibrium function in healthy volunteers. *232*(12), 2127-37.

Moskowitz, H. et al. (2000). *A Review of the Literature on the Effects of Low Doses of Alcohol on Driving-Related Skills.* Washington, DC: National Highway Traffic Safety Administration.

National Transport Commission. (2018). *Towards a national approach to drug driving.* Melbourne: National Transport Commission.

newmobility.news Luc Joris. (2020, June 26). *newmobility.news*. Récupéré sur newmobility.news: https://newmobility.news/2020/06/26/spectacular-rise-in-court-imposed-alcolocks/

NHTSA. (2010). *TRAFFIC SAFETY FACTS Research Note: Distracted Driving.* US Department of Transportation, NHTSA National Center for Statistics and Analysis. Washington, DC: NHTSA .

NHTSA. (2019). *Driver Alcohol Detection System For Safety (DADSS) – A Status Update, Report to Congress.* Driver Alcohol Detection System for Safety (DADDS). Washington DC: National Highway Traffic Safety Administration, NHTSA.

NHTSA, IACP, TSI. (2018). *The National Highway Transportation Safety Administration's 2018 DWI Detection and Standardized Field Sobriety Testing Instructor Guide.* National Highway Transportation Safety Administration, International Association of Chiefs, Transport Safety Institute. Washington DC: National Highway Transportation Safety Administration.

Nieuwkamp, R., Martensen, H., & Meesmann, U. (2017). *lcohol interlock, European Road Safety Decision Support System, developed by the H2020 project SafetyCube.* Récupéré sur www.roadsafety-dss.eu

Nordal, K., Øiestad, E., Enger, A., & Christophersen, A. (2015). Detection Times of Diazepam, Clonazepam, and Alprazolam in Oral Fluid Collected From Patients Admitted to Detoxification, After High and Repeated Drug Intake. *Ther Drug Monit, 37*, 451-60.

ONISR. (2020). *La sécurité routière en France. Bilan de l'accidentalité de l'année 2019.* Paris: Observatoire national interministériel de la sécurité routière .

Papalimperi, A. H., Athanaselis, S., Mina, A., Papoutsis, I., Spiliopoulou, C., & Papadodima, S. (2019). Incidence of fatalities of road traffic accidents associated with alcohol consumption and the use of psychoactive drugs: A 7-year survey (2011-2017). *Experimental and therapeutic medicine, 18:* , 2299-2306.

Peck, R. C., Gebers, M. A., Voas, R. B., & Romano, E. (2008). The relationship between blood alcohol concentration (BAC), age, and crash risk. *Journal of Safety Research, 39*(3), 311-319.

Pehrsson, A., Blencowe, T., Vimpari, K., Langel, K., Engblom, C., & Lillsunde, P. (2011, May). An evaluation of on-site oral fluid drug screening devices DrugWipe 5+ and Rapid STAT using oral fluid for confirmation analysis. *J Anal Toxicol, 35*(4), 211-218.

Porath, A., & Beirness, D. (2019). Predicting categories of drugs used by suspected drug-impaired drivers using the Drug Evaluation and Classification Program tests. *Traffic Inj Prev., 20*(3), 255-263. doi:10.1080/15389588.2018.1562178

Porath-Waller, A., & Beirness, D. (2014). An examination of the validity of the Standardized Field Sobriety Test in detecting drug impairment using data from the Drug Evaluation and Classification Program. *Traffic Injury Prevention, 15*, 125-131.

Reed, N. N., Hynd, D., Tress, M. M., Edwards, M., Stevens, A., McCarthy, M., . . . Visvikis, C. (2015). *Benefit and feasibility of a range of new technologies and unregulated measures in the field of vehicle occupant safety and protection of vulnerable road users.* European Commission, Directorate-General for Internal Market, Industry, Entrepreneurship and SMEs and Transport Research Laboratory (TRL). Luxembourg: Publications Office of the European Union. doi:10.2769/497485

Regan, M., Hallett, C., & Gordon, C. (2011, September). Driver distraction and driver inattention: Definition, relationship and taxonomy. *Accident; analysis and prevention, 43*(5), 1771-17781. doi:10.1016/j.aap.2011.04.008

Risk Solutions. (2017). *Evaluation of the new drug driving legislation, one year after its introduction.* Warrington: Risk Solutions.

Road Safety Authority. (2020). *Road deaths and alcohol: 2013-2017.* Dublin: Road Safety Authority.

Rogeberg, O. (2019). A meta-analysis of the crash risk of cannabis-positive drivers in culpability studies—Avoiding interpretational bias. *Accident Analysis and Prevention, 123*, 69-78.

Roiu, I., Birngruber, C., Spencer, V., Wollersen, H., Dettmeyer, R., & Verhoff, M. (2013, Oct 10). A comparison of breath- and blood-alcohol test results from real-life policing situations: a one-year study of data from the

Central Hessian police district in Germany. *Forensic Sci Int, 232*(1-3), 125-130. doi:10.1016/j.forsciint.2013.07.002
Rosenberg, E. (2015). *A Study of the Accuracy and Precision of Selected Breath Alcohol Measurement Devices ('Breathalyzers').* Vienna: TU Vienna.
Roth, T., Eklov, S., Drake, C., & Verster, J. (2014). Meta-analysis of on-the-road experimental studies of hypnotics: effects of time after intake, dose, and half-life. *Traffic Inj Prev. , 15*(5), 439-45. doi:10.1080/15389588.2013.830211.
Rush, C., Baker, R., & Wright, K. (1999). Acute physiological and behavioral effects of oral. *Drug and Alcohol Dependence, 55*, 1-12.
SafetyNet. (2009). *Novice Drivers.* Récupéré sur http://www.yasa.org/upload/uploadedfiles/novice_drivers.pdf
Scherer, J., Bohrer Schuch, J., Rabelo-da-Ponte, F. D., Silvestrin, R., Ornell, R., Vieira Sousa, T. R., . . . Pechansky, F. (2020, December). Analytical reliability of four oral fluid point-of-collection testing devices for drug detection in drivers. *Forensic Science International, 1*, 110434. doi:10.1016/j.forsciint.2020.110434
Schnabel, E. (2012, 03 19). Alcohol and driving-related performance - A comprehensive meta-analysis focusing the significance of the non-significant.
Significant. (2015). *Ex ante impactanalyse overheveling Alcoholslotprogramma naar het strafrecht.* Barneveld: Significant.
Silverans, P. e. (2006). *Alcolock Implementation in the European Union.* Brussels: European Commission.
Simmons, S. (2020). *The effects of cannabis and alcohol on driving performance and driver behaviour: a systematic review and meta-analysis (Unpublished doctoral thesis).* Calcary, A.B.: University of Calcary. Récupéré sur http://hdl.handle.net/1880/112405
Spit, W., Houwing, S., Hagenzieker, M., Mathijssen, R., & Modijefsky, M. (2014). *Study on the prevention of drink-driving by the use of alcohol interlock devices.* Rotterdam, Den Haag: Ecorys, SWOV.
Staner, L., Ertlé, S., Boeijinga, P., Rinaudo, G., Arnal, M., Muzet, A., & Luthringer, R. (2005). Next-day residual effects of hypnotics in DSM-IV primary insomnia: a driving simulator study with simultaneous electroencephalogram monitoring. *Psychopharmacology (Berl), 181*(4), 790-8.
Strand, M., Fjeld, B., Marianne, A., & Morland, J. (2011). *Psychomotor relevant performance: 1. After single dose administration of opioids, narcoanalgesics and hallucinogens to drug naïve subjects, 2. In patients treated chronically with morphine or methadone/buprenorphine.* Bergisch-Gladbach: Bundesanstalt für Strassenwesen.
Stuster, J. (2006). Validation of the standardized field sobriety test battery at 0.08% blood alcohol concentration. *Hum Factors, 48*(3), 608-14. doi:10.1518/001872006778606895
Stuster, J., & Burns, M. (1998). *Validation of the Standardized Field Sobriety Test Battery at BACs Below 0.10 Percent.* Anacapa Sciences, Inc. Washington: National Highway Traffic Safety Administration . Récupéré sur http://www.drugdetection.net/nhtsa%20docs/burns%20validation%20of%20sfst%20at%20bac%20below%200.10%20percent%20san%20diego.pdf
SWOV. (2009). *Geschat effect op de verkeersveiligheid van een alcoholslotprogramma (ASP) en de kosten-batenverhouding ervan. Advies aan het Directoraat-Generaal Mobiliteit van het Ministerie van Verkeer en Waterstaat.* Leidschendam: Stichting Wetenschappelijk Onderzoek Verkeersveiligheid SWOV.
SWOV. (2016). *18- to 24-year-olds: young drivers. SWOV Fact sheet.* The Hague: SWOV.
SWOV. (2016, March). *Alcoholslot. SWOV-Factsheet.* Den Haag: SWOV.
SWOV. (2018, June). SWOV Fact sheet. *Driving under the influence of alcohol*. The Hague, The Netherlands: SWOV.
TISPOL. (2010). *Enforcing drink and drug driving within Europe.* TISPOL Alcohol & Drug Driving Working Group. TISPOL European Traffic Police Network.
Toennes, S., Steinmeyer, S., Maurer, H., Moeller, M., & Kauert, G. (2005). *J Anal Toxicol, 29*(1), 22-27.
Traffic Injury Research Foundation (TIRF). (2009). Alcohol Interlocks: Planning for Success. *Proceedings of the 9th International Alcohol Interlock Symposium, Tällberg, Sweden 2008.* Ottawa, ON: Traffic Injury Research Foundation.
Traffic Injury Research Foundation. (2014). ALCOHOL INTERLOCKS: OPPORTUNITIES TO IMPROVE TRAFFIC MANAGEMENT. *PROCEEDINGS OF THE 13TH INTERNATIONAL ALCOHOL INTERLOCK SYMPOSIUM, Helsinki, Finland, September 9-11, 2012.* Ottawa, ON: Traffic Injury Research Foundation.
Trimbos & WODC. (2019). *Nationale Drug Monitor. Jaarbericht 2019. .* Trimbos-instituut, Utrecht & WODC, Den Haag.
Trotter, G., Skinner, R., & Rooney, B. (2021, Jan). Are the Preliminary Impairment Tests used by UK police fit for purpose? *Medicine, Science, and the Law, 61*(1), 4-5. doi:10.1177/0025802420966402
TRT Trasporti e Territorio Srl. (2014). *Technical development and deployment of alcohol interlocks in road safety policy.* Study for European Parliament, European Parliament, DIRECTORATE-GENERAL FOR

INTERNAL POLICIES, POLICY DEPARTMENT B: STRUCTURAL AND COHESION POLICIES, TRANSPORT AND TOURISM, Brussels. doi:10.2861/6005

Tyszka, T., Macko, A., & Stańczak, M. (2015). Alcohol reduces aversion to ambiguity. *Frontiers in Psychology, 5:1578*. doi:10.3389/fpsyg.2014.01578

UDV / GDV. (2020). *Alkohol-Interlock in Deutschland.* Berlin: Gesamtverband der Deutschen Versicherungswirtschaft e. V.

Valen, A., Bogstrand, S. T., Vinden, V., Frost , J., Larsson, M., Holtan, A., & Gjerde, H. (2019, Oct). Driver-related risk factors of fatal road traffic crashes associated with alcohol or drug impairment. *Accid Anal Prev.*(131), 191-199.

Van der Sluiszen, N. N., Vermeere, A., van Dijken, J. H., van de Loo, A. J., Veldstra, J. L., Verster, J. C., . . . Ramaekers, J. G. (2021, Jan). Driving performance and neurocognitive skills of long-term users of sedating antidepressants. *Hum Psychopharmacol, 36*(1), 1-12.

Van Dijken, J., Veldstra, J., Van de Loo, A., Verster, J., Van der Sluiszen, N., Vermeeren, A., . . . De Waard, D. (2020). The influence of alcohol (0.5‰) on the control and manoeuvring level of driving behaviour, finding measures to assess driving impairment: A simulator study,. *Transportation Research Part F: Traffic Psychology and Behaviour,*, 119-127,.

Vejdirektoratet. (2020). *Dødsulykker Årsrapport 2019.* Kopenhagen: Vejdirektoratet.

Vermeeren, A., Leufkens, T., & Verster, J. (2009). Effects of anxiolytics on driving. Dans P.-P. S. Verster J.C., *Drugs, Driving and Traffic Safety.* Basel: Birkhäuser.

Verstraete, A., & Legrand, S.-A. (2014). *Drug use, impaired driving and traffic accidents - Second edition.* Lisbon: European Monitoring Centre for Drugs and Drug Addiction (EMCDDA).

VIAS. (2018, February 9). Het alcoholslot vermindert de kans op recidive met ten minste 75%. Récupéré sur https://www.vias.be/nl/newsroom/het-alcoholslot-vermindert-de-kans-op-recidive-met-ten-minste-75/#:~:text=Het%20alcoholslot%20vermindert%20de%20kans%20op%20recidive%20met%20ten%20minste%2075%25,-Home&text=De%20Kamer%20heeft%20gisteren%20een,invloed%20van%

Vindenes, V., Jordbru, D., Knapskog, A.-B., Kvan , E., Mathisrud, G., Slørdal, L., & Mørland, J. (2011). Impairment based legislative limits for driving under the influence of non-alcohol drugs in Norway. *Forensic Science International*. doi:10.1016/j.forsciint.2011.11.004

Vindenes, V., Yttredal, B., Oeistad, E., Waal, H., Bernard, J., Morland, J., & Christophersen, A. (2011). Oral fluid is a viable alternative for monitoring drug abuse: detection of drugs in oral fluid by liquid chromatography-tandem mass spectrometry and comparison to the results from urine samples from patients treated with Methadone or Buprenorphine. *J Anal Toxicol, 35*, 32-39.

Voas, R., Tippetts, S., Marques, P. R., & Beirness, D. J. (2000). The Alberta Interlock Program: The Evaluation of a Province-Wide Program on DUI Recidivism. *Addiction, 94*(12), 1849-59. doi:10.1046/j.1360-0443.1999.9412184910.x

VTI. (2016). *Utvärdering av alkolås efter rattfylleri. Enkätstudie.* Linköping: VTI. Récupéré sur https://trimis.ec.europa.eu/project/evaluation-swedish-alcohol-interlock-program-drink-driving-offenders#tab-docs

Walsh JM, C. D. (2007, Jan-Feb). Evaluation of ten oral fluid point-of-collection drug-testing devices. *J Anal Toxicol., 31*(1), 44-54.

White, M. (2017). *Cannabis and road crashes: A close look at the best epidemiological evidence.* University of Adelaide, School of Psychology. Adelaide: University of Adelaide.

Wille, S., Raes, E., Lillsunde, P., Gunnar, T., Laloup, M., Samyn, N., . . . Verstraete, A. (2009, Aug). Relationship between oral fluid and blood concentrations of drugs of abuse in drivers suspected of driving under the influence of drugs. *Ther Drug Monit., 31*(4), 511-9. doi:10.1097/FTD.0b013e3181ae46ea

Wille, S., Richeval, C., Nachon-Phanithavong, M., Gaulier, J.-M., Di Fazio, V., Humbert, L., . . . Allorge, D. (2017, June). Prevalence of New Psychoactive Substances and Prescription Drugs in the Belgian Driving under the Influence of Drugs Population. *Drug Testing and Analysis, 10*(3). doi:10.1002/dta.2232

Willis, C., Lybrand, S., & Bellamy, N. (2004). lcohol ignition interlock programmes for reducing drink driving recidivism. *ochrane Database of Systematic Reviews*(3). doi:10.1002/14651858.CD004168.pub2

Wolff, K. (2013). *Driving under the influence of drugs: report from the expert panel on drug.* Consulté le 05 07, 2020, sur https://www.gov.uk/government/publications/driving-under-the-influence-of-drugs--2

Wolff, K., Agombar, R., Clatworthy, A., Cowan, D., Forrest, R., Osselton, D., . . . Johnston, A. (2017). *Expert Panel Review of alternative biological matrices for use as an evidential sample for drug driving.* RM4825 SB-2988.

Xiong, C., Xie, M., & Wang, L. (2012). Driver Fatigue Detection Based on AdaBoost. Dans D. Jin, & S. Lin (Éd.), *Advances in Future Computer and Control Systems. Advances in Intelligent and Soft Computing. 159*, pp. 13-17. Berlin, Heidelberg.: Springer. doi:https://doi.org/10.1007/978-3-642-29387-0_3

Zaal, D. (1994). *Traffic Law Enforcement: A review of the literature. .* Clayton, Victoria.: Monash University, Accident Research Centre.

Annex 1: Stakeholder participation

The findings of the study have been presented to an audience of stakeholders in an online webinar on 5 February 2021. In total 90 stakeholders registered for the webinar, representing more than 50 organisations. The organisations attending the webinar have been listed in the table below.

Table A1.1 Stakeholders consulted during the stakeholder webinar

Nr	Stakeholder	Country
1	Automobile Club D'Italia (ACI)	Italy
2	Alås AS	Norway
3	ALCOHOL COUNTERMEASURE SYSTEMS CORP	Canada
4	Alcolock france	France
5	ANT Koordinator	Denmark
6	Austrian Road Safety Board (KfV)	Austria
7	Autoridade Nacional de Segurança Rodoviária	Portugal
8	BFU, Swiss Council For Accident Prevention	Switzerland
9	CENELEC	Europe
10	Centre for Transport Studies	United Kingdom
11	Danish Road Safety Council	Denmark
12	Department of Transport, Road Safety Division	Ireland
13	German Road Safety Council (DVR)	Germany
14	European Commission - DG MOVE	Europe
15	Direccion General de Trafico	Spain
16	Dräger	Sweden, Norway, United Kingdom, Germany
17	European Transport Safety Council (ETSC)	Europe
18	European Automobile Manufacturers Association (ACEA)	Europe
19	European Monitoring Centre for Drugs and Drug Addiction (EMCDDA)	Europe
20	Federal Public Service Mobility and Transport (FOD)	Belgium
21	European Fed. of Road Traffic Victims (FEVR)	Europe
22	Hellenic Institute of Transport (HIT)	Greece
23	Instituto Nacional de Medicina Legal	Portugal
24	International Automobile Federation (FIA)	Europe
25	ITS Poland	Poland
26	ITS Poland	Poland
27	KG Knutsson AB	Sweden
28	Finnish Road Safety Council (liikenneturva)	Finland
29	Malta Road Safety Council	Malta
30	Malta Transport Authority	Malta
31	MA - Rusfri Trafikk	Norway
32	Mercedes-Benz AG	Germany
33	Ministério da Administração Interna	Portugal
34	Ministry of Infrastructure and the Environment	Netherlands
35	Ministry of Infrastructure of the Republic of Slovenia	Slovenia
36	Ministry of Infrastructure, roads and road traffic division	Slovenia
37	Ministry of Infrastructures and Transports	Italy
38	Ministry of Sustainable Development and Infrastructure (Department of Transport)	Luxemburg

Nr	Stakeholder	Country
39	National Police - Servizio Polizia Stradale	Italy
40	National Technical University of Athens (NTUA)	Greece
41	National Technical University of Athens (NTUA)	Greece
42	Observatoire National Interministériel pour la Sécurité Routière	France
43	Prevenção Rodoviária Portuguesa	Portugal
44	Road Safety Expert	Cyprus
45	Secretariat of National Road Safety Council	Poland
46	Serviço de Intervenção nos Comportamentos Aditivos e nas Dependências (SICAD)	Portugal
47	Slovenian Traffic Safety Agency	Slovenia
48	Swedish Road and Transport Research Institute (VTI)	Sweden
49	Swedish Transport Administration Trafikverket	Sweden
50	TÜV Technische Überwachung Hessen GmbH	Germany
51	University of Zilina	Slovakia
52	VdTÜV Verband der TÜV e.V.	Germany
53	Securetec Detektions Systems	Europe
54	ISTAT Directorate for Social Statistics and Welfare	Italy

In addition to the webinar, the study has benefited from the contribution of a panel of national experts. These experts have been approached for the provision of statistics and other information included in this study. The table below provides an overview of the organisations which have been consulted for information.

Table A1.2 Panel of national experts consulted during the study on national data

Country	Organisation
Austria	Austrian Road Safety Board KfV
Belgium	Vias institute
Bulgaria	Ministry of Interior
Croatia	Ministry of the Interior, Police Directorate, Road Safety Service
Cyprus	Road Safety Expert
Czechia	CDV
Denmark	Danish Road Safety Council
Estonia	Estonian Road Administration
Finland	Finnish Crash Data Institute (OTI),Finnish Motor Insurers' Centre
Germany	Deutscher Verkehrssicherheitsrat (DVR) - German Road Safety Council
Greece	National Technical University of Athens
Hungary	KTI
Ireland	Road Safety Authority
	An Garda Síochána Analysis Service
Italy	ACI - Area Professionale Statistica
	ISTAT Directorate for Social Statistics and Welfare
	National Police - Ministry of Interiors
	General Directorate for Road Safety - Ministry of Infrastructures and Transports
Latvia	Road Traffic Directorate
Lithuania	Ministry of Transport and Communications of the Republic of Lithuania - Road and Air Transport Policy Group
Netherlands	SWOV - Instituut voor Wetenschappelijk Onderzoek Verkeersveiligheid

Country	Organisation
Poland	National Road Safety Council
Portugal	LNEC
	Prevenção Rodoviária Portuguesa
Romania	Romanian Ministry of Internal Affairs, General Inspectorate of the Romanian Police, Traffic Police Directorate
Slovakia	MINISTERSTVO VNÚTRA SLOVENSKEJ REPUBLIKY, PREZÍDIUM POLICAJNÉHO ZBORU, odbor dopravnej polície
Slovenia	Slovenian Traffic Safety Agency
Spain	Direccion General de Trafico
Sweden	VTI
Switzerland	BFU
UK	Road Safety Statistics, Department for Transport

Annex 2: Alcohol and driving

BAC-limits in European countries in grams per litre.

	Standard	Commercial drivers	Novice drivers
Austria	0.5	0.1	0.1
Belgium	0.5	0.2	0.5
Bulgaria	0.5	0.5	0.5
Croatia	0.5	0.0	0.0
Cyprus	0.5	0.2	0.2
Czech Republic	0.0	0.0	0.0
Denmark	0.5	0.5	0.5
Estonia	0.2	0.2	0.2
Finland	0.5	0.5	0.5
France	0.5	0.5 (0.2 bus drivers)	0.2
Germany	0.5	0.0	0.0
Greece	0.5	0.2	0.2
Hungary	0.0	0.0	0.0
Ireland	0.5	0.2	0.2
Italy	0.5	0.0	0.0
Latvia	0.5	0.5	0.2
Lithuania	0.4	0.0	0.0
Luxembourg	0.5	0.2	0.2
Malta	0.5	0.2 (0.0 bus drivers)	0.2
Netherlands	0.5	0.5	0.2
Norway	0.2	0.2	0.2
Poland	0.2	0.2	0.2
Portugal	0.5	0.2	0.2
Romania	0.0	0.0	0.0
Slovakia	0.0	0.0	0.0
Slovenia	0.5	0.0	0.0
Spain	0.5	0.3	0.3
Sweden	0.2	0.2	0.2
UK **	0.8	0.8	0.8
Switzerland	0.5	0.1	0.1

** Scotland 0,5 for all groups.

Definition of road deaths attributed to alcohol use in individual countries

Country	Definition
Austria	Any death occurring as a result of road accident in which any active participant was found with blood alcohol level above 0,5 g/L However killed and unconscious road users are not tested for alcohol unless the prosecutor requires it.
Belgium	Any death occurring as a result of road accident in which any active participant was found with blood alcohol level above 0,5 g/L Alcohol tests are rarely done for killed and seriously injured people. Even slightly injured and unhurt people are not systematically tested for alcohol. Moreover, the police database only contains breath test results, results of blood tests are unknown in the Police database.
Bulgaria	Deaths occurring as a result of a road traffic accident in which the blamed for the traffic accident was found with blood alcohol level above 0.5 g/L.
Croatia	Any death occurring as a result of road accident in which any active participant was found with blood alcohol level above 0,5 g/L. All road collision participants whose state allows it are breath tested and if the test is positive, blood and urine shall be taken to confirm the level of alcohol. If a road user was killed, blood and urine samples are taken during autopsy. When results come out, data are included in police reports.

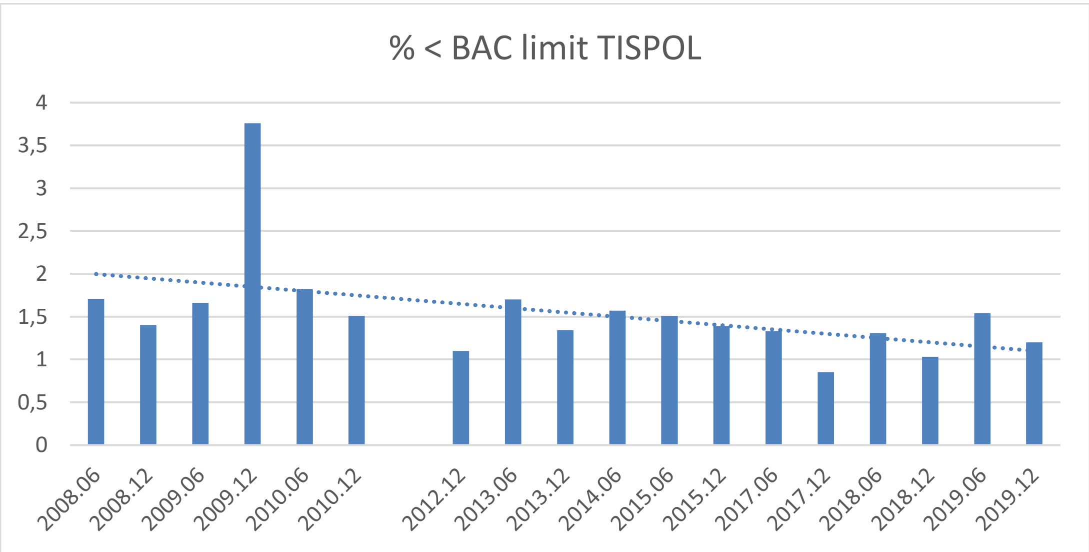
Country	Definition
Cyprus	Any death occurring as a result of road accident in which any active participant was found with blood alcohol level above 0,5 g/L Pedestrians who are alive at the scene of the collision are not tested.
Czechia	Any death occurring as a result of road accident in which the guilty participant was found with blood alcohol level above 0,0 g/L Killed and unconscious road users are not tested for alcohol, unless required by the prosecutor.
Denmark	Any death occurring as a result of road accident in which any active participant was found with blood alcohol level above 0,5 g/L However only suspected alive participants are tested.
Estonia	Deaths occurring as a result of a road collision in which at least one motor vehicle driver was found with blood alcohol level above 0,2 g/L. All active participants of a serious road collision are tested either at hospital (blood test) or at the scene (not injured participant) by a breath test. Fatally injured are tested at the autopsy
Finland	Person killed in an accident where the driver of the motor vehicle has been proven (by a blood test reading of at least 0.5 per mille or a breathalyser test result of exhalation containing at least 0.22 milligrams of alcohol per one litre of air) or is suspected on strong grounds to have been under the influence of alcohol at the time of the accident.
France	Any death occurring as a result of road accident in which any active participant was found with blood alcohol level above 0,5 g/L
Germany	Any death occurring as a result of road accident in which any active participant was found with blood alcohol level above 0,5 g/L Only alive suspected drivers are tested. In case of a single vehicle collision when nobody else has been injured, the alcohol test will not be done.
Greece	Deaths in collisions where a driver was found with blood alcohol level above 0,5 g/L In practice, however, the Police is not systematically testing drivers for alcohol.
Hungary	If at least one person dies as a result of an accident involving a concentration of 0.5 g/l of alcohol in the driver's body. After an accident drivers are always tested for alcohol, pedestrians and cyclists only in special cases.
Ireland	Any death occurring as a result of road accident in which any active participant (except pedestrian) was found with blood alcohol level above 0,5 g/L
Italy	Any death occurring as a result of road accident in which any active participant was found with blood alcohol level above 0,5 g/L In practice, it seems however that deaths are often attributed to drink driving only when alcohol is considered by the Police officer to be the unique contributory factor of the fatal accident. Also drivers or other killed persons on the spot might not be tested.
Latvia	Deaths occurring as a result of road accident in which at least one driver (excluding moped riders and cyclists) was found with blood alcohol level above 0,5 g/L (0.2 g/L for novice drivers). All active participants are tested.
Lithuania	Deaths occurring as a result of a road collision caused by drank driver (alcohol level above 0,4 g/L). All active participants are tested.
Luxembourg	From 2010 any death occurring as a result of road accident in which any active participant was found with blood alcohol level above 0,5 g/L. From 2001 to 2009: killed persons of accidents where the police suspected the presence of alcohol.
Malta	Statistics regarding alcohol-related road deaths are not published by the National Statistical office. The cause of death is established by the health authorities following a post-mortem examination (including toxicology analysis) as part of a magisterial inquiry. However, these data are collected to establish liability rather than for statistical and analysis purposes and very often are not recorded in the police database.
The Netherlands	Since 2011, the Police no longer provides data on alcohol-related road deaths. Post-mortem alcohol tests are not allowed, unless a district attorney explicitly requires it.
Poland	Any death occurring as a result of road accident in which any active participant was found with blood alcohol level above 0,2 g/L
Portugal	Any death occurring as a result of road accident in which any active participant was found with blood alcohol level above 0,5 g/L
Romania	Killed people tested for alcohol. Testing might only occur when the Police suspects the presence of alcohol (legal limit is 0.0 g/l).
Slovakia	
Slovenia	

Country	Definition
Spain	Up to 2015: Killed drivers who tested positive (>0.3 g/l) in post-mortem blood alcohol tests. From 2016: Any death occurring as a result of a road collision in which an active driver or cyclist was found with a BAC above 0,5 g/L (0,3g/L for professional and novice drivers). Killed drivers and cyclists are always tested during the mandatory autopsy conducted by coroners. From 2016, most of these post-mortem tests are communicated to the National Register. Tests conducted in hospitals are not reported to the National Register for Road Traffic Accident Victims. According to current law, police officers must conduct an alcohol breath test as long as the driver's condition allows it, i.e. the driver is not injured, sustains minor injuries or is hospitalised but can be submitted to a breath test. Tests must be conducted and recorded in the National Register for Road Traffic Accident Victims, but, in practice, this is not always the case. When the tests are conducted at hospitals, the data are not communicated to the police due to legal constraints and, therefore, are not captured in the national register.
Sweden	Killed car drivers who tested positive (BAC > 0.2 g/L) in post-mortem blood alcohol tests. (BUT: The Transport Administration compile statistics of killed car drivers who tested positive for alcohol.
Norway	Any death occurring in collisions involving a road user under the influence of alcohol (0,2 g/L). Tests are done for surviving participants. Until recently, killed road users were tested upon request only. The Autopsy Act was eventually revised in 2020 requiring legal or medical autopsy of all road users killed in RTCs (MHCS 2020).
Switzerland	Any death occurring as a result of road accident in which any active participant was found with blood alcohol level above 0,5 g/L In most cantons, tests are done systematically. In some cantons, tests are done according to the severity of the collision, the suspicion of alcohol consumption, the type of road user, the time when the collision occurred, etc.
United Kingdom	A reported incident on a public road in which someone is killed or injured, where at least one of the motor vehicle drivers or riders involved: (a) was found with blood alcohol level above 0,8 g/L (35 micrograms of alcohol per 100ml of breath in England and Wales) or 0,5 g/L (22 micrograms in Scotland), (b) died, within 12 hours of the accident, and was subsequently found to have more than 0,8 g/L (in England and Wales) or 0,5 g/L (in Scotland), (c) refused to give a breath test specimen when requested by the police (other than when incapable of doing so for medical reasons).

Source: Calinescu, T. (2018); additional information from experts collected by ITS/ECORYS.

Percentage of drivers over the legal BAC-limit in EU countries 2008-2019

Figure A2.1 Percentage of drivers over the legal BAC limit detected during TISPOL checks 2008-2019



Source: Tispol

Table A2.1 Percentage of tested drivers with alcohol concentration level above the legal limit in 12 European countries

	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
Ireland	0.2%	0.2%	0.2%	0.2%	0.2%	0.2%	0.3%	0.5%	0.5%	0.5%
Poland	4.9%	3.2%	2.3%	1.8%	0.9%	0.7%	0.6%	0.6%	0.6%	0.7%
Estonia	5.4%	-	1.7%	1.2%	1.0%	0.9%	0.8%	0.9%	0.8%	0.7%
Hungary	3.6%	2.9%	2.1%	1.9%	1.9%	1.5%	1.5%	1.2%	1.0%	0.9%
Sweden	0.8%	0.8%	0.8%	0.8%	0.8%	1.0%	1.2%	1.1%	1.0%	0.9%
Finland	0.5%	1.1%	1.3%	1.5%	0.9%	1.0%	0.7%	0.7%	0.8%	1.0%
Spain	1.8%	1.8%	1.7%	1.6%	1.5%	1.4%	1.5%	1.4%	1.3%	1.2%
Austria	3.7%	2.8%	2.4%	2.0%	1.8%	1.6%	1.7%	1.6%	1.6%	1.7%
Slovenia	3.8%	3.4%	3.1%	2.9%	2.8%	2.8%	3.0%	3.1%	3.3%	2.1%
Italy	4.7%	4.5%	3.9%	3.7%	3.6%	3.6%	3.7%	3.5%	3.3%	3.1%
Cyprus	3.3%	3.1%	2.8%	2.6%	2.7%	2.8%	2.8%	2.9%	3.0%	3.2%
United Kingdom	5.3%	4.9%	7.4%	7.2%	6.7%	7.0%	7.9%	7.2%	9.0%	8.9%
Mean (12)	3.2%	2.4%	2.5%	2.3%	2.1%	2.0%	2.1%	2.1%	2.2%	2.1%

Source: project expert panel consultation

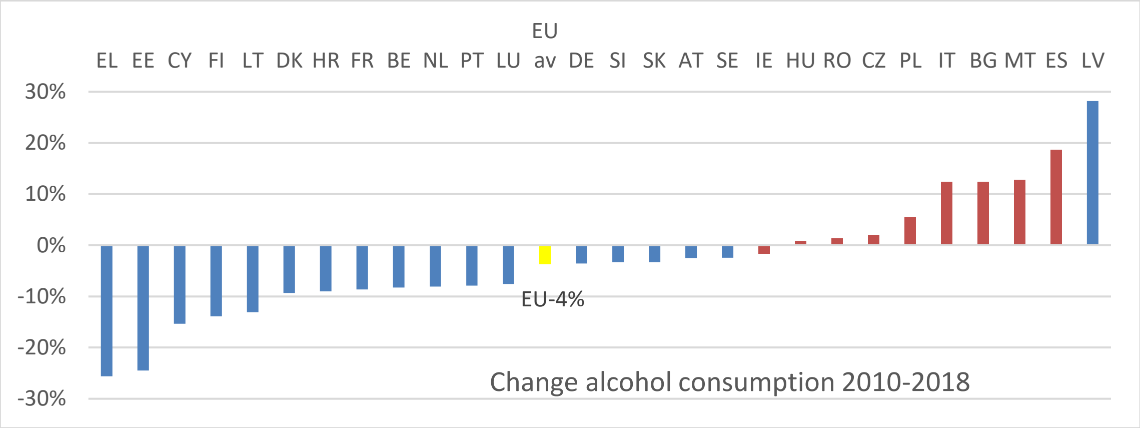
Table A2.2 Percentage of car drivers who admitted they had driven 1 hour after using drugs and after taking medication in the past 30 days by country

	Drive 1 hour after using drugs (other than medication)	Drive after taking medication that carries a warning that it may influence your driving ability
United Kingdom	7.5%	13.0%
Austria	7.3%	21.9%
Greece	7.2%	8.4%
Belgium	7.1%	18.1%
Ireland	6.8%	13.8%
France	6.3%	23.2%
Spain	5.9%	19.7%
The Netherlands	5.1%	14.9%
Sweden	4.7%	10.1%
Portugal	4.4%	13.2%
Switzerland	4.4%	16.2%
Italy	4.3%	12.6%
Denmark	4.3%	12.2%
Germany	3.7%	13.0%
Slovenia	3.5%	6.8%
Poland	2.9%	12.8%
Czechia	2.7%	11.5%
Hungary	2.2%	10.2%
Finland	1.7%	13.2%
Mean (19)	4.8%	13.9%

Source: ESRA 2, 2018.

Alcohol consumption in European countries 2010-2018

Figure A2.2 Change in alcohol consumption in European countries 2010-2018



Source: WHO

Annex 3: Drugs and driving

Regulation of drugs in road traffic in selected European countries

The following tables provide an overview of the rules on driving under influence of drugs in selected European countries. The information in the tables is obtained from the European Commission's *Going abroad website*[71] in combination with data from EMCDDA[72] .

Austria	
Legal basis	Road Traffic Act, Arts.5, 99 Driving Licence Act, Art. 26
Police power to stop / test:	Stop at random. Test with suspicion.
Oral fluid testing at roadside?	No
Evidentiary test	Blood, at hospital
Substances to which law applies	"Suchtgift"; generally drugs under UN61 and Schedules I+2 of UN71
Offence impairment level	Impairment
Blood drug limits ng/ml	No limits specified
Licence Suspension period	At least 4 weeks
Fine range	€800-3700
Prison	No

Belgium	
Legal basis	Law on traffic circulation, Arts.35, 37 bis Royal decree of 27 November 2015 concerning saliva and blood analysis
Police power to stop / test:	Stop at random. Test at random
Oral fluid testing at roadside?	Yes
Evidentiary test	Blood, at hospital
Substances to which law applies	(Art.37bis) 7 named substances (Art.35) Any
Offence impairment level	(Art.37bis) Impaired per se (Art.35) Impairment
Blood drug limits ng/ml	(Art.37bis) THC (cannabis) (≥1 ng/ml) Methylamphetamine(≥25 ng/ml) MDMA (ecstasy) (≥25 ng/ml) Amphetamine (≥25 ng/ml) Morphine or 6-acetylmorphine (≥10 ng/ml) Cocaine or benzoylecgonine (≥25 ng/ml)
Licence Suspension period	1 mth – 5 years
Fine range	€1000-10 000
Prison	No

[71] https://ec.europa.eu/transport/road_safety/going_abroad/search_en.htm

[72] https://www.emcdda.europa.eu/publications/topic-overviews/legal-approaches-to-drugs-and-driving/html_en

Bulgaria	
Legal basis	Art 165
Police power to stop / test:	Yes
Oral fluid testing at roadside?	Yes
Evidentiary test	Blood
Substances to which law applies	THC (cannabis) Methylamphetamine MDMA (ecstasy) Any substance, natural or synthetic, included in List I and List II of the Single Convention of Narcotic Drugs, 1961..
Offence impairment level	any
Blood drug limits ng/ml	No limits specified
Licence Suspension period	temporary revocation when under the influence of narcotic drug as well as in case of refusal to be checked with a technical facility or to give blood for a medical analysis – until a decision as to the driver's liability is passed; but not for more than 6 month.
Fine range	BGN 500 to BGN 1,500.
Prison	Up to 3 years imprisonment

Croatia	
Legal basis	Law on Safety in Road Traffic (LSRT) (OG 67/08, 48/10, 74/11, 80/13, 158/13, 92/14, 64/15), Art. 199(1), 282. Criminal Code (CC) (OG,125/11, 144/12, 56/15, 61/15), Art.226
Police power to stop / test:	Stop at random. Test at random.
Oral fluid testing at roadside?	Yes – before physical test
Evidentiary test	Blood, at hospital
Substances to which law applies	Any
Offence impairment level	(LSRT) Impairment (under influence) (CC) Impairment (not capable of driving, causing danger)
Blood drug limits ng/ml	No limits specified
Licence Suspension period	(LSRT) 1 mth – 2 years (CC) 1-5 years
Fine range	5000- 20.000,00 kn (€680-2.700)
Prison	(LSRT) Up to 2 mths (CC) Up to 3 years

Cyprus	
Legal basis	Motor vehicle and Road Traffic Law of 1972, s.9. Usually prosecution under the Narcotics Law of 1977, since use and possession is a criminal offence under that law anyway. No need to prove that the ability to drive safely was affected under the Narcotics Law.
Police power to stop / test:	Stop at random. Test at random
Oral fluid testing at roadside?	yes
Evidentiary test	New legislation is expected to introduce saliva screening and blood tests as valid evidence.
Substances to which law applies	Any controlled under Narcotics Law
Offence impairment level	Impairment
Blood drug limits ng/ml	No limits specified
Licence Suspension period	Not specified. Up to court’s discretion
Fine range	No fixed fine range
Prison	Up to 1 year

Denmark	
Legal basis	Road Traffic Act (LBK 1079 of 14 November 2005), ss.54, 55, 117d, 125, 126, 128. Act 524 of 6 June 2007, BEK 655 of 19 June 2007
Police power to stop / test:	Stop at random. Test at random
Oral fluid testing at roadside?	Yes – after physical test
Evidentiary test	Blood, at hospital
Substances to which law applies	Any, except if in accordance with medical prescription. 54 narcotics (including opiates, their derivates and cocaine) and some medicines are classified as dangerous to road safety under Danish law.
Offence impairment level	Impairment and impaired per se
Blood drug limits ng/ml	THC=1 amphetamine=20 cocaine=20 morphine=10 MDMA=20
Licence Suspension period	6 mths – 10 years or for life
Fine range	No fixed fine range
Prison	Up to 1.5 years

Estonia	
Legal basis	Traffic Act: §91 (removal from driving a vehicle) Use of drugs is punishable according to the Act on Narcotic Drugs and Psychotropic Substances and Precursors thereof: §151 Criminal Code (CC): §50, §424 Law Enforcement Act: §36, §37, §41
Police power to stop / test:	Stop with suspicion. Test at random
Oral fluid testing at roadside?	Possible
Evidentiary test	Blood, at hospital
Substances to which law applies	Any – an extensive list of substances is published: https://www.riigiteataja.ee/aktilisa/1301/1201/1014/Lisa1.pdf
Offence impairment level	(Traffic Act) If drug detected ("reason to believe substance use") (CC) Impairment
Blood drug limits ng/ml	No limits specified
Licence Suspension period	(Traffic Act) None (CC) Up to 3 years
Fine range	(Traffic Act) Up to €1200 (drug use offence) (CC) 30-500 daily rates (average daily income)
Prison	(Traffic Act) Administrative arrest in police detention house up to 30 days instead of fine (drug use offence) (CC) Up to 3 years

Finland	
Legal basis	Criminal Code Ch.23, s.3, 4, 8
Police power to stop / test:	Stop at random. Test with suspicion.
Oral fluid testing at roadside?	Yes – after physical test
Evidentiary test	Blood, at hospital or police station
Substances to which law applies	(Ch.23 s.3) Narcotic substance other than medicinal product which a person has a right to use (Ch.23 s.4) Any
Offence impairment level	(Ch.23 s.3) impaired per se (Ch.23 s.4) Impairment
Blood drug limits ng/ml	No limits specified
Licence Suspension period	Up to 5 years
Fine range	(Ch.23 s.3) Up to 120 day-fines (Ch.23 s.4) At least 60 day-fines
Prison	(Ch.23 s.3) Up to 6 mths (Ch.23 s.4) Up to 2 years

France	
Legal basis	Law 2016-41 of 26 Jan 2016, law 2003-87 of 3 Feb, law 99-505, (Art.L. 235-1 and L. 235-2 of code de la route), decree 2016-1152 of 24 Aug 2016, decree 2001-751 of 27 Aug (Art. R-235-1 and following of code de la route)
Police power to stop / test:	Stop at random. Test with suspicion.
Oral fluid testing at roadside?	Yes
Evidentiary test	Oral fluid, taken at roadside and sent to laboratory. Blood at hospital is possible.
Substances to which law applies	Substances or plants classed as narcotics
Offence impairment level	If drug detected
Blood drug limits ng/ml	No limits specified
Licence Suspension period	Up to 3 years
Fine range	€4500. €9000 if the driver is also under the influence of alcohol
Prison	2 years. 3 yrs if the driver is also under the influence of alcohol

Germany	
Legal basis	Road Traffic Code (StVG) s.24a(2) Criminal Code (CC) (StGB) ss.315c, 316,
Police power to stop / test:	Depends on Land
Oral fluid testing at roadside?	Depends on Land
Evidentiary test	Blood, at hospital
Substances to which law applies	(Road Traffic Code) 7 named substances (CC) Any
Offence impairment level	(Road Traffic Code) If drug detected (CC) Impairment
Blood drug limits ng/ml	No limits specified. Recommended analytical limits (in serum): THC=1 amphetamine=25 cocaine=10 morphine=10
Licence Suspension period	(Road Traffic Code) 1-3 mths (CC) 1-3 mths or withdrawal
Fine range	(Road Traffic Code) Up to €3000 (CC) General range for all criminal offences: according to the income of the offender
Prison	(Road Traffic Code) No (CC) s.315c (if endangering property or others): up to 5 years s.316: up to 1 yr

Greece	
Legal basis	Article 42 of the Greek Highway Code Penal Code – N 4619/2019
Police power to stop / test:	
Oral fluid testing at roadside?	yes
Evidentiary test	Blood
Substances to which law applies	Opiates and opioids substances: morphine, codeine, thebaine, papaverine narkotini, heroin, etc Hallucinogenic-hallucinogens substances: cannabis products Stimulants of the central nervous system: cocaine, benzoylecgonine, ecgonine methyl ester, amphetamines and their derivatives (MCMA, MDA, etc) Sedatives of the central nervous system: hypnotic and anxiolytic drugs such as benzodiazepines, etc
Offence impairment level	Impairment
Blood drug limits ng/ml	No limits specified
Licence Suspension period	90 to 180 days
Fine range	>200
Prison	Minimum two months imprisonment and at least ten years if it resulted in the death of another person.

Hungary	
Legal basis	Criminal Code Art.188
Police power to stop / test:	Stop at random. Test with suspicion.
Oral fluid testing at roadside?	No
Evidentiary test	Blood, at police station
Substances to which law applies	Any
Offence impairment level	Impairment
Blood drug limits ng/ml	No limits specified
Licence Suspension period	1-10 years or life
Fine range	No determinate fine
Prison	Up to 1 year without aggravating circumstances

Ireland	
Legal basis	Road Traffic Acts 1961 – 2016, ss4(1), 4(1A). SI 536 of 2014 The Road Traffic Act (Impairment Testing) (Commencement) Order
Police power to stop / test:	Stop at random if designated checkpoint. Prior to the new laws - the Road Traffic Act 2016 - a Garda had to have a specific reason to stop an individual under suspicion of driving under the influence of an illicit drug before they could take further action. Currently the Garda have the power to conduct roadside drug testing and the previous requirement to prove impairment or incapacitation no longer applies for cannabis and cocaine use
Oral fluid testing at roadside?	Yes from April 2017
Evidentiary test	Blood, at police station. Urine under certain conditions
Substances to which law applies	s.4(1A): cannabis, cocaine, heroin S.4(1): Any
Offence impairment level	S.4(1A) impaired per se. Medicinal product – impairment s.4(1) Impairment.
Blood drug limits ng/ml	s.4(1A): THC=1 cocaine=10 Benzoylecgonine=50 Morphine (6-AM)=5 (Whole blood)
Licence Suspension period	those convicted of the new offence of being above the threshold for cannabis, cocaine and heroin with no proof of impairment necessary by the Gardaí, the disqualification period is not less than 1 year for the first offence and not less than 2 years for the second or subsequent offence. or the existing offence of drug driving, while impaired, there is no change to the penalty or disqualification periods which are a minimum of 4 years for a first offence and 6 years for a second or subsequent offence.
Fine range	Up to €5000
Prison	Up to 6 months

Italy	
Legal basis	Law 285/1992 (Highway Code) and updates, Art 186 and 187, Road Traffic Law (RTL 41/2016)
Police power to stop / test:	Stop at random. Test with suspicion.
Oral fluid testing at roadside?	Yes
Evidentiary test	Blood, at hospital
Substances to which law applies	Any
Offence impairment level	If drug detected
Blood drug limits ng/ml	No limits specified
Licence Suspension period	15 days – 3 months. Up to 2 years for serious offences or 15 years for death.
Fine range	€ 1500 – 6000
Prison	6 mths – 1 yr; 1-2 years in case of accident. Other increases for young or professional drivers. In the event of a fatal collision, penalties range from eight to twelve years in prison and this increases by half (with a maximum of eighteen years) if more than one person is killed

Latvia	
Legal basis	Administrative Violations Code (AVC) , 149.15 2012 Cabinet Regulation No 296 "On Amendments to Cabinet Regulation No. 103 of 2 February 2010 "Procedures for obtaining and renewing driving licences" Criminal Code (CC) s.262
Police power to stop / test:	Stop at random. Test with suspicion.
Oral fluid testing at roadside?	No
Evidentiary test	Blood, at hospital
Substances to which law applies	(AVC) Any / medicinal (CC) Any
Offence impairment level	(AVC) Any drug – If drug detected. Medicinal product - impairment. (CC) If drug detected
Blood drug limits ng/ml	No limits specified
Licence Suspension period	(AVC) Up to 4 years (CC) Up to 5 years
Fine range	(AVC) Any drug - €1200-1400 Medicinal product – €40-280 (CC) fine not exceeding fifty times the minimum monthly wage
Prison	(AVC) Administrative arrest shall be imposed for a period from 10 up to 15 days (CC) Up to 2 years

Lithuania	
Legal basis	Code of Administrative Offences Art.422 Governmental Resolution No. 452, December 12, 2006 ,"The rules for identifying of intoxication or drunkenness for vehicle drivers and other persons"
Police power to stop / test:	Stop at random. Test with suspicion.
Oral fluid testing at roadside?	No
Evidentiary test	Blood/urine, at hospital
Substances to which law applies	Any
Offence impairment level	If drug detected
Blood drug limits ng/ml	No limits specified
Licence Suspension period	1-3 years
Fine range	€300-860
Prison	No

Luxemburg	
Legal basis	Loi modifiant la loi du 14 février 1955 concernant la réglementation de la circulation sur toutes les voies publiques, Art 12 Loi 18 septembre 2007 Règlement grand-ducal du 18 novembre 2011 concernant les critères techniques et les conditions d'homologation des appareils
Police power to stop / test:	Stop at random. Test with suspicion.
Oral fluid testing at roadside?	Yes – after physical test
Evidentiary test	Blood, at hospital
Substances to which law applies	All controlled substances
Offence impairment level	Impairment and impaired per se
Blood drug limits ng/ml	THC=1 amphetamine=25 Methamphetamine=25 MDMA,MDA=25 cocaine=25 Morphine=10
Licence Suspension period	1 mth - life
Fine range	€250-5000
Prison	8 days – 3 years

Malta	
Legal basis	Traffic Regulation Ordinance, Sections 15A, 15H, 15I
Police power to stop / test:	Stop at random. Test with suspicion.
Oral fluid testing at roadside?	No
Evidentiary test	[TBC]
Substances to which law applies	Any. Maltese Law does not specify any particular drugs but the Traffic Regulation Ordinance defines 'drug' as including any intoxicant other than alcohol.
Offence impairment level	Impairment
Blood drug limits ng/ml	No limits specified
Licence Suspension period	At least 6 months
Fine range	At least €1200
Prison	Up to 3 months

Netherlands	
Legal basis	Road Traffic Law 1994, Art.8. Besluit van 14 december 2016 sets per se limits which apply since July 2017
Police power to stop / test:	Stop at random. Test at random
Oral fluid testing at roadside?	Yes
Evidentiary test	Blood, at hospital or police station
Substances to which law applies	Any
Offence impairment level	Impairment and impaired per se
Blood drug limits	Amphetamine, methamfphtamine, cocaïne, MDMA, MDEA en MDA: 50 microgram per liter; Cannabis (tetrahydrocannabinol): 3,0 microgram per liter Heroïne (morphine): 20 microgram morphine per liter GHB, gamma butyrolactone,1,4-butaandiol: 10 milligram per liter. In combination lower limits apply for all substances
Licence Suspension period	Up to 5 years
Fine range	€6700 If accident causing bodily injury – up to € 16 750 If fatality – €16 750, or €67 000 if reckless
Prison	up to 3 mths If accident causing bodily injury - 2 year and 3 months, or 4.5 years if reckless If fatality – 4.5 years, or 9 years if reckless

Norway	
Legal basis	Road Traffic Act of 18 June 1965 No.4, ss 21-22a, 31, 33 Regulation of 20 Jan 2012 on fixed limits for influence of intoxicating substances
Police power to stop / test:	Stop at random. Test at random.
Oral fluid testing at roadside?	Yes – before or after physical test
Evidentiary test	Blood, at hospital or police station
Substances to which law applies	Any
Offence impairment level	Impairment, and impaired per se for 28 substances
Blood drug limits ng/ml	Impairment limits comparable to a blood alcohol concentration (BAC) of 0.02%, are defined for 20 psychotropic drugs, including the most prevalent benzodiazepines, cannabis, GHB, hallucinogens and opioids. Limits for graded sanctions, representing drug concentrations in blood likely to induce impairment comparable to BACs of 0.05% and 0.12%, are defined for 13 of the 20 substances. Alprazolam (3 ng/ml) Clonazepam (1.3 ng/ml) Diazepam (57 ng/ml) Fenazepam (1.8 ng/ml) Flunitrazepam (1.6 ng/ml) Nitrazepam (17 ng/ml) Oxazepam (172 ng/ml) Zolpidem (31 ng/ml) Zopiclone (12 ng/ml) THC (1.3 ng/ml) Amphetamine (41 ng/ml) Cocaine (24 ng/ml) MDMA (48 ng/ml) Methamphetamine (45 ng/ml) GHB (10 300 ng/ml) Ketamine (55 ng/ml) LSD (1 ng/ml) Buprenorphine (0.9 ng/ml) Methadone (25 ng/ml) Morphine (9 ng/ml)
Licence Suspension period	Minimum 1 year
Fine range	1.5x gross monthly income. Rarely under NOK 10 000,-
Prison	Up to 1 year

Poland	
Legal basis	Criminal Code, Art. 178a
Police power to stop / test:	Stop with suspicion. Test at random
Oral fluid testing at roadside?	Yes
Evidentiary test	Blood, at hospital or police station
Substances to which law applies	Any
Offence impairment level	If drug detected
Blood drug limits ng/ml	No limits specified
Licence Suspension period	From 1 to 10 years
Fine range	Up to 360 day fines
Prison	Up to 2 years

Portugal	
Legal basis	Road Law Decree–Law 44/2005 Art. 81; Regulation 1006/98 Criminal Code (CC), Art 291
Police power to stop / test:	Stop at random. Test with suspicion.
Oral fluid testing at roadside?	Yes
Evidentiary test	Blood, at hospital
Substances to which law applies	(Road Law) Substances legally considered as narcotic or psychotropic (CC) Any
Offence impairment level	If drug detected
Blood drug limits ng/ml	No limits specified
Licence Suspension period	2 months to 2 years
Fine range	(Road Law) €500 - €2500 (CC) Unlimited (causing danger) Up to 240 day fines (causing danger via negligence) Up to 120 day fines (negligence)
Prison	(CC) Up to 3 years (causing danger) Up to 2 years (causing danger via negligence) Up to 1 year (negligence)

Romania	
Legal basis	Criminal Code, arts. 336-337. Ministry of Health Order no 1512/12.12.2013
Police power to stop / test:	Stop at random. Test at random
Oral fluid testing at roadside?	Yes
Evidentiary test	Blood, at hospital
Substances to which law applies	All controlled substances
Offence impairment level	If drug detected
Blood drug limits ng/ml	No limits specified
Licence Suspension period	90 days. Cancellation possible for sentence of detention (suspended or not)
Fine range	30-400 day-fines (10-500 Ron per day)
Prison	1-5 years (also for refusing to give biological evidence); 2-7 years if aggravated

Slovenia	
Legal basis	Act of rules in road transport 82/13 (articles 22, 107/7, 107/8)/ Driver's Act (Official Gazette of the Republic of Slovenia, No. 109/10)
Police power to stop / test:	Stop at random. Test with suspicion.
Oral fluid testing at roadside?	Yes
Evidentiary test	Blood or urine, at hospital
Substances to which law applies	Any: - medicines that are marked with a full red triangle in accordance with the regulations on the labelling of medicines (trigon - absolute ban on driving), - medicines that are marked with an empty triangle in the colour in accordance with the regulations on the labelling of medicines of the text (trigonic - relative prohibition of driving), - illicit drugs from I., II. in III. groups of illicit drugs determined by the regulation governing the classification of illicit drugs. Exceptions van be made in case of medicinal use, based on doctor prescription and only when use is in accordance with instructions for use of the medicine and the written instructions of the doctor.
Offence impairment level	If drug detected
Blood drug limits ng/ml	No limits specified
Licence Suspension period	18 penal points (withdrawal of driving licence and re-test in 6 mths - 1 yr)
Fine range	From €1200
Prison	No

Slovakia	
Legal basis	Act 372/1990 Coll. on Administrative Offences (AAO) S.22(1)(f) Criminal Code (CC) S. 289 Act 8/2009 Coll. on Road Traffic S. 4(2)(b,c) (obligations of driver); S. 69 (1)(d)(testing); S. 70(1)(c) (licence suspension)
Police power to stop / test:	Stop at random. Test at random
Oral fluid testing at roadside?	No
Evidentiary test	Blood, at hospital
Substances to which law applies	Any
Offence impairment level	(AAO) If drug detected (CC) Impairment
Blood drug limits ng/ml	No limits specified
Licence Suspension period	(AAO) Up to 1 yr (CC) 1-10 years (general ban on activity)
Fine range	(AAO) €200-1000, or up to €3500 (legal person) (CC) €160 to €331 930 (general fine)
Prison	(AAO) No (CC) Up to 1 yr (recidivist) Up to 5 yrs (public transport)

Spain	
Legal basis	Administrative Code (AC): Royal Legislative Decree 6/2015, of October 30, Law on Traffic, Motor Vehicle Circulation and Road Safety (MVCRS), article 14. Criminal Code (CC): Organic Law 10/1995, dated November 23, Criminal Code and article 796. 7th Criminal Procedure Law, articles 379.2, 796.7
Police power to stop / test:	Stop at random. In case of accident, infraction or with suspicion. Obligatory test with suspicion.
Oral fluid testing at roadside?	Yes
Evidentiary test	Saliva, at roadside. Analysis in approved laboratory
Substances to which law applies	Any, except if in accordance with medical prescription. More prevalent illicit substances: Cannabis, Cocaine, Opioids, Amphetamine and Methamphetamine.
Offence impairment level	(AC) If drug detected (CC) Impairment
Blood drug limits ng/ml	No limits specified. Zero tolerance: presence of drug in saliva / blood.
Licence Suspension period	(AC): 6 points. Without licence suspension (CC): 1- 4 years. In case of refusal to perform the test: 1 - 4 years
Fine range	€500 - 1000
Prison	3 - 6 months, or a fine of 6 months - 1 year, or 31 - 90 days' community service. In case of refusal to perform the test: 6 months - 1 year

Sweden	
Legal basis	Act on Punishment for some Traffic Crimes (1951:649), s.4 and 4a
Police power to stop / test:	Stop at random. Test with suspicion.
Oral fluid testing at roadside?	No
Evidentiary test	[TBC]
Substances to which law applies	Any, but no liability if in accordance with medical prescription
Offence impairment level	If drug detected
Blood drug limits ng/ml	No limits specified
Licence Suspension period	1 mth –3 years. Forfeit of vehicle possible.
Fine range	Day fines
Prison	Up to 2 years

United Kingdom (England and Wales only)	
Legal basis	Road Traffic Act s.4 & s.5A.
Police power to stop / test:	Stop with suspicion. Test with suspicion.
Oral fluid testing at roadside?	Yes
Evidentiary test	Blood, at police station
Substances to which law applies	(s.5A) 17 specified (s.4) Any for impairment The law does not make any difference between legal (medicines) and illegal drugs, so anyone unfit to drive after taking any kind of drug is guilty of an offence.
Offence impairment level	(s.5A) impaired per se (s.4) Impairment
Blood drug limits ng/ml	(s.5A) THC=2 amphetamine=10 cocaine=10 Morphine=80
Licence Suspension period	Minimum 1 year (unlimited maximum)
Fine range	Unlimited
Prison	Up to 6 mths, or up to 14 years if fatality

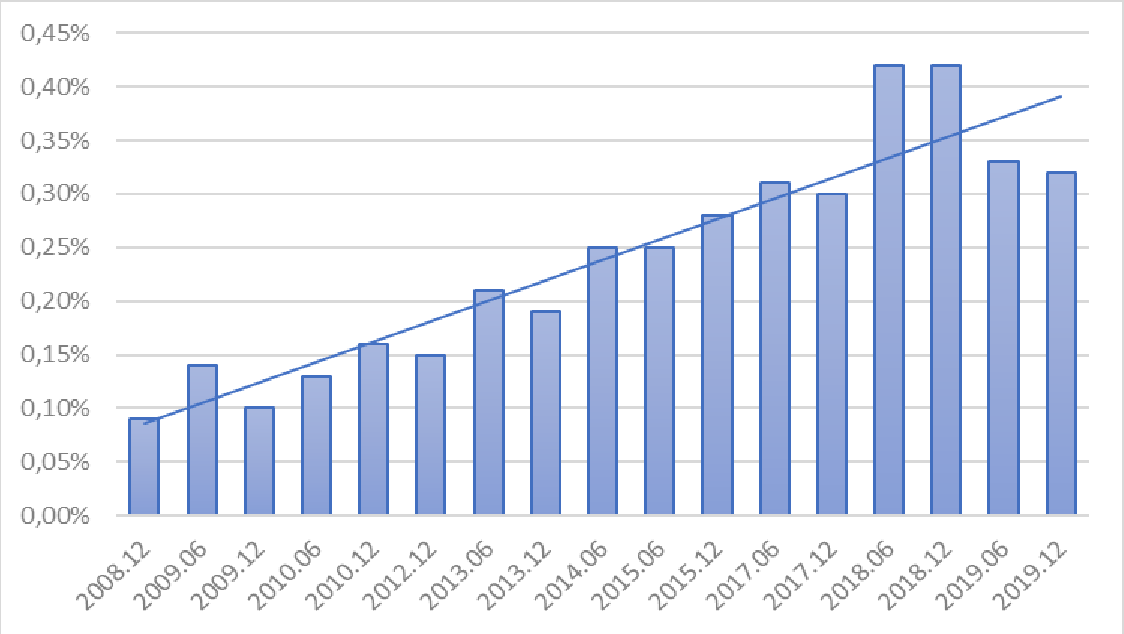
Prevention of drugs in traffic

Table 0.1 DRUID substance groups for the prevalence among drivers in general traffic

Illicit drugs	amphetamines	amphetamine
		methamphetamine or methamphetamine + amphetamine
		MDMA or MDMA + MDA
		MDEA or MDEA + MDA
		MDA
	cocaine	benzoylecgonine or cocaine + benzoylecgonine or cocaine
	THC	THC or THC + THCCOOH
	illicit opiates	6-acytylomorphine or 6-AM + codeine or 6-AM + morphine or 6-AM + codeine + morphine or (morphine + codeine and morphine >= codeine)
Medicinal drugs	benzodiazepines	diazepam or diazepam + nordiazepam or diazepam + oxazepam or diazepam + nordiazepam + oxazepam
		nordiazepam or nordiazepam + oxazepam
		oxazepam
		lorazepam
		alprazolam
		flunitrazepam or flunitrazepam + 7-aminiflunitrazepam
		clonazepam or clonazepam + 7-aminoclonozepam
	Z-drugs	zolpidem
		zopiclone
	medical opioids	morphine
		codeine or (codeine + morphine and codeine > morphine)
		methadone
		tramadol
Various combinations	alcohol - drugs	all combinations (except ethanol + THCCOH)
	multiple drugs	all combinations (except drug + THCCOOH)

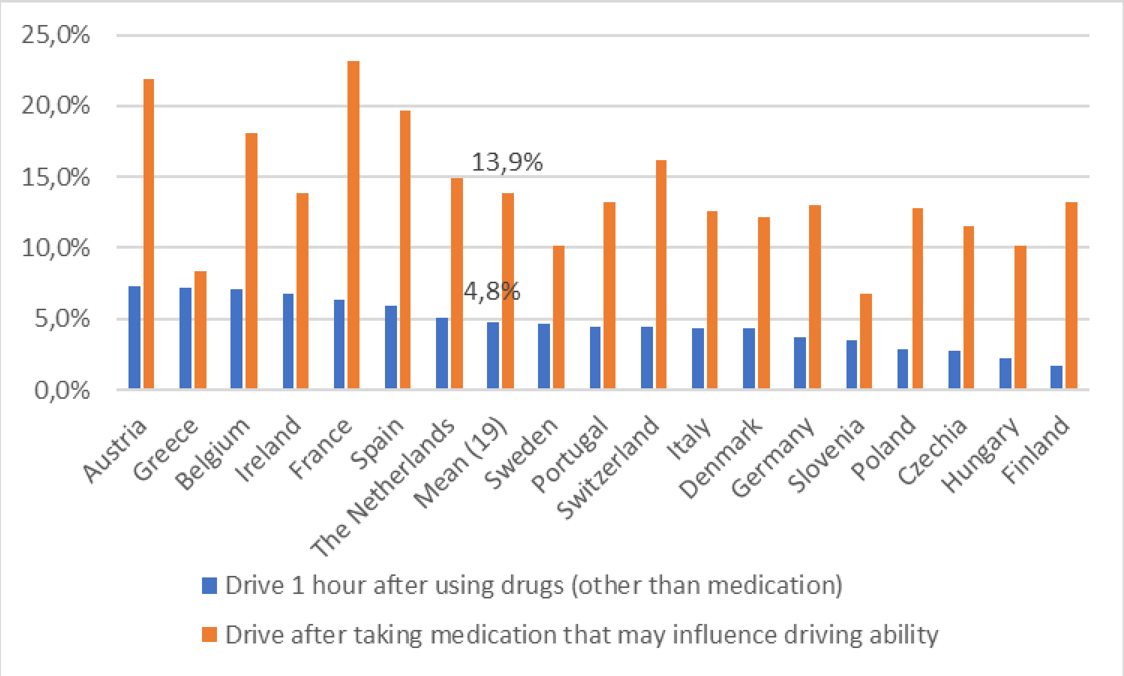
Source: Houwing, S. et al., 2011.

Figure 0.1 Drug offences detected – results of police checks coordinated by TISPOL in 2008-2019



Source: TISPOL

Figure 0.2 Prevalence of drugs in traffic based on surveys within the general driving population, 2018.



Source: ESRA survey

Table 0.2 Road fatalities with involvement of drugs in European countries 2010-2019

	2010 %	2011 %	2012 %	2013 %	2014 %	2015 %	2016 %	2017 %	2018 %	2019 %		Drug-related 2018 abs	Total fatalities 2018 abs
FR	13,1	12,6	4,5	13,3	14,5	14,5	14,0	14,3	15,5	15,2		494	3248
SE	7,1	8,8	8,1	6,5	7,8	8,1	13	15,8	9,6	10		31	324
ES	4,3	5,1	4,1	5,1	4,9	5,2	7,7	10,1	11,3	10,5		204	1806
CY	5	7	7,8	9,1	2,2	5,3	2,2	3,8	8,2	11,5		4	49
DK	4,3	3,6	4,8	4,7	4,9	7,9	4,7	6,9	7,4	10,6		13	175
SI							8,5	4,8	6,6	9,8		6	91
CH	4	6,3	6,5	7,1	6,6	6,3	10,6	8,7	6,4	4,3		15	233
FI			6,7	3,5	6,1	3,3	7,8	3,9	4,6	3,3		11	239
LU				7	3	6	10	21	3	18		1	36
CZ	2	1,4	1,2	2,1	1	1,6	2	0,9	2,9	2,6		19	658
IT						1,9	1,8	2,2	2,3	2,1		77	3334
DE	1,2	1,2	0,9	1	1,2	1,2	1	1,3	1,8			59	3275
PL	0	0,3	0,4	0,1	0,4	0,5	0,5	0,7	0,7	0,8		20	2862
AT			0,2	0	0,2	0,4	0,5	1,2	0,5	0,7		2	409
EE	0	0	0	1,2	2,6	1,5	0	4,2	0	0		0	67
LT					0	0	0	0	0	0		0	173
PT	6,7	8,3	8,6	11,2	9,9	8,9	11,2	11,4	11,6	13,3		78	675
total												**1034**	**17654**
												share	**6%**

Annex 4: Technical Standards Definitions

1. Alcohol interlock

2. Breath alcohol concentration

3. Breath sample

4. Accepted breath sample

5. Mouthpiece

6. Breath alcohol concentration limit

7. Retest

8. Start period

9. Restart period

10. Bypass

11. Override

12. Tampering

13. Aftermarket installation:

14. Warm-up time:

15. Manufacturer:

16. Data memory:

17. Blocking state:

State in which the alcohol interlock is inhibiting the start of the vehicle motor.

NOTE: the alcohol interlock may also be installed to inhibiting the commercial vehicle from being set in motion under own power by blocking an electronically operated gearbox, brakes or other interlock system preventing the vehicle to be moved under own power without a legal alcohol test provided by an alcohol interlock.

18. Unblocking state:

State in which the vehicle motor can be started.

NOTE: state in which the commercial vehicle can be set in motion after a legal test, provided by an alcohol interlock, are unblocking an electronically operated gearbox, brakes or other interlock system preventing the vehicle to be moved under own power.

19. Transport customer:

Company, private or public, or any other person or organization purchasing services of transport of goods, persons or other wares from a company, single person, private or public enterprise that provides such services.

20. Transport provider:

Any private or public company, person or other organization providing transport services for payment for persons, wares or other goods with vehicles powered by combustion engines, electricity or any other source of power.

NOTE: examples are trucking companies, bus companies, taxis, public or private fleet transport vehicles.

21. Professional vehicle driver:

A person who makes all or most of his/her income out of driving transport vehicles for goods, wares, persons or any transport services in return for payment.

NOTE: unions, transport workers federations or other organizations may be caretakers of the professional drivers interests versus transport providers, transport customers or public authorities related to common rules and recommendations for the mandatory use of alcohol interlocks in commercial vehicles.

22. Public and legislative authorities:

Public and political decision-makers that provides laws, regulations and other decisions for the mandatory use of alcohol interlocks.

NOTE: the alcohol interlock may also be an instrument to pursue a company alcohol policy by detecting potential alcohol problems in an early stage, possible to counter by adequate measures. This will demands programs including the unions, public authorities, transport companies and their organizations and specially designed programs to diminish development of alcohol problems among professional drivers.

Annex 5: Alcohol Interlock Programme Factsheets

Austria

Introduction

Following the (successful) trials performed in 2012 and 2013, Austria launched a voluntary rehabilitation programme for drink driving offenders in 2017. The programme started from the 1st of September 2017 and is limited to 5 years (2017 – 2022).

Target group

The programme offers the offender an option to get behind the wheel when half of their driving ban is completed with the prerequisite of having an alcohol interlock device installed. The participation of the programme is thereby voluntary for offenders based on the following criteria: [73] [74]

- Only applicable to category B and BE drivers;
- A suspension of the driving licence for at least four months;
- The expiration of at least half of the suspension period;
- No alcohol addiction.

Regulatory basis

The enforcement of the programme is carried out by the Arbeiter-Samariter-Bund (ASBÖ), which is the first point of contact for interested parties and this is also where the mentoring appointments take place. The judicial system is not involved.[75]

Costs of the programme

The minimum estimated costs for the participant are € 2.100 for six months, which consist of the following: [76]

- The costs of an alcohol interlock are roughly €1.500 - €2.500;
- Installation costs €300;
- The minimum costs for the mentoring programme are €600. Each mentoring interview costs roughly €150.

Programme specifics: such as regular mentor meetings

- This programme is the first to require the offender to regularly meet with a mentor. The driver has to meet a mentor every 2 months;
- Participatory conditions are that the costs for installation, rental and removal are paid by the participant.[77]

[73] ETSC (2017), Alternative Probation System (APS) in Austria.
[74] ETSC (2020), https://etsc.eu/wp-content/uploads/ALCOHOL_INTERLOCKS_FINAL.pdf.
[75] https://www.oesterreich.gv.at/themen/dokumente_und_recht/fuehrerschein/7/Seite.041040.html.
[76] https://www.kleinezeitung.at/auto/5276922/Alkolocks_Geraete-muessen-mindestens-sechs-Monate-verwendet-werden.
[77] https://etsc.eu/austria-launches-alcohol-interlock-rehabilitation-programme/.

Finland

Introduction

Finland ran multiple trials from 2005 to 2008 regarding voluntary alcohol interlock use in commercial transport. Following these trials, the programme became permanent since July 2008.

Next to the offender/rehabilitation programme, the Ministry of Transport also recommended in 2006 to use alcohol interlock in professional school and day care transport. 17 municipalities had been using alcohol interlock for this purpose until 2008. Since 2011, the Finnish regulation adopted a rule that imposed transport organised by a municipality, school or institute to be equipped with an alcohol interlock. This applies for the transportation of pupils and related to day care.[78]

Target group

The programme is voluntary for offenders, in the sense that the offender can choose to apply for an alcohol interlock, instead of being banned from driving. The following criteria and conditions are applied:

- BAC between 0.5 - 1.2 g/l equals 12-36 months participation;
- BAC (equal or above) 1.2 g/l equals 12-26 months participation;
- To enter the programme the offenders have to send their application to the police.

In addition, the largest number of alcohol interlocks in Finland are mandatory installed in transportation vehicles for kindergarten/school trips.

Regulatory basis

In Finland, a driving under influence offender has to apply for a specific driving license. Before applying for such a driving license to the police, offenders should discuss their use of drugs, health effects and treatment options. After receiving the specific driving license, the alcohol interlock can be installed. Read-out of the data takes place every 60 days and the data is transferred to a system monitored by the police.[79]

Costs of the programme

The following yearly costs estimates are related to the Finnish offender/rehabilitation programme:

- Year 1 = € 2.400;
- Year 2 = € 1.920;
- Year 3 = € 1.440.

These yearly costs estimated can be divided into the following costs elements:

- Alcohol interlock device and installation = € 1.250 – € 1.500;
- Doctor (or another health care professional) = € 30 – € 160;
- Inspection of the vehicle (after the installation of the interlock) = € 40– € 60;
- (New) driving licence = € 30;
- Data read-out (every 60 days) = € 20 – € 60;
- Calibration of the alcohol interlock = € 30 – € 60;
- Removal of the interlock = € 100 – € 170.

All the costs of the programme are paid by the participant (e.g. purchase, installation, inspection, read-out of data, calibration and removal). Interest in the programme is still rather low with roughly 500 yearly applicants.[80] [81]

---

78 https://etsc.eu/wp-content/uploads/Analysis-of-Finnish-legislation-on-alcohol-interlocks-TRAFI-Marita-L%C3%B6ytty.pdf.
79 Idem.
80 https://etsrc.eu/wp-content/uploads/3.-Alcohol-Interlocks-in-Finland-TRAFI.pdf.
81 Liikenneturva (Road Safety Association), https://www.liikenneturva.fi/fi/liikenteessa/alkolukko#3b34a4a9.

Sweden

Introduction

In 1999 Sweden introduced, as one of the first countries in Europe, by means of a trial programme an alcohol interlock programme for cars. The trial has been extended from 2003 onwards by including cars, busses and trucks. Finally, a law regarding a permanent program for DUI offenders become permanent since the 1st of January 2012.

More than a decade later (in 2012), roughly 80.000 commercial transport vehicles – trains, trams, ferries and ships – were equipped with an alcohol interlock. Municipalities mandated the installation of alcohol interlocks in buses and the Swedish Road Authority obliges subcontractors to have their trucks installed with an alcohol interlock **Invalid source specified.**.

Target group

The alcohol interlock programme is open for all driving under influence offenders. The goal of the permanent program was to achieve a higher participation rate than the trial period (i.e. 11%). Three studies have been evaluating the alcohol interlock programme and concluded this goal have been reached as the participation rate is equal to 30%. From the participants 83% completes the programme.

Regulatory basis

In case the police detects a driver under influence of alcohol their driving license is sent to the Swedish Transport Agency. After which, either the license is revoked or an interlock application will be granted for one or two years. The programme has the following differentiated timeline:

- 1 year (prolonged to two years in case of diagnosis):
  - BAC 0,2 - 0,9 g/l
- 2 years if:
  - BAC ≥ 1,0 g/l
  - Repeated DUI during a five year period
  - DUI in combination with a diagnosed addiction or abuse of alcohol

In addition, the report about the criminal charge is send to the prosecutor and criminal charges are settled by the prosecutor or court. [82]

Costs of the programme

The following costs are related to the Swedish offender/rehabilitation programme:

- Introduction costs = € 420;
- Recurring costs = € 168 p/month;
- Conclusion and follow-up costs = € 784 (estimated medical costs of € 672);
- The total costs for 1 year are € 2.150 – € 2.700. In case of 2 years participation, the costs for the participant are € 2.850 – € 4.150.[83]

Programme specifics: pilot project 'Alco Gate'

In 2013, Sweden even went a step further by running a pilot project 'Alco Gate'. Purpose of the trial was to control the maritime border and test technology. The Port of Gothenburg installed checkpoints for all buses and trucks entering the country. The driver needed to blow into a breathalyser to open the Alco Gate and enter the country. The trial was considered a success and the technology used could be a complementary measure.[84]

82 https://etsc.eu/wp-content/uploads/Drink-Driving-in-Sweden-Swedish-Transport-Agency.pdf.
83 Idem.
84 https://etsc.eu/case-study-alco-gates-in-sweden/.

Netherlands

Introduction

The Netherlands implemented from the first of December 2011 alcohol interlock programme(s). There were multiple programmes, target groups and criteria's identified. These different programme will be briefly described and the main characteristics are summarised in Table A.1 .[85]

- **Education Measure Alcohol and Traffic (EMA)**: this measure is imposed since April 2015 on novice and experienced drivers with a BAC between 0.8‰ and 1.3‰ (novice drivers) and 1.0‰ and 1.8‰ (experiences drivers). An EMA-course consists of a full- and two half day courses. During this course the participants will receive information and are exchanging experiences. The costs for a participant are €1.000;
- **Light EMA (LEMA)**: both novice and experienced drivers are from 2011 onwards, when caught with a BAC between 0.5‰ and 0.8‰ (novice drivers) and 0.8‰ and 1.0‰ (experiences drivers), imposed with LEMA. LEMA consists of a 2 half day courses that focuses on transferring knowledge and participations are given additional assignments. The costs for a participant are equal to €625;
- **Alcohol Interlock Programme (ASP)**: between December 2011 and March 2015 an ASP could be imposed on novice- and experiences drivers with a BAC of respectively 1.0‰ – 1.8‰ and 1.3‰ – 1.8‰. An ASP consists of installing an alcohol interlock for a period of 2 years. In addition, the participation has to perform, within the first six months of the programme, a motivation course of three half days. The costs for a participant varied between €3.940 to €4.266 (dependent on the lease package);
- **Research Alcohol:** both novice and experienced drivers are from April 2015 onwards imposed with a psychiatric, physical and blood research related to drink driving when caught with a BAC over 1.3‰ (novice drivers) and 1.8‰ (experiences drivers). The costs for a participant are equal to €1.192;
- **Education Measure Behaviour and Traffic (EMG)**: an EMG has a different (broader) target group, because it is imposed on drivers that exceed the maximum speed limit with 50 km/h within city limits. Currently, an EMG consists of 2 course days and the associated costs for a participant are equal to €1.080. The EMG exceeds the current scope of this study and is therefore left out of the analysis.

Target group

An alcohol interlock programme could be imposed, between 2011 and 2015, on novice drivers with a BAC between 1.0‰ and 1.8‰ and on experienced drivers with a BAC between 1.3‰ and 1.8‰. In Table A.1 an overview of various alcohol programmes in the Netherlands has been provided.

Table A.1 Overview of alcohol programmes in the Netherlands

Measure	Target group	BAC	Costs	Period
LEMA	Novice drivers	0,5-0,8‰	€625	2008 – current
	Experienced drivers	0,8-1,0‰		2011 – current
EMA	Novice drivers	0,8-1,3‰	€1.000	2015 – current
	Experienced drivers	1,0-1,8‰		
Alcohol Interlock Programme (ASP)	Novice drivers	1,0-1,8‰	€3.940 to €4.266	1/12/2011 – 31/03/2015
	Experienced drivers	1,3-1,8‰		
Research Alcohol	Novice drivers	≥1,3‰	€1.192	2015 – current
	Experienced drivers	≥1,8‰		2015 – current

85 https://www.wodc.nl/binaries/Cahier%202019-20_Volledige%20tekst_tcm28-420582.pdf.

Regulatory basis

The Central Office for Motor Vehicle Driver Testing (CBR) could impose an alcohol interlock programme from December 2011 to September 2014. In March 2015, the High Court decided that someone who is obliged to participate in an alcohol interlock programme cannot also be prosecuted.

One of the main reasons for this is that the alcohol interlock in an administrative measure imposed by the CBR. The judicial system (i.e. a judge) is not involved. Although, driving under influence is in principle also a criminal offence. People that are obliged to participate in an alcohol interlock program can also be prosecuted and punished by the court. On that basis the High Court decided that the measure can indeed be seen as double punishment.[86]

Costs of the programme

The following costs were related to the Dutch offender/rehabilitation programme:

- Introduction costs = € 360;
- Recurring costs = € 111 - € 126,50 per month;
- Conclusion and follow-up costs = € 1.120;
- The total programme costs (for 2 years) are between € 4.000 and € 5.000. All costs are of these costs are paid by the participant.

Programme specifics: programme cancellation in 2015

In 2014, the alcohol interlock programme (ASP) was evaluated on the following aspects:

- participation rates;
- experience of the stakeholders;
- relationship of the AIP to criminal law;
- effects on road safety.

After the evaluation, the High Court decided in 2015 to stop imposing ASP's. The main argument for this was the lacking possibility to adjust for personal circumstances, which according to the Court led to inequality and arbitrariness, and double sanctioning due to fines and installation of alcohol interlock. The Dutch Ministry of Transport and Environment cancelled the programme as of September 2016, because of the limited number participants.[87] [88]

Norway

Introduction

Following an alcohol interlock seminar (in April 2007), the Government Minister of Transport and Communication (Liv Signe Navarsete) established a work group to prepare practical and political platform for an offender program, largely based on the Swedish model. The initial strategy included both offender programs, and compulsory use as a proactive instrument for preventing driving cars under the influence of alcohol. The following priorities are set:

- School buses in particular and buses in general (mandatory requirement);
- Taxi and other passenger vehicles;
- Transport Fleet sector;
- Construction Operations;
- Heavy transport sector;
- Alcohol interlocks in passenger cars (preventive use).

[86] https://www.raadvanstate.nl/@8599/cbr-mag-geen/.
[87] https://etsc.eu/wp-content/uploads/Charles-Goldenbeld-SWOV.pdf.
[88] https://www.wodc.nl/binaries/FS%202018-8_1769h_tcm28-361825.pdf.

Target group

From January 1st 2019, it is mandatory to have alcohol interlocks in buses and minibuses in Norway. The Law is open for all vehicles doing transport for payment, but in the sub-law (forskrifter = regulations in Norway) it was restrained to busses and minibuses, with option for expansion later. Within 2023 all busses and minibuses on Norwegian roads, new and old, are to be equipped with alcohol interlocks.

Costs of the programme

The purchase costs of the alcohol interlock are €800 euro, whereas the recurring costs are equal to € 19,90 / month

Programme specifics: voluntary uptake

The Norwegian Taxi Association (represented in NEK/NK BTTF 116-2, Alcohol Interlocks for Motor Vehicles) was disappointed to be left out, and has requested mandatory use of alcohol interlocks also for taxi. A significant number of local taxi companies, are now implementing alcohol interlocks in their taxi cars, as company policy. The same is the case with transport companies, both commuter and heavy trucks. Contractors of transports do more and more include demand for alcohol interlocks in contracts with transport companies. Besides the mandatory use, a "voluntary" implementation and use of alcohol interlocks has therefore developed in a unexpected direction.

France

Introduction

In France, alcohol interlock related measures came into force in 2010. From then on, this sanction has been rarely used. In the meantime, several départements (7 in total) have been trialling a wider usage of alcohol interlocks in order to reduce drink-driving offences. Following from these successful trials, the programme is rolled out on a nationwide scale in 2019.[89] [90]

Target group

Offenders (with a BAC above 0.8 g/l) are given the option to install an alcohol interlock instead of a driving ban. Since 2020, the interlock can be installed for a maximum of one year, while it was previously six months. In addition, the government announced in 2018 that in cases of recidivism an alcohol interlock will be obligatory.[91]

Regulatory basis

In France, a judge is able to sentence you to drive with an equipped alcohol ignition interlock device (EAD). The judge can oblige a driver with an EAD in the following cases:

- Driving offense while alcoholic;
- Obviously intoxicated driving offense;
- Refusal to submit to blood alcohol checks;
- Recurrent driving under the influence of alcohol or drugs;
- Repeated refusal to submit to alcohol tests or drug tests;
- Homicide or unintentional injury by driving while under the influence of alcohol.

The duration of the penalty has the following options:

- The duration is 5 years maximum in case it is an additional sentence;
- The duration is between 6 months and 3 years if it is a penal composition measure;

89 https://etsc.eu/alcohol-interlock-programmes-finally-get-a-boost-in-france/.
90 https://etsc.eu/france-rolls-out-alcohol-interlock-programme-nationwide/.
91 https://etsc.eu/alcohol-interlocks-now-mandatory-in-belgium-for-high-level-and-repeat-offenders/.

- In case of the latter option, a road safety awareness course must be followed (see section on programme specifics). [92]

Costs of the programme

The offender is charged with € 1.300 to purchase an alcohol start-up test. Another option is renting the device for (around) or € 100 per month. The prices are excluding the price of assembly and disassembly.[93]

Programme specifics

In order to impose an alcohol interlock as an alternative measure (compared to license suspension) the following conditions should be met by the driver:

- The alcohol interlock should be installed by the participants own expense;
- The participants should carry out a medical-psychological follow-up (consists of consultations, but without monitoring during the programme). [94]

Belgium

Introduction

Belgium started with an alcohol interlock programme in 2010. In the period before 2018, judges had the possibility, not the obligation, to impose the program for a 1 to 5 year period for offenders caught with a BAC above 0.8 g/l. However, since the start of the programme only a limited number of offenders have participated in the offender programme (anno 2018 only 67 participants). The main reason for little interest so far is that judges were hesitant to impose an alcohol interlock programme, because the offenders does not always agree to participate and the participation costs are relatively high.[95]

From the 1st of July 2018, the Belgium legislator made a couple of regulatory changes (see section on regulatory basis). Since these regulatory changes are obtained, the number of court-imposed alcohol interlock rose tremendously. Between 2015 and 2018, the number of participant varied between 9 and 23. In 2019 and (the first two months of) 2020 the measure was imposed respectively 167 and 88 times.[96]

Target group

The main reason for changing the legislation in this matter is based on the recent findings by VIAS Institute**Invalid source specified.**. According to this study, an alcohol interlock reduce the chance of recidivism with 75%. Therefore, the programme's prime focus is on recidivist, which makes a support programme essential to make sure the driver stays away from their bad habits.

Regulatory basis

Before 2018, the Road Traffic Act leaves it up to judges to decide whether or not to impose an alcohol interlock. When looking in the rear-view mirror this turned out to be unsuccessful. In practice, judges were not inclined to impose an alcohol lock, because offenders could not afford the associated cost of an alcohol interlock, the support program is to heavy or offenders will (potentially) fear to lose their job.

From the 1st of July 2018, the rules with regard to alcohol interlocks have been changed as follows:

---

92 https://www.securite-routiere.gouv.fr/reglementation-liee-lusager/conducteurs-avec-ead/lethylotest-anti-demarrage.

93 https://www.permisapoints.fr/legislation/securite-routiere-ethylotest-anti-demarrage-place-suspension-permis.

94 ETSC (2020), https://etsc.eu/wp-content/uploads/ALCOHOL_INTERLOCKS_FINAL.pdf.

95 https://mobilit.belgium.be/nl/wegverkeer/rijbewijzen/alcoholslot.

96 https://newmobility.news/2020/06/26/spectacular-rise-in-court-imposed-alcolocks/.

- The judge is, in case of a first offend and a BAC above 1.8 g/l, obliged to impose an alcohol interlock. The judge has the possibility to waive the installation of alcohol interlock, but needs to explicitly motivate the reason. In that case, the fine will vary between 1.600 and 16.000 euros;
- The judge is, in case of recidivism and a BAC above 1.2 g/l, obliged to impose an alcohol interlock. Moreover, the recidivist loses the right to drive are car for 3 months, which is linked to multiple investigations (medical, psychological, theoretic and practical).[97]

In case of a mild intoxication of alcohol (from 0.8 per mile), it is still up to the judge to decide whether or not to impose an alcohol interlock. However, in case of an intoxication level of 1.8 per mile, the judge is in principle obliged to impose an alcohol interlock, unless the judge believes this is not an adequate sanction. This decision should be explicitly motivated. Because of these legal changes one could state that the alcohol interlock becomes the rule rather than the exception.[98]

There is an exception made in case the offender is dependent on alcohol. If so, on the basis of physical or psychological reasons their license will be withdrawn.

Costs of the programme

The costs of the programme are split into two cost components: (1) alcohol interlock device and (2) support program.

Alcohol interlock

The costs of purchasing the alcohol interlock are ranging from € 2.546 (for 1 year) and € 4.090 (for 3 years). The additional costs for services are ranging from € 1.484 - € 1.151 per year (dependent on the participation period).

Support program

The additional support programme costs cover education, analyse the alcohol interlock records, personal counselling, closing conversation and administrative activities related to the programme. The costs of the support program are dependent on the participation term and payment method. Table A.2 presents the total costs with a range from € 1.210 (1-year) to € 2.178 (5-years).

Table A.2 Costs of the support program

Period	Costs
1 year	€ 1.210
2 years	€ 1.452
3 years	€ 1.694
4 years	€ 1.936
5 years	€ 2. 178

Source: Vias institute (2020), wat is de kostprijs van een alcoholslot?

Programme specifics

As indicated previously, the programme contains an additional support programme to create awareness about the risks of alcohol, drink driving, recidivism and technical aspects of the system. There are three entities involved during the programme: VIAS Institute, Psycho Medisch Advies (since September 2018) and Noviter (since July 2019).[99]

97 https://mobilit.belgium.be/nl/wegverkeer/rijbewijzen/alcoholslot.
98 Idem.
99 ETSC (2020), https://etsc.eu/wp-content/uploads/ALCOHOL_INTERLOCKS_FINAL.pdf.

Denmark

Introduction

In Denmark, the sanction for drink driving have been changed several times since 2005. According to the most up-to-date information provided by the Danish Transport Authority, there are two schemes in place, a mandatory and voluntary scheme. The conditions of these two schemes depend on the level of intoxication and whether the offender has been caught multiple times. [100]

Target group

In Denmark two types of alcohol programmes / schemes are in place.

Mandatory scheme

The offender is imposed with a mandatory scheme in case of the following conditions:

- The offender is caught with an BAC level of over 2.0 per mille;
- The offender is caught several times (except when the BAC was 2.0 in the first time and 1.2 the second time);
- The mandatory scheme means that the offender has to drive two years with an alcohol interlock (after the disqualification period).

Voluntary scheme

The offender is imposed with a voluntary scheme in case of the following conditions:

- The offender is caught with a BAC between 1.2 and 2.0 per mille;
- The offender is caught twice (the first time at most 2.0 per mille and the second time at most 1.2 per mille);
- The voluntary scheme means that the offender can regain their driving license by participating in an alcohol interlock scheme. This lasts until the disqualification period expires.[101]

Regulatory basis

In case the court denies you the right to drive a car, the alcohol lock schemes (in line with the earlier description) complements the sanction for driving under influence. Furthermore, the alcolock must be approved by the Danish Transport Authority and is therefore an administrative sanction. [102]

Costs of the programme

The purchase and leasing costs of installation of an alcohol interlock are roughly as follows:

- Purchase costs (incl. installation) vary – dependent on the model – between €2.620 and €2.750 (SEK 19,500-20,500 incl. VAT);
- Leasing consists of €122 (909 SEK / month). This monthly payment includes the alcohol lock à €1.800 (approx. SEK 13,375), assembly à €170 - €470 (approx. SEK 1,250 - SEK 3,500), service à €150 (approx. SEK 850) and administration of log files à €500 (3,750 SEK).

Next to the costs of acquiring a new driver's license, applicants of an alcohol interlock driving license should pay an additional fee for connection with the applications. This fee is (per 1st of April 2015) for participants in the voluntary scheme equal to roughly €370 (DKK 2,765).[103]

---

[100] https://etsc.eu/wp-content/uploads/Drink-Driving-policies-from-Denmark-Pernille-Ehlers-Danish-Road-Safety-Council.pdf.
[101] https://fstyr.dk/da/Regler-om-koerekort/Alkolaas-ANT-kursus-efter-spirituskoersel.
[102] https://www.fstyr.dk/da/-/media/FSTYR-lister/Publikationer/Vejledning---Alkol%C3%A5s-efter-spiritusk%C3%B8rsel.pdf.
[103] https://fstyr.dk/da/Regler-om-koerekort/Alkolaas-ANT-kursus-efter-spirituskoersel.

Finally, the offender should complete a course about alcohol, drugs and traffic (ANT course). The course costs roughly €430 (DKK 3,200).[104]

Programme specifics

Annually 1.200 people lost their license due to driving under influence of alcohol. They are obliged to participate a course (held in Central Jutland) as a result of their actions. From 2015 onwards, roughly the same amount of people will be joining a similar course as a result of driving under influence of drugs.[105]

United Kingdom

Introduction

The United Kingdom (and Wales) has the highest BAC limit (0.8 g/l) in place of all European countries. In Scotland the BAC limit is set at 0.5 g/l and is thereby somewhat stricter.[106] Since 2018, Durham started a first trial with alcohol interlock in the UK. As part of the trial, devices were offered free of charge to (voluntary) participants and offenders are proactively approached to have an alcohol interlock fitted to their car.[107]

Despite various efforts, such as campaigns, the UK still faces more than 9.000 casualties as a (direct or indirect) result of drink driving.[108] In 2019, a feasibility study will be performed that focusses on the adding alcohol interlocks to drink-driving rehabilitation programmes.[109]

Regulatory basis

Crossing the legal (BAC) limits could result in a driving ban for at least 12 months, a fine up to 5.000 pounds, penalty points on your license (3 – 11 points) and potentially prison time (up to 6 months). However, currently there is no alcohol interlock programme in place enforced by law.[110]

Target group and costs of the programme

Apart from the trial, the programme is not yet enforced and imposed by law. Therefore, no description of the target group and a cost estimation can be provided.

Lithuania

Introduction

Lithuania has become, as of the 1st of January 2020, the ninth EU Member State that introduced an alcohol interlock as part of a rehabilitation programme. Since 2016, Lithuania build up experience with the use of alcohol interlock by fitting these devices in 80 school buses, shuttle buses in Vilnius and voluntary installation by a couple of passenger and freight companies.[111] As of the 1st of January 2020 Lithuania took the next step by adjusting the Law on Road Traffic Safety and adding the definition of an alcolock and allowed imposing a restriction on driving without an alcolock. [112]

---

[104] https://stiften.dk/artikel/1200-narkobilister-skal-p%C3%A5-skoleb%C3%A6nken.
[105] https://stiften.dk/artikel/1200-narkobilister-skal-p%C3%A5-skoleb%C3%A6nken.
[106] https://www.rivervaleleasing.co.uk/blog/posts/alcohol-interlock-device-uk.
[107] https://www.durham.police.uk/news-and-events/Pages/News%20Articles/Durham-Police-Introduce-UK's-First-In-Car-Breath-Test.aspx.
[108] https://www.rivervaleleasing.co.uk/blog/posts/alcohol-interlock-device-uk.
[109] https://etsc.eu/uk-government-to-review-potential-of-alcohol-interlocks/.
[110] https://www.rivervaleleasing.co.uk/blog/posts/alcohol-interlock-device-uk
[111] https://etsc.eu/lithuania-launches-alcohol-interlock-programme/.
[112] http://sumin.lrv.lt/lt/naujienos/nuo-2020-metu-galimybe-anksciau-atgauti-vairuotojo-pazymejima.

Target group

The alcohol interlock-based programme for rehabilitating drink-driving offenders, which will consist of a period where the offender is banned from driving. When it comes to the rehabilitation programme, the following offender distinction is made:

- Low-risk offenders are drivers with over two years of driving experience and are caught with a BAC level between 0.4‰ to 1.5‰. For novice drivers with up to 2 years of driving experience a BAC level between 0.0 and 0.4‰ is applicable;
- High-risk offenders are novice drivers in excess of 0.4‰ BAC. For other drivers exceeding the BAC level of 1.5‰ is applied as a threshold. A driver who refuses to provide a sample is also considered a high-risk offender.

The offenders categorised as being high-risk are required to attend the rehabilitation course. Certain high-risk offender will need to pay a fine of €280 – €1.000 (LTL 1,000 to 3,500) and are imposed with a driving disqualification between 1 and 3 years.

Regulatory basis

Drivers who have been caught with a BAC level up to 1.5‰ and lost their driving license will be able to apply for an alcohol interlock programme. Representatives by the Ministry state that the administrative penalty may be imposed by a court or an out-of-court administrative offense authority.

The Ministry of Health is responsible for the driver rehabilitation course. However, this programme includes several public institutions and private companies. Courses include re-educating offenders, training, changing alcohol consumption habits, and introducing drivers to potential threats.[113]

Costs of the programme

The following cost aspects are related to the alcohol interlock programme in Lithuania:

- The price of the alcohol interlock system start from €1.000 to €1.200;
- Installation of the system strongly depends on the specific details, but are according to a Lithuanian supplier equal to roughly €300;
- Calibration of the alcohol interlock is estimated at €50 p/year;
- The price of rehabilitation courses for the offending driver would vary from €85 to €115 (300 to 400 LTL).[114] [115] [116]

Poland

Introduction

In Poland, new measures came into force on 18th of May 2015, which touched upon the following:

- Severe punishments for drunk drivers: among other prison time, suspending the driving licence for life, fines between €1.100 – €2.200 (PLN 5.000 – 10.000);
- Driving under influence offenders will be obliged to install an alcohol interlock. In case the person is banned from driving because of a drunk driving offense they can apply for driving with an alcohol interlock after half of their sentence is fulfilled;
- Recidivist will banned for life. However, these offenders can apply after 10 years of their sentence for driving with an alcohol interlock.

113 https://tka.lt/assets/uploads/sites/2/2019/09/Vairuotoju-reabilitacijos-programos-koncepcija.pdf.
114 https://www.lrt.lt/naujienos/eismas/7/1129888/alkobloku-naudojimo-tvarka-aiski-bet-yra-kita-puse-kokybiski-kainuoja-tukstancius-pigesnius-galima-apgauti.
115 https://respublikosvm.lt/alkoblokas-kaina-lietuvoje-antialkoholinis-variklio-uzraktas/.
116 https://tka.lt/assets/uploads/sites/2/2019/09/Vairuotoju-reabilitacijos-programos-koncepcija.pdf.

Poland follows Belgium, Denmark, France and Sweden by imposing these new measures that are backed by the court. [117] [118] [119]

Target group

The alcohol interlock programme targets the following type of offenders:

- Offenders driving with a BAC between 0.2 and 0.5 g/l (offence);
- Offenders driving with a BAC above 0.5 g/l (crime).

The offender programme targets high-risk groups (often young men and recidivists). Polish accident statistics show that the risk of being involved in driving-under-influence accidents is significantly higher in the 18-24 age group.

Regulatory basis

The option of a conditional shortening of the driving restriction was introduced by the amendment to the Act - Road Traffic Law (effective from May 18, 2015). For drivers that are banned for life will have the opportunity to apply for a change (after 10 years). In these cases, the court will make a decision after examining all circumstances, e.g. environmental opinion.[120]

Costs of the programme

The following cost aspects are related to the alcohol interlock programme in Poland:

- Purchase costs of an alcohol interlock range from €670 to €1.150 (PLN 3,000 – PLN 5,000);
- Installation costs range from €90 to €135 (PLN 400 to 600) (dependent on the type of car);
- Disassembly costs are equal to roughly €45 (PLN 200);
- The device needs to be calibrated once a year with an expected cost of €10 (PLN 50).[121]

Finally, the customer is obliged to pay for the installation of the device.

Switzerland

In 2018, the Swiss parliament has voted to cancel the planned introduction of alcohol interlocks for drink-driving offenders in Switzerland in a move described by Swiss road safety experts as 'incomprehensible'. [122] The government had evaluated the measure and concluded on the basis of costs that the programme should be cancelled.[123]

117 https://etsc.eu/poland-seventh-eu-country-to-require-interlocks-for-convicted-drink-drivers/.
118 https://www.premier.gov.pl/en/news/news/stricter-punishments-for-drivers-since-18-may.html.
119 https://www.motofakty.pl/artykul/blokada-alkoholowa-przepisy-zastosowanie-i-skutecznosc.html.
120 https://www.prawodrogowe.pl/informacje/kronika-legislacyjna/kto-moze-skorzystac-z-prawa-do-blokady-alkoholowej.
121 http://blokada-alkoholowa.pl/.
122 https://etsc.eu/swiss-cancellation-of-alcohol-interlock-programme-will-make-road-safety-targets-harder-to-reach/
123 https://www.astra.admin.ch/astra/de/home/dokumentation/medienmitteilungen/anzeige-meldungen.msg-id-67319.html

GETTING IN TOUCH WITH THE EU

In person

All over the European Union, there are hundreds of Europe Direct information centres. You can find the address of the centre nearest you at: https://europa.eu/european-union/contact_en

On the phone or by email

Europe Direct is a service that answers your questions about the European Union. You can contact this service:

– by freephone: 00 800 6 7 8 9 10 11 (certain operators may charge for these calls),

– at the following standard number: +32 22999696, or

– by email via: https://europa.eu/european-union/contact_en

FINDING INFORMATION ABOUT THE EU

Online

Information about the European Union in all the official languages of the EU is available on the Europa website at: https://europa.eu/european-union/index_en

EU publications

You can download or order free and priced EU publications from: https://publications.europa.eu/en/publications. Multiple copies of free publications may be obtained by contacting Europe Direct or your local information centre (see https://europa.eu/european-union/contact_en).

EU law and related documents

For access to legal information from the EU, including all EU law since 1952 in all the official language versions, go to EUR-Lex at: http://eur-lex.europa.eu

Open data from the EU

The EU Open Data Portal (http://data.europa.eu/euodp/en) provides access to datasets from the EU. Data can be downloaded and reused for free, for both commercial and non-commercial purposes.

Catalogue number
MI-02-21-452-EN-N

Publications Office
of the European Union

ISBN: 978-92-76-34080-5

doi: 10.2832/284545