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DRUID

Driving under the Influence of Drugs, Alcohol and Medicines

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Evaluation of legal measures to combat DUI / DUID

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Evaluation of legal measures to combat DUI/DUID

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List of abbreviations

DUI	Driving under the influence of alcohol
DUID	Driving under the influence of illicit psychoactive substances other than alcohol
n	Size of the sample
NHTSA	National Highway Traffic Safety Administration
OECD	Organization for Economic Co-operation and Development
RBT	Random Breath Testing
THC	Tetrahydrocannabinol (the main psychoactive substance in the cannabis plant)

1. Executive summary

This report analyses how driving under the influence of psychoactive substances can be combated effectively by legal interventions. It focuses thereby on the criminological point of view. All statements in this report are related to commonly used substances in traffic and to the most relevant high-risk user groups, because a panacea for all substances and groups involved in driving under the influence cannot be offered due to their heterogeneity. In any case, it is recommendable to implement laws which are targeted at those special driver groups (e. g.: adolescent drivers; high-BAC drivers). With the support of empirical findings, it is possible to tackle clear tendencies for promising countermeasures. The next step would then be to discuss suitable, efficient and effective ways and means of enacting them on the European political level.

The optimal way of reducing impaired driving due to psychoactive influence within the whole society would be the strengthening of individual self-decisions against the consumption of psychoactive substances at large scale (e. g.: via school education programs or by creatively conceived mass media campaigns, also using the modern possibilities of the internet). As this objective cannot be reached entirely and, in particular, swiftly, legal interventions are at present, and will remain in the future, necessary to reduce psychoactive impairment in traffic. Access restrictions seem to be very effective, because they reduce - if properly implemented and controlled - the availability of impairing substances in a direct manner. The elevation of the legal purchase age for alcohol or the implementation of enhanced alcohol taxes can be named as telling examples in this context.

Alcohol impaired driving is still the most important road safety risk. There are several ways to diminish that risk.

The most general of those, and also a suitable one for special risk groups, is the enactment and implementation of legal BAC thresholds. In this respect, the per se laws must be considered as the most effective approach to curb DUI. The standard per se value should not be higher than 0.05 % as recommended by EU to all member states (Commission Recommendation 2001/115/EC of 17 January 2001). The effectiveness of per se BAC values below 0.05 % is very much dependent on the prevailing societal, legal, political environment and the enforcement activity of the police in the respective member state, but also on habituation.

Further on, explicit reactions to the breach of rules seem necessary. Studies show that informal non-legal consequences (e. g.: social disapproval, especially by peers and friends) are to be considered as pivotal in conducing people to law abiding behaviour. Especially in the case of adolescent offenders, they seem regularly to have much higher impact than formal legal consequences. However, a complete abandonment of punitive legal sanctions seems not the appropriate way to deal with law violations. As jail sanctions and even prison sentences

are, as comparative evaluation studies demonstrate, no effective countermeasures for DUI, they should be avoided as far as possible, in particular among first-offenders, at least in cases without aggravating circumstances. In contrast, well-executed probation orders are suitable for first- and repeat-offenders alike. Fines are much more effective among adolescent offenders than among adults, already due to limited financial means of the former group.

For special driver groups, the implementation of a zero-tolerance approach seems to be appropriate. Especially for young and novice drivers, the zero-limit is the most effective way to deal with alcohol in traffic. For convicted DUI offenders, a lowering of the legal threshold for a certain period of time after the judicial or administrative conviction seems to be promising to enhance traffic safety, but the practical implementation has to be assured. For other risk groups (e. g.: professional drivers, drivers of large vehicles or drivers of vehicles carrying dangerous goods), the enactment of lower legal per se BAC levels should be discussed with respect to the specialties of these driver groups. The implementation of BAC thresholds of at maximum 0.02 % was also recommended by the European Commission (Commission Recommendation 2001/115/EC of 17 January 2001).

A very vast problem in case of DUI is the low risk of apprehension, because only apprehended drivers are subjected to eligible punitive and especially rehabilitative measures. Thus, further efforts in this field must focus on the enhancement of the enforcement endeavours. The enforcement of per se laws is rather easy in principle, but the complexity increases with a decrease of the per se BAC value. The implementation of random breath testing laws is inevitable for securing a vigorous enforcement of zero-tolerance laws in general, but in particular for higher risk thresholds. As low amounts of alcohol regularly do not cause any visible signs of impairment for observers (e. g.: traffic police patrol officers), the otherwise valid suspicion based strategy is not promising here. In consequence, the implementation of legally fixed evidential analytical procedures is recommendable.

DUID, which comprises illicit drug consumption and the intake of illegally used medicines, is a much more complex issue than DUI. Therefore, it is rather complicated to develop effective counterstrategies. The main problem is the diversity of DUI and DUID offenders. The above mentioned statements and proposals in case of DUI are only partly valid in case of DUID and, therefore, they have to be specified.

The informal sanctions are also much more effective in preventing DUID than the formal ones, but due to the often comparatively more permissive social environment of DUID offenderes, it is more complicated to realize this aim. However, the effectiveness of the named formal penalties may not differ significantly as far as the respective personal traits of offenders are taken into consideration.

In the near future, only the zero-tolerance and the impairment approach are available in case of DUID. As far as the first approach is favoured, it must be acknowledged that the cut-offs as limits of detection do neither include recent psychoactive substance consumption nor being under their influence. Thus, it is urgently necessary to implement lower effect limits which are able to prove the negative affection of the driving skills. Regarding the enforcement procedure, the zero-tolerance approach is also more promising. Especially the implementation of random drug tests is urgently necessary to increase the currently very low risk of apprehension. As far as the development of valid screening devices is possible, the enactment of legally fixed evidential analytical procedures is recommendable.

In order to ensure an efficient and effective enforcement of impairment laws, it is essential to obligate traffic police officers to notice very thoroughly and completely all signs of impairment in each case in the official protocol, because these records are the main and regularly crucial basis for a court conviction. In order to enable those officers to fulfil their duty properly, it will be regularly necessary to offer them special training which will help them to become sensitive for signs of impairment and then to recognize and assess this impairment when controlling the persons at the spot. Nevertheless, till now the effectiveness of enforced impairment laws is commonly relatively poor.

The enforcement strategies must be targeted at special driver groups. On a general level, it must be distinguished between the detection-based and the deterrence-based strategy. The detection-based strategy is more important for high-BAC drivers and hard-core consumers of drugs, because they can hardly be deterred by other means. Therefore, an enhancement of the control density is less effective than an increase of the control efficiency. In contrast, the deterrence-based strategy is more suitable for the majority of social drinkers, young drink drivers and occasional drug users. To achieve this objective, highly visible testing sessions at places and during times with high traffic, but low offender density (e. g.: early morning hours) must be conducted. For the detection strategy, places with inverse characteristics must be chosen, but it is important to conduct unobtrusive controlling sessions. In each case, it is important to pursue those efforts continuously.

Young drivers in general are being characterized by a low level of awareness regarding legal interventions and enforcement efforts. Therefore, comprehensive accompanying publicity and education campaigns are urgently recommended.

In case of the use of legal (medicinal) drugs in traffic, policymakers have to find a balance between the aspects of traffic safety for all, and the therapeutic needs of the single road user. Regularly, zero-tolerance laws are not the appropriate approach to deal with psychoactive medicines in traffic, because the main aim of any legislation in this field, targeting mostly older persons, must be the perpetuation of the possibility to drive safely as far as feasible. Many drivers need the medicinal substances urgently to reconstitute their fitness to drive. Consequently, it is not necessary to deter them, but to increase preventive efforts, in particular educative measures. Thus, the impairment legislation is more suitable in this case. The main disadvantage of this type of law is the above mentioned quite complicated enforcement procedure.

Mixed intoxication through alcohol and other psychoactive substances (included legally used ones) poses a much greater traffic safety hazard than the sole consumption of each of these substances. Consequently, the per se BAC limit in those cases must be lower than for the exclusive impairment through alcohol, at best zero. The specific design of this type of law must be determined by interdisciplinary discussions.

The prior statements regarding DUI and DUID are based on the assumption that offenders are at least in principle deterred by the existing legal regulations and their enforcement. But this modus operandi does not work in case of addicted or even not yet addicted, but at least hard-core drinkers and consumers. The later ones are often recidivists, mainly because they do not make up a rational choice before starting to drive under the influence of substances. These offenders must be identified as soon as possible, primarily because for them the imposition of rehabilitative measures seems the only appropriate way to combat the underlying consumption problem. However, for most of them a complete abandonment from punitive

sanctions would not be appropriate. Since it is being proven by empirical evidence that these drivers show a measurable higher level of legal knowledge than other driver groups, a further enhancement of publicity campaigns regarding legal changes alone, without the additional strategy to confront them with personally directed consequences for norm-violating behaviour, seems not promising.

2. Introduction

2.1 General statements

Driving is often considered as a necessity to maintain one´s livelihood. Thus, it is not amazing that the problem of psychoactive substances in traffic is present since several decades, because the consumption of these substances is a considerable part of the life of a number of drivers. While DUI is very well investigated in the sciences, this statement is not valid for DUID. Driving under the influence of impairing substances other than alcohol increased in the recent years. This may be mainly due to a higher risk of detection, but not to an actual increase of the number of impaired drivers. Particularly, the increased enforcement efforts, the technical progress and professional training of police officers in this field contributed comprehensively to the named development. Within the recent years, the incidence of drunken driving has been combated successfully, but far from entirely. So, alcohol in traffic remains the biggest problem for traffic safety. Nevertheless, the prevalence of legal psychoactive substances in European traffic is two to five times higher than the one of illicit drugs (Ojaniemi et al., 2009 with reference to Walsh et al., 2004). Due to the high dark field in this area, the problem of drugs in traffic may be greater than estimated and will increase within the next years.

The common downward trend regarding DUI is not only based on legal interventions, but also on further circumstances like safer cars and better roads. Additionally, DUI/DUID downward trends often appear simultaneously with an economic crisis (Ojaniemi et al., 2009). Another main contribution to this trend is the enhanced social disapproval of drunken driving. This phenomenon is at least partly affected by legal regulations, because they aim at directing future behaviour.

The lack of effective counterstrategies against DUID is mainly based on the fact that this issue is a much more complex one than DUI, namely due to the high number of different psychoactive substances and their different implication on the individual physical and mental performance. In addition, unforeseeable difficulties to develop valid on-road testing devices appeared. To sum it up, all scientific research in the field of psychoactive substances other than alcohol features a backwardness of several decades in comparison to alcohol. Comprehensive and interdisciplinary projects like DRUID are urgently necessary to regain this backwardness as fast as possible. Nevertheless, DUI still remains a vast problem for traffic safety. Thus, this topic is also covered and updated by this document.

The legal and police interventions to combat DUI cannot be simply transferred to DUID, because these two issues cannot be compared without taking several specialities into consideration. When DUID legislation is discussed, it is widely contentious if medicinal drugs are also covered by this topic. The discussion in and among the European member states is still ongoing (overview of pros and cons: de Gier, 2004). Generally spoken, in case of medicinal drugs in traffic, policymakers have to find a balance between the aspects of traffic safety and the therapeutic needs of the single road user. The legal solutions for driving under the influence of medicinal substances cannot treat uniformly all different consumption behaviours, but they must differentiate very carefully between all conceivable scenarios. Up

to now, an individual adjudication of each case seems inevitable, but it is not satisfactory from the practical point of view.

2.2 Definitions

The following definitions are the foundation for the further understanding of this analysis. Other, more specific definitions will be outlined in the according chapters.

From the criminological viewpoint the deterrent effectiveness of legal interventions is the most crucial element to reduce the incidence of DUI/DUID. Two kinds of deterrence and prevention exist, general and special deterrence/prevention. While general deterrence looks at the effects among the public as a whole or at least a subgroup like all potential drivers under the influence of alcohol, drugs or medicines, special deterrence focuses on the particular offender, who already showed deviant behaviour.

2.2.1 General deterrence and prevention

General deterrence aims at dissuading others, who were not the explicit subject of the imposed sanctions, from committing the same or a similar crime the offender was punished for. This aims is reached through the sheer fear of punishment. General deterrence consists of the following elements, which can overlap each other: punishment certainty, celerity and severity (Legge & Park, 1994). This sequence also complies with the importance of the three elements in the general deterrence theory (Freeman et al., 2006; Fischer, 1998). General deterrence appears on the level of the threat of legal consequences, of elucidation, prosecution and conviction.

The punishment certainty consists of the risk of detection[1], which is mainly influenced by the control practice of the police, and the pressure of prosecution. Due to stricter requirements regarding the relevant evidence for a law infringement, the judicial procedure features higher rates of dismissals than in case of administratively imposed sanctions. Therefore, the pressure of prosecution is commonly lower in the first case. The swiftness of the sanctioning process is mainly influenced by the applied procedure of imposition, judicial or administrative, because the first one is more often delayed due to the regular imperative of time-consuming court sessions. The severity of punishment includes - besides the abstract legal threat of sanctions - the practice of imposition. A homogeneous, diaphanous and consistent sanctioning practice is one main general deterrent factor. This statement counts especially for different jurisdictions of one country, but also for the sanctioning among the European member states. It is hardly justifiable why driving under the influence of psychoactive substances is more dangerous, leading to more severe penalties, in some jurisdictions, while it is regarded as a less severe offence in others. The associational element for all the named factors is the public legal knowledge, because when the targeted population is not aware of the compulsory consequences for contraventions, the three core factors are not able to deploy their general deterrent effectiveness.

For the empirical measurement of the general deterrent impact of DUI/DUID countermeasures, it is necessary to reveal the change of the incidence rates of drivers under psychoactive impairment. As the exact numbers are ascertainable at best with roadside surveys, which are conducted very rarely, other proxy variables must be applied. The number of drivers convicted for DUI/DUID is a rather imprecise mean, because the dark field is very wide and, additionally, it is dependent on the intensity of the police enforcement. Hence, the

[1] The term risk of apprehension is used synonymously in this document.

numbers of substance related fatalities or (serious) injuries are in most empirical studies used to estimate the incidence of impaired driving. In these cases, the dark field is very small and, thus, much more appropriate for scientific purposes. As in many jurisdictions no data regarding the BAC or substance level of the killed or injured driver are available, a lot of empirical studies used proxy variables like the rate of single vehicle night time accidents, which are very likely to be alcohol related (Briscoe, 2004 with reference to Henstridge et al., 1997).

The counter aspect of general deterrence is called general prevention and aims at the internalization of moral inhibitions and the socialization of preventive habits caused by legal interventions and, therefore, at clarification and stabilisation of the respective norm. General prevention compasses to cause long-termed learning, confidence, moral and pacification effects. The major basis for a high level of general prevention is the implementation of socially accepted legal regulations. In international research, this aspect is almost never evaluated, because it is nearly impossible to measure empirically the change of public confidence in relation to a certain behavioural aspect (e. g.: drunken driving) caused by the law amendment. Any change in this area is the result of highly complex procedures in a pluralistic society and, consequently, it is hardly possible to attribute the observed outcome to the impact of a single statutory measure. The results for general prevention are mainly influenced by the existing law in the respective country (Berger et al., 1990). It is well-known that the elements of general prevention are much more important than the factors of general deterrence to cause law-abiding behaviour in the long run. The level of disapproval of DUI/DUID is a main indicator for the general preventive impact. The compliance rates in Europe pertaining to the prohibition to drive under the influence of alcohol are commonly rather high, while the values are highest in the Northern member states (ESCAPE, 2003).

2.2.2 Special deterrence and prevention

Special deterrence has the objective to change the behaviour of the accused and convicted person to a future crimeless life through the impact of the sentence itself. The above mentioned three main deterrent factors punishment certainty, celerity and severity are also suitable in this context, because only the personal connecting factor changes.

The main indicator for specific deterrence is the recidivism rate. As far as empirical studies are evaluated within this document, only those evaluations are included which regard further DUI-/DUID-convictions as recidivism, because otherwise the special deterrent results are confounded by unspecific, non-substance related law violations.

In contrast, special prevention aims at the rehabilitation and social reintegration of the offender due to an improvement of the behaviour caused by a change of the personality and not only by the fear of further penalties.

2.2.3 Significance

Empirical studies usually make use of samples of e. g. persons or events or objects instead of dealing with whole populations etc. The statistically most suitable way so far is the drawing of representative random samples. When doing so, one is always and inevitably confronted with the risk of a sampling error (e. g. due to known and unknown variability among or between the “objects” of the empirical study). So, when researchers find a clear, and theoretically or substantially interesting, result like a ten per cent reduction of the reconviction rates among first-offenders when having undergone a treatment method “A” as compared to treatment method “B” such a result may actually be attributable to random fluctuations, and,

therefore, not showing genuine substantial links. In order to check whether observed differences are "true" ones or just lying within the range of random intervals, sophisticated statistical significance tests have been developed. Their results are shown as "P-values". In social and human sciences a probability value of <.05 is usually taken as an agreeable significant result. This implies in methodological terms: the probability that the observed outcome of a study is based on random variations is less then five per cent. Or to say it the other way round: One can be sure with more than 95 per cent confidence that the observed difference is a substantial one. If the significance level is going over 99 per cent (p <.01), the difference is usually being called "very significant". The most impressive significance level a study can reach, namely over 99.9 per cent (p <.001), is usually called "highly significant". If a couple of factors (variables) seem to be related with each other one can check the strength of the relation by using other methods leading technically to so-called correlation coefficients. Apart from that, quality criteria of measurement tools are the so-called validity and reliability of the results they are producing. Even very good statistical results deserve eventually to be checked for their relevance, which is whether or not they can serve as a meaningful basis for progress in theoretical refinement and/or in practical respectively policy oriented endeavours or undertakings.

2.2.4 Psychoactive substances and driving

The term psychoactive substances contains alcohol, illicit drugs and medicines (licit drugs), which are able to affect the central nervous system. Although it seems confounding to subsume medicines under the term drugs, it may not be neglected that some medicinal substances are as impairing as illicit drugs (de Gier, 2004). Medicines are only legal if they are prescribed by a physician and consumed like advised. But if these psychoactive substances are either not prescribed or consumed in other dosages like advised for purposes other than those for which they are intended, there is no reason why these consumption behaviours should be privileged in contrast to illicit drug use. Consequently, the named misuse of medicinal drugs is regarded as DUID.

2.2.5 Per se laws

Per se laws establish a fixed substance limit (e. g.: BAC) and if the driver is detected with a substance concentration reaching or exceeding the limit, he has committed a law violation without the necessity of showing any further signs of impairment. Thus, the intoxication of the driver is legally proofed and cannot be rebutted with other evidence. The only precondition for the use of breath/blood test results in the court session is the correct administration of the test procedure. Presumptive/prima facie laws are the weaker form of per se laws, because they allow the offender to proof that his driving abilities were not affected negatively during the drive, although the legal BAC limit was reached or passed. This kind of law is currently only rarely in effect. Zero-tolerance laws are a specific subgroup of per se laws with a substance concentration of zero. This means that any detectable amount of legally named psychoactive substances in the driver´s body fluids has to be considered as a law violation.

2.2.6 Impairment legislation

In case of impairment legislation, it must be proven in each single case that the driving skills of the driver are affected negatively. This behaviour-based approach does not require an abnormality during the driving session, but it is enough if signs of impairment are shown during the police stopping procedure. Most European countries use for these purposes fixed protocols. The cause for the impairment does regularly not matter, because it can be related to

physical illness or to consumption of impairing substances. In the latter case, it is not necessary that the consumption is a recent one, as far as the impairing effect continues.

2.3 Presentation of the general purposes of sanctioning considering modern theories of sanctioning

The imposition of sanctions for law violations serves four main purposes: incapacitation, retribution, deterrence and rehabilitation (Freeman et al., 2006). Incapacitation aims at the hindrance of future deviant behaviour by sentencing the offender to jail or imposing a vehicle related sentence on him/her[2] (especially vehicle forfeiture). The main aspect of retribution is the proportionality of the severity of punishment with regard to the severity of the offence. Retribution is dependent on very specific circumstances of the individual case and, thus, it is more located at the act of sanctioning in the narrow sense, which is not covered by this document. The aspect of rehabilitation is already covered by the comprehensive DRUID-Deliverables[3] 5.1.1 and 5.2.1. The imposition of punitive sanctions is commonly not connected with very high levels of rehabilitative impact. Consequently, this Deliverable will focus on the aspects of general and special deterrence.

Traffic offences committed under the influence of alcohol exhibit a specialty, which is very important from the criminological point of view. These law violations can be considered as "everybody offences", because (almost) every driver is in the situation of being a potential offender. Thus, the general deterrent effectiveness of threatened sanctions for DUI and of specific BAC thresholds is mainly influenced by the social acceptance of these legal regulations. In case of DUID, this statement is only partly valid, because the set of potential offenders is much smaller. Sanctions for DUI/DUID among the European member states are very heterogeneous as far as their amount is concerned, but the types of the sentences are mostly restricted to fines, jail penalties and licence measures, in particular driving ban or licence withdrawal. In few countries, the judge can substitute jail penalties by community work. The procedure of adjudication differs between judicial and administrative imposition, but the imposition of jail periods is regularly in the competence of courts and not of administrative agencies. In case of substance related accidents causing personal harm, in all member states the criminal courts are responsible for the imposition of the sentence (ESCAPE, 2003). In almost all member states, the range of available sanctions is much wider for the courts than for the administrations.

2.4 Differentiation between drug policy and traffic safety policy

In the following, the main differences between drug policy in general and traffic related drug policy will be outlined, because this differentiation will be relevant at several chapters within this document. Drug policy refers to the consumption of drugs and their legality within the whole society, while the traffic related drug policy only refers to dangers for traffic safety due to the consumption of psychoactive substances. The ministry of health is commonly the most appropriate organisation to develop and to implement drug policy (WHO, 2002), while the ministry of transport is regularly responsible in case of the second alternative. The aims of these two policies are different. On the one hand, there is the desire to increase public health (Chatwin, 2004; van Solinge, 1999) and to ensure the productive efficiency of the social network and the whole national economy by prohibiting the possession and the consumption of insalubrious substances. Of course, the ways to achieve this objective of drug policy are

[2] In this document the masculine form is used only for the reason of clearness, but it is self-evident that it covers males and females.

[3] Deliverables without further specifications are the ones of the DRUID-project.

very different among the European member states due to the absence of harmonized legislation in this field (apart from the EU drugs action plans). On the other hand, the main objective is to guard the road users and their constitutionally protected values health, life and property against harm, caused by drivers who are impaired by psychoactive substances. The main objective of general drug policy in relation to traffic safety is the reduction of the prevalence rates of psychoactive impairment in the society as a whole, resulting in a reduced incidence of impaired drivers. Additionally, the prevalence rates of legal substances (especially medicines) are mainly influenced by the legal regulations concerning prescription. Consequently, traffic related regulations have to focus on the enhancement of traffic safety, while causes for justification of general drug policy are manifold.

For drug policy, which spans over the cultivation, manufacture, distribution, possession and consumption of illicit drugs, two different major approaches exist, a tolerant policy in relation to the possession and consumption of drugs and a more restrictive and prohibitive one. As far as trafficking is concerned, all member states pursue a way of harsh penalisation. The first progressive approach aims at harm reduction and treatment of drug users in conjunction with decriminalization of the drug use and de- and self-regulation of the drug distribution (Weinacht, 2000). The second punitive approach, which is mainly based on the theory of general deterrence, applies criminal sanction not only on drug dealers, but also on drug consumers. The general zero-tolerance approach is regarded more and more critically in the society. Nevertheless, the prohibitive approach is wider spread among European member states (Chatwin, 2007).

The Pompidou I project evaluated possible connections between harsh or soft drug policies in general and in traffic among the European member states. This project was not able to confirm such a connection (Mettke, 2000). Overlaps of these fields are not desirable (Gillard, 2004), but in practice they appear several times. Nevertheless, the legal regulations in these two fields should not be conflicting, because otherwise it can be estimated that the acceptance of the respective rules among the targeted population will be quite low. Updates of existing or invention of new legal regulations must always be done with respect to the other area. It must be emphasized that a liberal approach in drug policy, which regularly deals with the self-damage of the consumers, must not conflict with a strict drug traffic policy, because in the latter case values of other road users are endangered. This approach is, for example, pursued in The Netherlands. Nevertheless, it may also be possible that the endeavours are conflictive if drug policy wants to prohibit a certain substance due to its noxiousness, but traffic related drug policy does not support this prohibition due to a lack of scientific evidence for the impairing effect of this substance. In this case, it can be assumed that the common understanding for such a governmental decision may be elevated when the scientific background is announced with the legal regulation. Therefore, it is important to note that legislators must be aware that the specific regulations within these two main groups are consistent and backed up with scientific knowledge. In the ideal case, these two areas work together hand in hand, because the synchronisation of these efforts should enhance the credibility of legal measures against impairing substances. In this way, the social disapproval, connected with a higher social pressure on the offender, can be increased.

3. Presentation of the main risk groups pertaining to DUI/DUID

A very comprehensive presentation of the characteristics of DUI/DUID offenders and recidivists is contained in Deliverable 5.1.1. Hence, only the main risk groups in traffic (see: Krüger & Schöch, 1995) are outlined, as far as it is important for the criminological contemplation. As the statutory methods executed in case of DUI cannot be transferred

entirely to DUID, it is a first, but very important step to identify the main traits of DUI/DUID offenders.

The beginning of impairment of the driving skills at a BAC level of 0.02 % or 0.03 % is scientifically proven (Bernat, Dunsmuir & Wagenaar, 2004). Nevertheless, most substance related drivers overestimate their individual ability to drive and, additionally, they assume that they are less impaired in case of driving under the influence of psychoactive substances (Deliverable 2.2.1; Macdonald & Dooley, 1993; Job, 1990). This phenomenon is very wide spread among the drivers who belong to the main risk groups in traffic (see: following chapters). A further obstacle is the circumstance that DUI offenders often do not realize that they have an alcohol problem, what may lead to problems for further treatment (Macdonald & Dooley, 1993). It can be estimated that the same situation can be observed among DUID offenders.

3.1 Adolescent and novice drivers

In the following, drivers up to 25 years are named adolescent or youth, but in particular drivers under the age of 21 years belong to a high-risk group, because they are responsible for a disproportionate number of accidents under the influence of alcohol or drugs. These drivers accumulate different risk factors, which contribute to the high risk for traffic safety:

- less experience with driving,
- less experience with the consumption of psychoactive substances and
- youth flippancy.

Hence, adolescent drivers are in most European member states a target of special legal driving regulations (e. g.: lower per se BAC limits or graduated licensing systems). Although the vast majority of novice drivers is aged under 21 years, this is not compelling. But even older novice drivers represent a certain risk for traffic safety if they have consumed at least little amounts of alcoholic beverages, because they feature little driving experience. Therefore, some member states (e. g.: Germany) have extended their regulations for adolescent drivers to novice drivers. The German Roadside Survey revealed that only 5 % of the novice drivers are older than 25 years (Krüger & Schöch, 1995). As it can be expected that these rates are similar in other European member states, it seems not urgently necessary to enlarge the special regulations for youth drivers to novice drivers.

3.2 Drugged drivers

Among adolescent drivers, especially males, the number of drugged drivers is considerable overrepresented in comparison to older drivers (Christophersen et al., 2002; EMCDDA, 2007). Especially the consumption of cannabis is very wide spread among adolescent drivers, but the distribution of this specific substance is mostly restricted to drivers up to 25 years and can be considered as a youth phenomenon. As drugged drivers are empirically proven to be more often recidivists than drunken drivers (Holmgren et al., 2008), future legal efforts must be targeted at these drivers. A retrospective study in Norway with a follow-up period of seven years revealed that drugged drivers have a twofold recidivism risk in comparison to drunken drivers with very high BAC levels between 0.16 % and 0.19 % (Christophersen et al., 2002), who already have had a very sizeable recidivism risk. Another study revealed that none of the drivers who were convicted for driving under the influence of cannabis re-offended (Gjerde et al., 1988). This may support the value set of special regulations for driving under the influence of cannabis and of hard drugs in some European member states. Among scientific researchers a common consensus exists that in case of DUID additional or other sanctions

than the classical ones like fines and imprisonment are urgently to be imposed (Christophersen & Morland, 1997; Christophersen et al., 2002).

3.3 Problem drinkers/consumers

The main characteristics of hard core drink drivers, who often feature symptoms of alcohol dependence or abuse, are depicted in Deliverable 5.1.1. This high-risk group contains drivers with a problematic consumption behaviour pertaining to psychoactive substances, especially alcohol. The distinction between normal/social and heavy/problem drinkers is based on the Quantity-Frequency-Indices (Löbmann/Krüger/Vollrath/Schöch 1998). In case of alcohol, the relevant BAC limit to diagnose problematic consumption behaviour is commonly drawn at 0.15 % (Deliverable 5.1.1), because such a high value is not only reached within participation in social life. A study among 327 DUI offenders came to the conclusion that in case of BAC levels of at least 0.16 % about 50 % were alcohol dependant (Brinkmann et al., 2002). For other psychoactive substances, the results are less clear and very dependent on the respective active ingredient. But it can be considered that hard-core drinkers are comparable with chronic users of illicit drugs (OECD, 2010).

The main problem among these drivers is the fact that the theory of deterrence almost does not operate. The model of deterrence is based on the assumption that drivers make up a rational choice before driving under the influence, considering the level of enforcement, the accident risk, the degree of intoxication and the attitudes towards drinking and driving (Akers, 1990). But drivers with consumption problems or even addicts are not able to make up this rational choice, because they are mostly dominated by the consumption. Consequently, it is much more complicated to prevent them from driving under the influence (Freeman et al., 2006 with reference to Beirness, Mayhew & Simpson, 1997). Even zero-tolerance laws are not able to deter them (Holmgren, 2008). These risk group drivers are commonly hardly to deter by the means of general deterrence, even if the efforts are explicitly targeted to these offenders. After it is proven that these drivers show a measurable higher level of legal knowledge than other driver groups (Wieczorek, Mirand & Callahan, 1994; Grube & Kearney, 1983), a further enhancement of publicity campaigns regarding legal changes seems not promising. Additionally, they are commonly well informed about the locations of police enforcement activities with the aim to avoid them.

Therefore, it can be argued that the most effective approach to curb the problem of DUI/DUID must be seen in the altering of the individual preferences. In this context, the implementation of awareness and education campaigns is strongly recommended (Mannering, Bottinger & Black, 1987). But it also must be acknowledged that these campaigns are in most cases far away from being sufficient to alter the behaviour. These offenders must be treated with special deterrent measures, especially treatment and rehabilitation, to solve the underlying consumption problem (Deliverable 5.1.1; Legge & Park, 1994; Yu, 2000).

Nevertheless, for most DUI/DUID cases a complete abandonment from punitive sanctions cannot be regarded as the appropriate way to deal with the offenders. The precondition for the imposition of suitable measures on the offender is their apprehension. This is rather difficult, because problem drinkers and consumers mostly do not show signs of impairment. Addicted persons even need a certain psychoactive substance level in their blood to be able to act inconspicuously.

Apart from that, it should be considered that the occasional drinkers also represent a considerable risk for traffic safety, because their numbers are much higher than the ones of

frequent or problem drinkers (Chamberlain & Solomon, 2002).

3.4 Multi-drug consumers

A further high-risk group are consumers of different psychoactive substances (legally or illegally used medicines/drugs in combination with alcohol or different illicitly used medicines/drugs simultaneously). The vast majority of them can be found among adolescent drivers. Poly-drug use among detected DUID offenders is very wide spread and ranges between 40 % and 80 % (Deliverable 5.1.1). This was confirmed by a recent study from Finland, which revealed that in 77.1 % of all cases suspected for DUID more than one psychoactive substance was detected. While in 33.3 % alcohol in combination with an illicit drug was detected, the rest of 43.8 % contained more than one psychoactive substance other than alcohol (Ojaniemi et al., 2009). Empirically evidence exists that the recidivism rates of multi-drug users are highest in comparison to consumers of alcohol or drugs alone (Christophersen et al., 1996). In these cases, the level of impairment regarding the driving suitability is almost not foreseeable and, therefore, the potential of endangering traffic safety cannot be calculated reliable. Multi-drug use is also a challenge for remedial programmes.

3.5 Recidivists

The main reasons for recidivism are contained in the in-depth study of Deliverable 5.2.1. Recidivists comprise a high number of problem drinkers or consumers (Holmgren et al., 2008). Especially offenders with three or more previous substance related convictions are very likely to be dependent. Thus, the number of prior DUI convictions can be regarded as the most reliable predictor for future deviant behaviour, which is also empirically proven for alcohol (Yu, 1994; Yu, 2000), but it may be also valid in case of DUID. Multiple DUI/DUID recidivists are relatively rare. This outcome is primarily not due to their low incidence rates, but to the low risk of apprehension, proven by studies from the dark field research. For example, a dark field study in Germany, conducted in the early 1990´s, had revealed that only one of 600 journeys with drivers having BAC levels of at least 0.08 % had been detected by the police (Kazenwadel & Vollrath, 1995). About 20 % to 30 % of all convicted DUI offenders belong to the group of recidivists, but it must be assumed that the actual numbers are manifold higher and that a large proportion of DUI/DUID first-offenders are treated misleadingly not as repeat-offenders, who have regularly to undergo rehabilitative efforts.

4. Necessity of comprehensive counter strategies to combat the prevalence of intoxicants in the whole society

The problem of driving under the influence of alcohol, illicit drugs or medicines cannot be combated entirely with countermeasures restricted to the field of traffic law, because the consumption of psychoactive substances is a societal aspect, which covers all areas of life. As DUI and DUID present complicated and multivariate phenomena, their solution must also be multivariate (OECD, 2010). Only a little percentage of drunken drivers is detected and convicted and, consequently, only these persons are subjected to eligible punitive and especially rehabilitative measures. But the undetected rest, which contains a considerable number of drivers with consumption problems, will not be concerned and change their consumption behaviours (Hingson, 1995). This statement is much more valid for driving under the influence of illicit drugs or medicines, where the detection rate is considerable lower than in case of alcohol impairment.

Hence, comprehensive counterstrategies beyond the general and special deterrence related policies must be implemented, which aim at a reduction of the population of impaired

persons, who are at risk of driving impaired as well. Of course, the optimal way of reducing psychoactive impairment within the whole society would be an individual self-decision against the consumption of psychoactive substances, achieved by an effective drug policy in general. It can be legitimately assumed that this aim will never be reached completely, but educational campaigns, which show the physical-mental effects of the consumption of psychoactive substances - especially in relation to the fitness to drive - can mainly contribute to reach it.

4.1 Restrictions for the access of intoxicants

Access restrictions for intoxicants seem to be very effective, because they extract the problem at the root by reducing the availability of impairing substances. For example, the elevation of the legal purchase age for alcohol can be named explicitly, because this measure is empirically proven to reduce alcohol impaired accidents among the targeted adolescent drivers (Hingson, 1995 with reference to NHTSA, 1991; OECD, 2010). This approach is only suitable for legal substances, namely alcohol and medicinal drugs. But when a member state does not criminalize the selling and the possession of other psychoactive substances (e. g.: cannabis), this approach is also applicable (e. g.: controlled sale of legally defined maximum amounts of certain substances at the sale stations).

For medicinal drugs it can be taken into consideration to tighten up the prescription duties of the physician to limit the access to psychoactive medicines. Additionally, the reliability of criteria for sales outlets (e. g.: internet pharmacies) can be strengthen. Legal changes in this field always pose a certain risk for the patients, which must be in the main focus of these deliberations. Therefore, it may be more recommendable to improve the counseling of patients concerning the impairing quality of the prescribed medicine in each case. If these obligations are not fulfilled by the physician, he may be liable for damages caused by the patient due to the substance consumption (Füllmich, 1995). For these purposes, DRUID Workpackage 7 has developed a new system for computers of medical doctors and pharmacists, which is able to contribute to a comprehensive enhancement of traffic safety (Deliverable 7.2.2). If the medical doctor or the pharmacist adheres to the advices of this programme, there may be no possibility for the concerned person to claim civil commitments in case of unpredictable consequences.

The reduction of the outlet density or the monopolization of the sales points of legal intoxicants can be additional legal measures, which may contribute to a reduction of the magnitude of the impaired driving population.

All prior statements are only applicable for licit substances. In case of illegal substances, the only promising countermeasure can be seen in comprehensive police controls to avoid the distribution.

4.2 Charge of taxes

As far as alcohol is concerned, the implementation of alcohol taxes are empirically proven to cause significant general deterrent effects, resulting in measurable lower rates of alcohol related fatalities (Saffer & Grossman, 1987; Chaloupka, 1993; Ruhm, 1996; Eisenberg, 2003 with reference to Chaloupka et al., 1991). This budding outcome can be observed even among chronic drinkers, because there is no possibility to avoid this additional financial burden. These taxes are also one factor which may have contributed to the low DUI rates in Scandinavia, where the taxes are one of the highest in the world (Ross & Klette, 1995). This countermeasure is restricted to legal substances. But in case of legally used medicines, this

approach is not proportional and also not desirable from the view of health care policy due to the medicinal indication of the use.

4.3 Other measures

Some member states (e. g.: Italy) have implemented vehicle related countermeasures for DUI/DUID (e. g.: licence plate confiscation or vehicle forfeiture), at least in case of recidivism. These measures may cause measurable general, but also special deterrent impact on the offenders. The major precondition for the effectiveness is that the used car is in the property of the offender, because otherwise he will not feel any pain for the law infringement (Ross, Simon & Cleary 1996). The effectiveness of alcohol ignition interlock devices are subject of Deliverable 6.2.1.

5. Empirical research results from the field of DUI/DUID sanctioning

The vast majority of the analysed empirical evaluation studies dealt with the assessment of sanctions for alcohol offences and not for law violations in conjunction with illicit drugs and medicines. Hence, especially in the latter field further research is needed, because a scientific shortfall of several decades must be gained. The main problem of this lack of empirical studies pertaining to other psychoactive substances than alcohol is the diverseness of DUI and DUID offenders. Thus, it is not simply possible to transfer the results of the alcohol related research to drug impaired driving. One main declaration, which can be drawn from the studies which concentrated on the traits of drugged drivers, is their high percentage of both young drivers and recidivists. These insights are a measurable support for the scientific work, because it can be cautiously assumed that the most effective countermeasures among DUI offenders who are either young or recidivists will also show deterrent impact among DUID offenders. As far as possible, it is, therefore, outlined which specialties in case of DUID must be considered.

Most of the studies which evaluated the general deterrent impact of legal interventions were cross-sectional analyses. These research works compare the respective variables of the examined states with the control states, while the control states have not implemented this specific countermeasure so far. In case of special deterrence studies, regularly the recidivism rates of offender groups, who received different sanctions or combinations of them, are compared to each other.

One main obstacle for the research which focuses on the evaluation of the general deterrent effectiveness of legal interventions and programmes is the fact that in a considerable number of cases the states implement different statutory measures simultaneously. These measures work together or they do not (Epperlein, 1987). Thus, a very considerable number of empirical studies evaluated the general deterrent impact of the whole intervention package (e. g.: Nagata et al., 2008; Neustrom & Norton, 1993; Lacey & Jones, 2000). For the scientific work presented in this document, these results are sparsely valuable due to the circumstance that the observed outcome cannot be attributed to single components of the changed law. But just this is of particular importance due to the founded assumption that almost no state will implement exactly the same intervention package as examined in another state. Even, if empirical studies disentangle between the respective countermeasures and their corresponding effectiveness, it is rather difficult to attribute the revealed outcome to the single countermeasures precisely (Soole, Haworth & Watson, 2008; Nichols & Ross, 1990). Actually, when the same legal countermeasure is evaluated in several empirical studies, it is rather likely that the results are not comparable across studies due to the great diverseness of the surrounding legal environment and sometimes also of the outcome measures (Wagenaar,

Zobeck, Williams & Hingson, 1995). To omit at least the second aspect to the greatest possible extent, for the secondary analysis of empirical studies within this paper only those evaluations are included which chose a substance related outcome variable. Consequently, the general deterrent impact of a specific legal intervention cannot be predicted precisely (Chamberlain & Solomon, 2002). This counts to a smaller extent also for special deterrent effects.

Beyond these scientific statements it may not be neglected that the positive development of alcohol related casualties among the European member states is commonly not attributable to one single countermeasure, but to a bundle of different legislative, nationally furnished interventions, which have the potential to cause long-term effects. This outcome can generally only be achieved with strong enforcement behind the respective measures (Voas, Tippetts & Fell, 2000). Hence, the enforcement measures are outlined in detail in section 8.2. A close connection between self-reported drink driving behaviour and the legal situation and its enforcement in the respective member state is empirically proven (SARTRE 3, 2004b). For the combat against DUID, the same statement is valid, because effective efforts in this field usually involve a combination of legislative initiatives, enforcement practices and primary prevention activities (OECD, 2010).

Detailed information for all reviewed empirical studies can be found in the Annex (see: 10.).

5.1 General deterrent effects of impaired driving related counterstrategies

Krüger et al. (2003 with reference to De Jong & Hingson, 1998) concluded that an effective general deterrence DUI policy must comprise administrative licence revocation laws, sobriety checkpoints, lower per se standards and zero-tolerance laws. Apart from the first aspect, which is extensively worked out in Deliverable 6.2.1, all other elements are highlighted within this document.

5.1.1 Comprehensive DUI policies

As already mentioned, the deterrence theory consists of three major elements: punishment certainty, celerity and severity. These three factors do not have the same importance for the causation of law-abiding behaviour. On the basis of empirical findings it can be argued that the punishment severity has not such a great deterrent potential as sanctioning certainty or celerity have (Nagin & Pogarsky, 2001; Ross, 1992; Epperlein, 1987; Evans, Neville & Graham, 1991 with further references; ESCAPE, 2003; Donovan, 1989). For example, a review (Löbmann, 2001), which evaluated four international studies pertaining to enhanced sanctioning celerity by the implementation of licence suspensions by the police at the spot, revealed that all studies reported measurable deterrent impact of the respective legal measures. In contrast, the seven reviewed studies from the 1980´s, which evaluated the general deterrent effectiveness of an enhancement of the sentence severity, observed no significant effects on the alcohol related variables. Empirical studies evaluating the general deterrent impact of the punishment certainty mostly concentrate on the risk of apprehension caused by the police (Freeman & Watson, 2009). The subjectively perceived and not the objective risk of detection is the main general deterrent factor in this context (SARTRE 3, 2004b; see also: Moore et al., 1993). In most cases, the first one is higher than the second one, what is mainly influenced by the intensity of the media coverage regarding the enforcement efforts. For example, an empirical evaluation (n = 77) (Löbmann, 2002) observed a 25 % higher subjective likelihood of detection than it was in fact, but this rate decreased with an enhancement of the objective risk. In this context, it must be considered that among often controlled drivers the personally experienced ineffectiveness of control efforts leads to an

assimilation of the perceived and the objective risk of detection (Hilsenbeck & Löbmann, 1998).

Within the present studies analysis only few evaluations came to the conclusion that an increase of the penalties for DUI is connected with an increase of general deterrence (Peck, 1991; Rogers & Schoenig, 1994). In contrast, a considerable number of empirical studies revealed a decrease or at least no significant change of the substance related variables due to more severe legal regulations (Briscoe, 2004; Kinkade & Leone, 1992; Ross, Mc Cleary & La Free, 1990 with further references). The reason for this phenomenon is more complicated than it seems at the first glance, because the increase of the punishment severity leads in fact to an increase of the general deterrent level. But this promising outcome is regularly counterbalanced by decreases of the social acceptance of the sanctions and of the general preventive level, which are much more important elements than the ones of general deterrence to achieve law-abiding behaviour. As a result, at best modest effects for traffic safety can be observed by an increased sanction severity. This phenomenon is due to the mentioned special situation of traffic law violations as "everybody offences", what counts much more for DUI than for DUID. Nevertheless, this statement must be considered with some caution, because it is more valid if the law change is not accompanied by a high level of enforcement (Briscoe, 2004 with reference to Nagin, 1998 and Ross, 1984). It is proven that enhanced enforcement efforts, which increase the certainty of punishment, can neutralize this compensational effect at least partly. Additionally, it must be argued that an increase of the sanctioning severity without comprehensive accompanying media coverage has commonly no great potential to cause significant general deterrent impact. The SARTRE 3 study (2004a) observed a common tendency among the interviewees in the different European member states to consider alcohol as a major cause for accidents in traffic, resulting in high rates of approval for more severe DUI sanctions (ranging from 76 % to 95 %), but a negative association between approval for more severe sanctions and self-reported illegal drink driving was recognized. Consequently, it can be assumed that an increase of the punishment severity is more effective among non-drinkers or social drinkers than among frequent drinkers.

It is also scientifically proven that the sanctioning certainty causes general deterrent impact even among chronic substance users, while the sanctioning severity was not able to cause comparable effects (for cannabis: Jones, Donnelly, Swift & Weatherburn, 2006; for adolescent binge-drinkers: Grosvenor, Toomey & Wagenaar, 1999).

Fixed sentences are commonly applied due to their potential to increase the certainty and especially the swiftness of the sanctioning procedure. In this context, it must be emphasized that fixed penalties can only be applied in case of administrative sanctioning, but not in case of criminal code convictions due to their higher level of social-ethical degradation connected with them. In the consequence, a conflict with the constitutional principle of proportionality may appear. Therefore, the European member states have fixed penalties only implemented for administrative misdemeanours, while criminal courts always have discretion when imposing sentences. ESCAPE (2003) contains thereby a description of the ideal type of criminal and administrative law system.

DUI policies do not have the same general deterrent impact on each offender group due to the so called relative sentence severity. Thus, it is recommendable to implement laws which are targeted at special driver groups (e. g.: adolescent drivers; high-BAC drivers) to enhance the general deterrent effect among these subgroups. For example, enhanced sanctions in Minnesota for high-BAC drivers from 0.20 % upward showed a significant general deterrent

impact among both first- and multiple-offenders (Mc Cartt & Northrup, 2004). This is very promising, because hard core drinkers are proven to be hardly to deter.

As a conclusion, it must be remarked that the implementation of law changes in the field of DUI commonly does seldom lead to longer-lived benefits for traffic safety when it is not connected with an increase of the enforcement level and, therefore, with an elevation of the perceived apprehension risk (Donovan, 1989). The surrounding consequences of the law implementation, especially the costs for respectable enforcement efforts, must be taken into consideration before the law becomes effective to ensure a well execution of the law. Otherwise, the intended general deterrent impact will diminish after a short period of time (Kinkade & Leone, 1992). This counts also for DUID law changes.

Nevertheless, it must be acknowledged that non-legal consequences regularly have much higher general deterrent impact than legal consequences (Nagin & Pogarsky, 2001 with reference to Nagin, 1998 and Williams & Hawkins, 1986). The most important non-legal consequences are social disapproval, especially by peers and friends, and internal loss. Particularly, the first element causes much higher deterrent impact among adolescent drivers than among older drivers (Freeman et al., 2006). Thus, it is important to increase the disapproval rate at first among this offender group. This counts for DUID offenders as well, but in this case it is more complicated to realize due to their more permissive social environment.

When general deterrent effects of specific legal interventions are measured by the development of substance related accidents or casualties, it must be emphasized that the outcome of the respective empirical study is mainly influenced by the preciseness of the statistical inclusion coverage pertaining to the causation of the accident. Therefore, the results may be biased by this factor, because all over Europe the same standard has not been reached until now. A further impediment in the combat against DUI/DUID is the fact that a considerable number of member states still do not distinguish between alcohol, drugs and medicines in their accident and prosecution/conviction statistics (de Gier, 2004). Therefore, it is rather problematic to identify best solutions for the sanctioning of DUI/DUID offenders, because most evaluation studies have to base their findings on these official data. Thus, a precise distinction must be recommended, because then the effectiveness of legal interventions can be observed very fast and corresponding changes can be enacted promptly. Additionally, the implementation of uniform standards among all European states would lead to higher comparability of the respective results.

5.1.2 General and special deterrent impact of driving licence measures

Sanctions which focus on the driving licence are evaluated in detail in DRUID Workpackage 6 (Deliverable 6.2.1). These measures are proven to be an effective general and special deterrent. The observed effectiveness is mainly due the “hurting” effect of this kind of sanction (see also: Deliverable 2.2.1 with reference to self-reported data from DUI offenders in Hungary and Sweden). As far as drivers with consumption problems or even addicts are concerned, a combination of licence measures with remedial interventions is strongly recommended. For the judgement of the effectiveness of licence actions, the re-granting procedure (e. g.: medical-psychological examination) must always be considered, because both parts belong to a whole.

5.1.3 General deterrent effect of jail penalties

As far as the evaluation of the general deterrent effects of jail sanctions is concerned, only unconditional jail penalties, but not probative ones are examined empirically, because probation belongs to the sanctioning in the narrow sense and the execution process, respectively. Whether the offender receives probation or not, is a very individual question. Hence, the legislator cannot anticipate this decision in the abstract legal regulations. Consequently, no member state has a law in force which threatens probation for DUI/DUID. The imposition of jail terms is in all member states in the responsibility of the courts and not of the administrations.

In most empirical studies from U. S., legal regulations were outlined containing mandatory jail penalties for DUI. Regularly, the maximum duration of the incarceration period is written down in the law, often only few days (e. g.: Wagenaar et al., 2007: ten days). The respective duration is up to the responsibility of the competent judge. One main problem, which can sometimes be observed in case of mandatory jail sanctions for DUI, is a lack of strict judicial enforcement (Grube & Kearney, 1983). Some judges are reluctant to impose severe sanctions on DUI offenders, who are - at least in their perception - minor offenders with regularly law-abiding behaviour. This counts in particular for criminal sanctions, which are connected with criminal records (Sen, 2001). These records contain the potential to cause problems in the future life of the offenders. Of course, these criminal records are able to produce additional general deterrence, but this may be compensated by a further decrease of the social acceptance. These preconditions must be kept in mind for the further understanding of the following results. It may be assumed that the judicial reluctance in case of DUID is measurable lower due the regularly higher risks for traffic safety.

Jail sanctions are regularly not regarded as effective general deterrent countermeasures for DUI (Voas & Fischer, 2001; Whetten-Goldstein et al., 2000; Evans, Neville & Graham, 1991; Ruhm, 1996 with reference to Wilkinson, 1987; Jones et al., 1988; Sloan, Reilly & Schenzler, 1995). A comprehensive international review (Wagenaar et al., 2007) came to the conclusion that only 10 % of the evaluated studies reported a significant general deterrent impact due to their implementation.

This outcome, which is often amplified by a lack of public awareness and a very heterogeneous practice of the judicial imposition, may be mainly due to the special situation of DUI as an “everybody offence”. This leads to the consequence that most of the concerned drivers do hardly approve severe penalties for DUI, causing lower levels of compliance, social acceptance and of law-abiding behaviour. Especially mandatory jail sanctions for first-offenders are in a number of cases regarded as too severe. Of course, this counts much more if the concerned drivers are recorded drunk driving offenders. But this statement must be relativized, because the specific outcome is very much dependent on how the sanctions are furnished in the respective legal system. If jail penalties are only very short-termed, the general deterrent impact is in fact rather low. The situation may change if the jail periods are extended. But the extension must be handled with caution, because otherwise the acceptance level among the general public will decrease, leading to an increase of impaired driving offences in the consequence.

Nevertheless, it is possible that the implementation of jail penalty laws lead to a decrease of impaired driving (Villaveces et al., 2003; Legge & Park, 1994; Benson, Rasmussen & Mast, 1999; Ruhm, 1996; Zador et al., 1989; Sloan, Reilly & Schenzler, 1994), even among adolescent drivers (Eisenberg, 2003). Another empirical study even concluded that the highest

self-reported general deterrent impact among a mixed driver population belonged to jail penalties, while the results for fines were worst (Freeman & Watson, 2009). These findings are less valid for the group of repeat-offenders, because most of the studies observed measurable general deterrent impact only if first-offenders were targeted by the respective law (Wagenaar et al., 2007; Kenkel, 1993). The same counts for drivers with high BAC levels, who are commonly not as deterred as social drink drivers with lower BAC levels (Eisenberg, 2003).

The success of (unconditional) jail penalties in the Scandinavian states is due to a package of different measures - and not only to the implementation of (mandatory) jail penalties - and also to their more law-abiding culture. But even these countries are not able to provide unambiguously empirical proof for the special deterrent effectiveness of unconditional jail penalties. A study, conducted in Sweden (Shapiro & Votey, 1984), revealed that this type of sanction is only connected with negative regression coefficients among younger drivers up to 25 years and older drivers from 56 years upward, but not among the vast group of drivers aged between 26 and 55 years. The abandonment of mandatory jail penalties for DUI in these states is not connected with an increase of DUI offences and, therefore, not with a decrease of the general deterrent impact of DUI penalties in common. This outcome was observed among both high- and low-BAC offenders (for Sweden and Norway: Ross & Klette, 1995).

Jail penalties are partly regarded as effective measures by having the potential to cause longer-termed effects of social learning (regarding the seriousness of impaired driving), leading to a decrease of the corresponding social acceptance (Nichols & Ross, 1990; Grube & Kearney, 1983). Of course, this depends much on the design of the underlying law.

To sum it up, it must be recognized that in most cases the main risk-groups in traffic are not deterred by jail sanctions, in particular recidivist and high-risk drinkers. The best results are achievable among first-offenders, but also some empirical evidence for the general deterrent effectiveness among adolescent drivers exists. As the vast majority of the drugged drivers are recidivists and adolescents, the expectations for the outcome are ambivalent, but it can be expected that jail periods will cause only modest general deterrent effects.

5.1.4 Fines

A comprehensive review (Wagenaar et al., 2007) revealed that six of 19 evaluated empirical studies reported significant reductions of the respective outcome variables (e. g.: alcohol related fatal accidents, night time fatalities). Fines contain the potential to cause measurable general deterrent effects (Sloan, Reilly & Schenzler, 1995) if the respective height is able to create a substantial financial burden for each delinquent. This can be achieved best through the measurement of the fines according to the individual income of the misdemeanants. Of course, this modus operandi is connected with more exposure for the authorities, because they have to gather information about the income of each offender. As a result, many states do not use this individual income approach in case of administrative procedures, but they have enacted laws which contain certain lump sums for these minor severe offences. Consequently, these lump sums are regularly not very high, because they have to be geared to the average incomes. Thus, they are mostly not connected with significant levels of general deterrence, sometimes even with negative impact on traffic safety by increasing the number of substance related accidents (Legge & Park, 1994).

It is empirically proven that the implementation of mandatory minimum fine laws causes much higher general deterrent impact than the imposition of laws which do not contain such a

minimum level. This is proven for mixed groups of drivers (Benson, Rasmussen & Mast, 1999; Chaloupka, Saffer & Grossmann, 1993; Mullahy & Sindelar, 1994), but also for first-offenders (Young & Likens, 2000; Whetten-Goldstein et al., 2000). Consequently, the increase of the punishment severity is in case of monetary penalties able to cause additional general deterrence. The decision between these two approaches in case of fine imposition must be made up by the legislators of each member state.

To achieve significant general deterrent effects, it is recommended to enact mandatory minimum fines of at least € 500,-- (Whetten-Goldstein et al., 2000 with reference to Wilkinson, 1987 and Chaloupka, Saffer & Grossmann, 1993 recommended a minimum sum of $ 500, but due to the common rice in prices, a sum of € 500,-- seems to be adequate). This minimum sum was also confirmed by the national expert round in Slovenia (Annex to Deliverable 6.2.1). Of course, it is self-evident that the general deterrent effectiveness of such a fine differs considerable between the European member states due to the distinctions in the macroeconomic development. Consequently, the named amount should be equal to one fourth or one third of an average monthly income.

Usually, fines have much higher general deterrent impact among adolescent offenders than among adults. This is mainly based on the limited financial means of the first group (Wagenaar et al., 2007; Whetten-Goldstein et al., 2000). Thus, it can be argued that the observed results are transferable to DUID offences.

In comparison to jail penalties, fines are connected with much higher levels of social acceptance. Therefore, they have the potential to produce considerable levels of general prevention. In contrast to incarceration periods, which are rather costly for the community, fines have the advantage that they can fund DUI/DUID countermeasure efforts (Nichols & Ross, 1990).

5.1.5 Demerit point system

About the specific and especially the general deterrent effects of demerit point systems only sparse is known (ESCAPE, 2003). Therefore, the demerit point systems of the European member states and best practices for its implementation will be evaluated within the EU-Project “Best Point”, which already started in September 2010.

5.2 Special deterrent effects of impaired driving related counterstrategies

In the field of special deterrence, it also can be remarked that informal sanctions are more effective deterrents than formal ones. This counts especially for offenders with certain ties to society (De Jong, 1997). An analysis among DUI offenders from Sweden and Hungary and DUID offenders from Sweden revealed that punitive sanctions are not regarded as “real” deterrents, apart from licence withdrawal (Deliverable 2.2.1). So, at least among drivers with consumption problems these sanctions are not enough, but also treatment and other rehabilitative approaches are needed.

5.2.1 Comprehensive DUI policies

Because special deterrence is based on the same underlying mechanism as general deterrence, it is empirically proven that an increase of the sanctioning severity (especially: implementation of jail penalties) does seldom lead to a significant decrease of the recidivism rates. This statement is more suitable to describe the situation among repeat-offenders, while among first-offenders more severe penalties can cause at least in some cases effects (Mann et al., 1991; Wheeler & Hissong, 1988). This may be due to the circumstance that repeat-

offenders more likely suffer from consumption problems. Nevertheless, it must be noted that some studies found measurable special deterrent impact of increased punishment severity, even among repeat-offenders (Freeman et al., 2006). An empirical study, conducted in New York, revealed that among offenders with alcohol problems, the celerity of sanctioning was the most important special deterrent element (Yu, Evans & Clark, 2006), but exactly its perception is often lacking among DUI offenders (Freeman et al., 2006). To achieve a high level of special deterrence, it must be recommended to improve at first the punishment certainty, but also the celerity.

The enactment of high-BAC laws, containing enhanced sanctions for drivers who exceed certain per se thresholds, can be an effective deterrent to avoid further reconvictions, because legislation which focuses on special offender groups is commonly connected with higher levels of deterrence than legal regulations without concrete targets. This effect is visible among both first-and repeat-offenders. Additionally, it must be emphasized that among drivers outside the initial target group no measurable effects can be expected (Mc Cartt & Northrup, 2004).

5.2.2 Special deterrent effect of jail penalties

5.2.2.1 Unconditional jail penalties

Jail penalties are often related to rather high reconviction rates (De Jong, 1997), especially among repeat-offenders (Wheeler & Hissong, 1988), indicating a lack of special deterrence. But this outcome is not necessarily an indicator for lacking effectiveness. In fact, these empirical results are at least partly affected by the bias of negative selection, which arises from the worse predictions concerning the future legal behaviour of these offenders. It is commonly known that especially drivers from the high-risk groups, namely hard-core consumers and recidivists, are likely to receive severe penalties, especially unconditional jail penalties. But these offenders feature per se a higher than average recidivism risk. Probably, this negative selection bias is even more present in DUID studies, because these offenders are higher than average recidivists.

Nevertheless, some empirical studies are available which report measurable special deterrent impact on the targeted DUI offenders (Jones et al., 1988), even among recidivists (Yu, 2000). But it should be acknowledged that this impact lasts commonly only a short period of time after the release of the offender.

In Norway, a change of the Road traffic act took place in 1988. This led to an increase of the imposition of fines and to a decrease of the application of unconditional jail terms, which were prior to the law change mandatory for three weeks in each case of DUI. This legal intervention did not cause any harm as far the reconviction rates before and after the law implementation were concerned (Skurtveit et al., 1998). Therefore, it must be acknowledged that the special deterrent impact was not negatively affected, although Scandinavia has a long tradition of severe penalties for DUI/DUID and, therefore, always captures a special position.

Another empirical study (De Jong, 1997) came to the conclusion that a prolongation of the incarceration periods led to a reduction of the recidivism rates among repeat-offenders. But the vast majority of offenders receiving longer incarceration periods have worse outlooks concerning future law-abiding behaviour than offenders who receive less severe sanctions. Weinrath & Gartrell (2001) came up with more detailed results. The researchers revealed that the worst outcome was connected with jail terms of a duration up to four months, while the

results for offenders receiving jail penalties with a duration up to six months and up to twelve months did not differ significantly. Therefore, the researchers concluded that jail periods of six months are optimal from the special deterrent point of view.

The special deterrent impact of each punitive sanction, not only the one of jail periods, is mainly influenced by the individual DUI history and the social circumstances the offender lives under. Among offenders with lots of ties to society, the special deterrent impact of jail penalties or other punitive sanctions is much lower than the impact of informal sanctions, which were imposed through relatives, peers or friends. Consequently, jail sentences cause much greater special deterrent effects if they are accompanied by these social punishments.

In case of first-offenders, the jail penalty is often considered as contra-productive, because it activates a labelling process, leading to higher reconviction rates (De Young, 1997). Hence, it can be assumed that diversion will be most effective for this target group, especially if connected with some alternative measures, at best rehabilitation (De Jong, 1997).

Finally, it must be concluded that the empirical evidence for the special deterrent impact of jail sanctions in case of DUI is rather weak (Voas & Fischer, 2001; Nichols & Ross, 1990). There is no reason apparent, why this outcome should change positively in case of DUID.

5.2.2.2 Probation

While the traditional sanctions fines and jail periods often show no significant differences in their special deterrent impact (Martin, Annan & Forst, 1993), probationers can achieve lower reconviction rates if they receive a close surveillance by probation officers (Wheeler & Hissong, 1988). This precondition is in practice one of the major problems due to the lack of financial and personal resources in many jurisdictions. When this requirement is not fulfilled, the special deterrent outcome for probationers will probably be worse in comparison to unconditional jail penalties, because the sentencing severity as an additional deterrent drops out almost completely in case of probation. This was confirmed by an empirical study in Maryland (Taxman & Piquero, 1998). This evaluation revealed that the outcome for supervised probationers was worst, while the results for unsupervised probationers were slightly better and the ones for unconditional jail inmates were best. The improvement of the results for unsupervised probation may be surprising, but is due to stricter conditions imposed on offenders without having a probation officer. Therefore, these offenders are targeted by a more severe penalty than the supervised probationers, who are in fact almost not supervised at all.

Consequently, well-executed probation is a suitable special deterrent for first- and repeat-offenders (Mann et al., 1991). This may be also valid in case of DUID, but in this case it depends on the further restrictions and obligations imposed on the offender in addition to the surveillance by the probation officer.

5.2.3 Fines

Only few studies show significant evidence for the special deterrent impact of fines among DUI offenders (Yu, 1994; Yu, 2000), while others show no measurable impact or even negative effects by increasing the recidivism rates (Taxman & Piquero, 1998 with further references). In most cases the greatest special deterrent effects are visible among young drivers due to their limited financial means (Shapiro & Votey, 1984).

One reviewed study observed an increase of the recidivism rates in relation to the elevated height of the fines (Mann et al., 1991), while the vast majority of the empirical evaluations uncovered the converse effect (Martin, Annan & Forst, 1993; Yu, 1994). Other empirical results observed no measurable effect between the height of the fine and the likelihood of recidivism (Moffatt & Poynton, 2007). Generally, it must be argued that fines only have special deterrent impact if they are not too modest. This is at best achievable if they are adapted to the individual income of the offenders to create a substantial burden. Therefore, the moderate lump sums in the United States are not connected with high levels of special deterrence as the measureable higher fines in Europe (Voas & Fischer, 2001; Taxman & Piquero, 1998). Moreover, the height of the fines should consider the seriousness of the individual offence and also the posed risk for traffic safety. Therefore, it is proposed to fix the minimum limit for first-offences at about € 500,--. As already named above (see: 5.1.4), the determination of the sum has to take the macroeconomic circumstances into consideration.

One advantage of fines is that they are hardly avoidable. This statement leads to the recommendation to improve the fine collecting system. One should not forget that the cost-benefit ratio for fines is much better than for jail penalties and the earned money can be spend to support DUI/DUID publicity campaigns and education programmes, which serve as further deterrent elements (Voas & Fischer, 2001).

6. Per se legislation

In most countries, DUID is based on the legal experiences from DUI. Regularly, two different main approaches exist: impairment statutes and per se laws. The latter ones contain two subgroups: zero-tolerance and risk thresholds. The impairment approach is depicted in detail in the next paragraph. This paragraph deals with the two threshold related approaches for psychoactive substances. As sanctions can only be imposed if a law violation is committed, these thresholds are needed on the more abstract level to define the preconditions for such an infringement.

Per se legislation is a main element to ensure swift and certain sanctioning of the mass phenomenon DUI/DUID. This type of law tries to find an appropriate equalization between the freedom rights of the aggrieved party and the protective interests of third parties. However, the main problem of per se laws is the disregard of the single case justness, because not every person shows the same level of intoxication and of impaired driving skills at a certain fixed threshold. This can be compensated at least partly through the dimensioning of the sanctions in each case, but in most member states the discretion of the administrative authorities is rather limited. Consequently, this possibility of compensation is restricted to court cases. A common disadvantage of risk thresholds is the circumstance that they are often connected with the ambition, especially among younger drivers, to reach these limits, leading to an underestimation of the risks for traffic safety at lower levels. Thus, zero-tolerance laws are proven to be more effective among this target group (for details see: 6.1.4).

Additionally, the implementation of per se laws can be connected with the risk of decriminalization of certain behaviours in traffic if the respective legal system threatens more severe sanctions in case of impairment than in case of the sheer limit exceeding. This can be explained by the circumstance that at least some police officers, who must detect and protocol signs of impairment thoroughly, can tend to note “only” a per se infringement. This is due to the lower level of connected time and effort with each single law infringement.

6.1 Zero-tolerance approach

This type of law is the consequence of the lack of scientific research to name specific risk thresholds for substances other than alcohol. Zero-tolerance laws for both DUI and DUID always contain a clear message: driving with any amount of the named psychoactive substances is dangerous and, therefore, forbidden.

In contrast, it seems a bit confounding that the driver is punished, although he shows (besides detectable traces of the respective substance in his blood) no signs of impairment and, consequently, poses no risk for traffic safety. As remarked above, the enhancement of traffic safety is the only appropriate reason to justify legal regulations in case of traffic policy. Sometimes, these laws are misused to penetrate non-traffic related drug policies. This may not be exercised, because as already mentioned the drug policy in general and the traffic safety policy must be separated precisely. This counts especially for the implementation of random drug testing laws (OECD, 2010), which can be used easily for other purposes. For example, it can be utilized to control and to sanction the incidence of illegal drugs in the society as a whole, especially if enforcement of the drug prohibition in traffic is relatively low (explicitly for cannabis: Kreuzer, 2000).

The legal per se limits should consider that the mixed intoxication through alcohol and drugs is a much greater traffic safety hazard than the sole consumption of each of these substances (for cannabis: Tunbridge, 2004). Consequently, the per se limit for the specific substances in this case must be lower than for the exclusive impairment through only one substance (Grotenhermen et al., 2007). It should be discussed interdisciplinary if lower BAC per se limits should be implemented for drivers who have shown the presence of psychoactive substances other than alcohol in the same blood sample. Therefore, a maximum BAC threshold of 0.03 % can be recommended due to the empirical proof that above this value the driving skills are negatively affected. By now, no member state has enacted such regulations, but the discussion at least started (de Gier, 2004a).

6.1.1 Lower effect limit or limit of detection? - Definitions and presentation of the set of problems from the legal-criminological point of view

The establishment of risk thresholds takes for granted that the scientific research is able to define a relationship between substance concentration, level of impairment and corresponding crash risk (EMCDDA, 2008; literature review: EMCDDA, 1999). This is possible since more than 50 years in case of alcohol (see: the thoroughly conducted meta-analysis in Deliverable 1.1.2a), but not for other psychoactive substances. This is mainly due to the high variety of dose-effect-relations among the numerous active ingredients. Nevertheless, some very promising scientific approaches to establish per se limits exist, at least for most common substances like cannabis (Grotenhermen et al., 2007). It must be feared that the transformation in practice will still last a considerable period of time. Consequently, for the near future only the zero-tolerance and the impairment approach are available in case of DUID.

By now, no European member state has implemented legal regulations containing genuine risk thresholds for other substances than alcohol. Besides the impairment approach (see: 7.), which is still the most common approach in Europe (Nickel & de Gier, 2009), the zero-tolerance approach is the second possibility of legal regulation to combat DUID. In case of zero-tolerance laws it must be distinguished between two approaches. The first one considers each exceeding of the limit of detection as a law infringement, this cut off – in some countries named analytical threshold - is based on technical limitations and should guarantee a valid and reliable analytical result, also avoiding false positive results. The second alternative uses

lower effect limits as cut-off values. Substance detection below this cut off does not implicit recent psychoactive substance consumption or being under influence.

It is a question of constitutional proportionality if a violation of the zero-tolerance law leads to criminal or administrative sanctions in the respective country. In the latter case a legal justification seems easier than in the first case. The sheer limit of detection does not proof that the consumption is a recent one, because modern technical equipment is able to detect substances which were consumed longer time ago and, therefore, do not unfold any impairing influence. Due to the technical progress, the detection limit is steadily decreasing. The establishment of such an approach would lead to a high number of substance-positive drivers, although they have only traces of drugs in their blood, which were not ascribed to the conscious consumption of illegal substances, but to other factors (Grotenhermen et al., 2007). As far as the substance concentration cannot be influenced by the offender (e. g.: endogenous alcohol; consumption of poppy-seed cake), an imposition of sanctions seems not constitutionally proportional. Additionally, it may conflict with the presumption of innocence.

In case of zero-tolerance legislation, thus, it is necessary to implement lower effect limits, because only the exceeding of these limits indicates the beginning of an impairing effect on the driving skills. The limit of detection does not show this effect. As far as a definition of lower effect limits is not possible, a legal regulation in the field of traffic legislation cannot really be justified (other in case of common drug policy; see: 2.4). The detection limit is mainly dependent on the technical development of the respective forensic laboratory. A high level of technical equipment leads to a low detection limit and, therefore, to a higher risk of conviction. As the limit of detection detection is dependent on the measuring instrument. It may vary between different provinces of a country and also among the European member states themselves, this approach may result in a higher heterogeneity of the sanction practice. As far as the limit of detection varies in one state, the rule of equality can be affected additionally. This problem can be solved temporarily by the definition of a certain detection limit in the respective country, which must be valid all over this country.

The definition of lower effect limits comprise the possibility to implement uniform cut offs all over Europe. For the zero-tolerance member states, it can be recommended to implement homogeneous lower effect limits for DUID, because it would increase the level of confidence among the driver population measurably if these values are the same all over Europe. This proceeding would contain a clear statement: driving under the influence of psychoactive substances is dangerous under every circumstance, independent from the site of crime.

The consequence of a zero-tolerance legislation without fixed lower effect limits as cut-off limits would be a low level of social acceptance, resulting in a poor general preventive effectiveness and an increased number of deviants. The heterogeneity of the sanctioning practice is a factor which also affects the level of general deterrence negatively. As far as traffic safety policy is concerned, it is only justifiable to prohibit psychoactive substances in traffic which impair the driving skills. But with reference to the entity of all legal regulations from general drug policy and traffic policy, an inclusion of other general prohibited substances seems justifiable. Finally, this decision must be made up with respect to the specialities of each national legal system.

6.1.2 Specialties in the case of alcohol consumption

For alcohol, few member states have yet implemented a zero-tolerance approach as far as young/novice or professional drivers are concerned. Some other states, especially the Eastern

ones, have enacted these zero-tolerance laws as a standard threshold (see: Deliverable 6.2). Zero-tolerance laws in case of DUI are commonly considered up to BAC levels of 0.02 %, which can be regarded as a lower effect limit. The effectiveness of this type of law or its lack depends very much on the social acceptance of this legal value. The level of social acceptance is also based on the consumption habits and the level of law-abidingness in the respective member state. In this context, the so called peccadillo risk appears particularly, because a decrease of the legal per se BAC level leads to an increase of the number of deviants, what is an additional challenge for the enforcement practice, as an increase of not apprehended drivers leads to a reduction of the perceived sanctioning certainty and, consequently, to a decrease of the general deterrent level. If a law violation is already committed after the consumption of very low amounts of alcoholic beverages, the common understanding for such a regulation will decrease, as it is not possible for a majority of people to adhere to this law within the social life. This outcome is connected with an elevation of the solidarity with the offenders, which also leads to a reduction of the very effective social sanctioning by disapproval of friends and peers. But it must be considered that a persistent level of enforcement is in general able to neutralize the lack of social acceptance, even in the long run. But as the enforcement of zero-tolerance laws is rather problematic due to often lacking signs of impairment (see: 8.2.3) and an increased number of offenders, this compensational effect is not very reliable.

The SARTRE 3 data (2004a) indicated a wide variety of approval rates for zero-tolerance laws for all drivers, ranging from 21 % to 87 %, with 40 % in the average. Additionally, it was shown that countries with low BAC per se thresholds at present contain a high number of proponents for zero-tolerance laws. This may prefigure that the attitude towards drinking and driving is mainly influenced by habituation regarding the legal environment for DUI. It was also revealed that lower limits are connected with a decrease of the self-assessed amount of alcoholic beverages which can be drunk before exceeding the legal per se threshold. Consequently, the implementation of zero-tolerance laws as a common standard among all member states is connected with several imponderabilities as the social acceptance is the decisive factor. Hence, the implementation of such regulations is mainly dependent on the societal and legal environment.

6.1.3 Specialties in the case of drug and medicine consumption

The mentioned peccadillo risk in case of DUID is not very wide spread due to a higher social disapproval of drugged driving. From this point of view, the implementation of zero-tolerance laws seems less problematic. As remarked above, the implementation of lower effect limits is urgently recommendable from the legal-criminological point of view.

The implementation of a zero-tolerance law for psychoactive substances other than alcohol in Finland and Sweden led to a manifold increase of the positive body fluid samples (Ojaniemi et al., 2009 with reference to Holmgren et al., 2008 and Jones, 2005). This may not lead to the assumption that these laws are ineffective general deterrents, producing more DUID offenders. The observed outcome is mainly due to higher levels of enforcement through trainings for police officers and better technical equipment. Moreover, zero-tolerance laws tend to motivate the police officers to make more stops and tests than under the former impairment law due to lower rates of dismissals.

Regularly, zero-tolerance laws are not the appropriate approach to deal with psychoactive medicines in traffic (see also: Gillard, 2004), because the main aim of any legislation in this field, targeting mostly older persons, must be the perpetuation of the possibility to drive safely

as far as feasible. This statement is due to the lack of precise scientific research regarding the impairing potential of these substances (OECD, 2010). Many drivers need the medicinal substances urgently to reconstitute their fitness to drive and, consequently, it is not necessary to deter them, but to increase preventive efforts, in particular educative measures. Thus, many of these substances lead on balance to an enhancement of the traffic safety. Many zero-tolerance laws in Europe exclude medicinal drugs from their range of application, at least if the substance is prescribed. In the latter case, most of the court cases will need expert support answering the question of therapeutic ranges for the medication. This leads to enhanced costs and durations of proceedings. Nevertheless, the exclusion is not compelling as far as the risk for traffic safety is taken into consideration if the scientific research has proven the impairing effects of the specific substances. These aspects must be acknowledged when concrete limits are fixed. In each case, the pros and cons must be weight up thoroughly before enacting legal regulations, which often have striking consequences for the consumers.

6.1.4 Empirical research findings in the field of criminology for young and novice drivers

Most of the evaluated zero-tolerance laws only weigh for drivers up to 21 years. It is empirically proven that the implementation of zero-tolerance laws for adolescent drivers is connected with measurable, not always significant reductions of alcohol related casualties and consequently with high levels of general deterrence (Voas, Tippetts & Fell, 2003; Hingson, Heeren, Howland & Winter, 1991; Zwerling & Jones, 1999; De Jong & Hingson, 1998; Villaveces et al., 2003; Shults et al., 2001). In almost all cases, the reductions are observable immediately after the law had been implemented (Hingson, Heeren & Morelock, 1989). The declines of alcohol related fatalities are also discernable among the high-risk group of binge drinkers, who consume at least five drinks per sitting and other high-BAC drivers. This group showed, in addition, significant reductions of self-reported binge drinking behaviour and drink driving due to the enactment of zero-tolerance laws (Carpenter, 2004; Hingson, Heeren & Morelock, 1989).

It is empirically proven that the reductions of alcohol involved accidents are significantly higher among males than among females (Carpenter, 2004 with reference to Dee & Evans, 2001), what also counts for the self-reported drink driving behaviour (Carpenter, 2004). This phenomenon is mainly attributable to the higher social value of the driving privileges among the first ones. Therefore, the results are extremely promising due to the fact that young males belong to one of the most common high-risk groups in traffic. Additionally, the EU-project IMMORTAL (Deliverable D-P2, 2005) had conducted a cost-benefit analysis of zero-tolerance laws for youth drivers up to 25 years among three European member states (The Netherlands, Norway, Spain). It had been proven that the implementation of zero-tolerance laws for adolescent drivers was highly cost-effective in the Netherlands, but not cost-effective in Norway and Spain.

Among adult drivers, almost no general deterrent impact can be detected due to the circumstance that they are not part of the main target group (Hingson, Heeren, Howland & Winter, 1991; Hingson, Heeren & Morelock, 1989; Hingson, Heeren & Winter, 1994; Dee, 2001). Thus, laws with special targets are hardly able to affect the drink driving behaviour among outstanding licence holders. This can be explained by a decrease of the social acceptance of such low limits for “normal” drivers, who are not part of a proven high-risk group (e. g.: drivers of cars with hazardous material).

A major precondition for these general deterrent effects is a high level of accompanying media and enforcement measures (Ferguson & Williams, 2002; Fell & Voas, 2006 with

reference to Lacey, Jones & Wiliszowski, 2000; Zwerling & Jones, 1999 with reference to Blomberg, 1992). In contrast, the survey of Hingson, Heeren & Morelock (1989) among police officers revealed that there was sometimes a lack of enforcing zero-tolerance laws. This was mainly due to limitations of detecting any signs of impairment caused by such low amounts of alcohol or the subjective perception of an exaggerated severity of this type of legislation.

Several researchers concluded that the only modest general deterrent effects, which were observed in some studies, are mainly due to low levels of awareness among youth drivers (Hingson, Heeren & Morelock, 1989; Ferguson & Williams, 2002 with reference to Voas, Lange & Tippetts, 1998). Therefore, comprehensive accompanying publicity and education campaigns, even during school times, are urgently recommended (Hingson, Heeren & Winter, 1999). Nevertheless, few studies found out that zero-tolerance laws lead to an increase of the incidence of DUI among the targeted adolescents (Whetten-Goldstein et al., 2000; Wagenaar, O´Malley & La Fond, 2001). This outcome, in particular, may be mainly based on a lack of social acceptance, leading to low levels of general prevention due to the sharp intrusion in the social drinking habituations. But commonly, the social support of zero-tolerance laws, even among younger drivers, is rather high, leading to considerable levels of law-abiding behaviour.

Although the 0.00 % per se level is connected with slightly higher reductions of alcohol related fatalities and, therefore, with higher general deterrent impact, it must be assumed that the social acceptance for the 0.02 % per se level is higher. This is mainly due to the exclusion of technical uncertainties and individual factors which cannot be influenced by the individual person (e. g.: endogenous alcohol). This finding can be transferred to DUID as well, where the implementation of lower effect limits is urgently recommended for this reason (see: 6.1.1). Additionally, enforcement problems will occur more intensively in case of 0.00 % per se levels, leading to a decrease of the general deterrent impact in the long run. But the implementation of lower per se limits - above the zero-tolerance approach with values ranging between 0.04 % and 0.06 % - for younger than for older drivers is, regularly, only connected with modest, non-significant reductions of the incidence of DUI among adolescents (Hingson, Heeren & Winter, 1999; Wagenaar, O´Malley & La Fond, 2001; Hingson, Heeren & Winter, 1994; De Jong & Hingson, 1998). These lower per se limits do not send the right message to adolescents, because in case of a certain per se limit, they will mostly try to reach it, while zero-tolerance laws contain a right and clear statement.

Although only weak empirical evidence (Haque & Cameron, 1989) was found for the group of novice drivers - in particular, learners and driving licence probationers -, the results are very similar to the ones of adolescent drivers, because the vast majority of novice drivers are adolescents. Therefore, the results can be transferred in most cases (which may explain the lack of empirical studies examining the group of novice drivers). In Europe, only few member states have implemented special thresholds only for novice, but not for adolescent drivers simultaneously (see: Deliverable 6.1). Thus, it is rather difficult to find suitable legal regulations for further scientific examinations. But also in case of novice drivers, the most important general deterrent elements can be seen in media coverage and enforcement activities. Strict zero-tolerance laws for novice drivers are connected with very high percentages of acceptance among all countries, independent if they currently have implemented special legal regulation for this target group or not (SARTRE 3, 2004a).
To sum it up, it must be emphasized that the implementation of zero-tolerance laws for adolescent drivers is very recommendable, but only if their strict enforcement is assured.

Thus, it can be estimated that this countermeasure can also be regarded as effective to curb DUID, at least as far as the drugged drivers are youth people.

6.1.5 Empirical research findings for convicted DUI offenders

Some states in the U. S. have enacted lower legal per se BAC thresholds for convicted DUI offenders. These laws must be divided into two sections: lower than standard per se BAC limits and zero-tolerance laws. For the first variant, Hingson, Heeren & Winter (1998) evaluated a legal regulation in Maine, which contained a 0.05 % per se BAC limit for convicted DUI offenders, while the standard BAC threshold was 0.10 %. The study uncovered a highly significant 48 % reduction of alcohol related fatalities due to the implementation of this legal regulation, while the highest reductions were found among drivers with BAC levels of at least 0.15 %. However, the empirical power of this study is rather weak due to the simultaneous enactment of further legal DUI regulations. Nevertheless, a clear tendency may be revealed.

Jones & Rodriguez-Iglesias (2004) evaluated the second alternative, the zero-tolerance approach. This evaluation uncovered a significant decrease of the alcohol related fatality rates after the law was implemented. The outcome was also connected with longevity. This study concluded that higher reductions were observed among high-BAC drivers with at least 0.10 %. Additionally, the same researchers evaluated the special deterrent impact of this law. It was revealed that it led to measurable, but not significant reductions of the recidivism likelihood and to prolongations of the recidivism time. Of course, the question if the zero-tolerance approach can be considered as an effective special deterrent depends mainly on the imposed sanctions and not on the applied threshold approach.

The empirical results are quite promising, so it can be recommended to implement such regulations in Europe, because convicted DUI offenders can be considered as one risk-group, although their reconviction rates are not higher than the ones in other fields of delinquency. But as already noted, a considerable number of DUI offenders remain first-offenders due to the low apprehension risk. Therefore, a lowering of the legal threshold for a certain period of time after the judicial or administrative conviction seems to be promising to enhance traffic safety. Finally, it seems mainly to be an issue of the national constitutional proportionality if these lower thresholds can be implemented or not.

6.2 Risk thresholds

6.2.1 Definitions and set of problems

After the first per se threshold of 0.05 % had been enacted in Norway in 1936, this kind of law can be considered as an international standard tool in the combat against DUI by enhancing the punishment certainty. Currently, only Great Britain, Ireland and Malta have legal BAC limits of 0.08 %, while all other European member states have implemented thresholds of 0.05 % or lower (see: Deliverable 6.1).

In the following, a short overview about the determination of risk thresholds is given. The most relevant information, besides political or ethical considerations, in order to determine thresholds is the information about the accident risk in traffic dependent on different concentrations of single substances. Direct information about the accident risk in traffic can only be gained by conducting epidemiological studies. Representative studies on prevalence in accident-free and accident populations are difficult and expensive. Especially for substances with a low exposure rate in the population, a huge sample ought to be examined in

order to get reliable estimations. Thus, for most of the substances, either legal or illegal, the data necessary for calculating risk indices are missing or incomplete, which leads to substantial problems for the estimation of traffic risks. Therefore, experimental data should fill the knowledge gaps.

The effectiveness of this type of law is also confirmed empirically. The very implementation of per se laws is in most cases connected with measurable general deterrence (Legge & Park, 1994; Zador et al., 1989; Mann et al., 2001 with reference to Voas et al., 2000), because they aim at an increase of the sanctioning certainty, which can be considered as one of the major general deterrents. Additionally, it is empirically proven that the high-risk group of adolescent drivers is positively affected by per se laws (Zador et al., 1989). As it was argued, the long-termed effectiveness of this countermeasure is not strongly proven (Mann et al., 2001 with reference to Noordzij, 1994) and the longevity depends very much on the level of enforcement (Mann et al., 2001). Therefore, it is possible to achieve long-term general deterrent effects when the enforcement efforts will be sustained for longer periods of time and will not decay soon after the law implementation (see: Vollrath, 2000 with reference to Aberg, 1995 and Mc Lean et al., 1995). If the legal threshold is lowered, the number of undetected DUI offenders will, consequently, increase, because the difficulty to detect signs of impairment increases with lower alcohol levels. As a result, the general deterrent effectiveness of the lower per se limit will be undermined due to the lowering of the perceived detection risk. Administrative per se laws achieve in most cases higher levels of general deterrence than judicial per se laws, because the first ones, additionally, enhance the level of the sanctioning celerity (Evans, Neville & Graham, 1991). It must be noted that the combination of per se laws with criminal sanctions is rather problematic due to the special situation of DUI as an “everybody offence”. More recent empirical findings for the general deterrent impact of this law type are rare, because most states all over the world have adopted it within the 1960´s and 1970´s. These results are hardly transferable to the contemporary situation due to considerable societal changes.

The SARTRE 3 project (2004a) showed that three quarters of the interviewees from countries having currently a 0.08 % per se BAC limit favour the lowering to the 0.05 % BAC limit. In contrast, about half of the drivers from countries having currently lower per se BAC standards than 0.05 % approve an enhancement up to 0.05 %. This project was also able to uncover a significant connection between the compulsory per se BAC limit in the member states and the incidence of self-reported drink driving, i. e. the higher the BAC threshold, the higher the frequency of DUI. From the point of traffic safety, a lowering of the per se standards seems to be desirable. The main target groups for further legislative procedures in this field must be the two high-risk groups of young and high-BAC drivers.

When a certain (lower) per se threshold is implemented - besides the scientific knowledge - especially the legal and political circumstances must be considered carefully (Mann et al., 2001; Norström, 1998). Whether the respective legal threshold is accepted or not, depends mainly on the prevailing social attitudes and the enforcement activity of the police (Krüger & Schöch, 1998; Chamberlain & Solomon, 2002), but also on the habituation (SARTRE 3, 2004a). Each lowering of the legal per se threshold commonly leads to an increase of the number of drivers exceeding the limit and, therefore, to an elevation of the number of convictions (Deshapriya & Iwase, 1996). This is a challenge for the police and the judicial system, which must be considered before such lower limits are implemented. So, it is almost impossible to forecast the effectiveness of a per se limit lowering in a specific country, but it can be assumed that a vigorously enforced reduced threshold leads to a reduction of drivers

having BAC values above and below the initial legal per se threshold (Transportation Research Board, 1987). The reduction of the legal per se limit leads in many cases to a reduction of the social acceptance of drinking and driving, leading to an elevation of the social pressure on the offender. But also an interdependency with the above mentioned peccadillo risk (see: 6.1.2) must be considered. It can be assumed that the magnitude of both effects is greater if the reduction of the threshold is enacted by a greater extent.

Additionally, it must be remarked that the implementation of 0.10 % per se laws is seldom connected with higher levels of general deterrence, because drivers with such a high BAC level were also charged under the former impairment law (Eisenberg, 2003). Consequently, the targeted driver group does not regard the implementation of this type of regulation as a tightening of the existing law. So, it does not give the right signal to potential drunk drivers, because the general deterrent element sanctioning severity drops out. This aspect can be transferred to DUID legislation, because the implementation of very high risk thresholds (due to uncertainties in scientific research) for psychoactive substances other than alcohol may not lead to additional traffic safety benefits in comparison to the impairment approach.

6.2.2 Presentation of the general preventive and deterrent empirical results of lower per se thresholds for all drivers

6.2.2.1 From 0.10 % to 0.08 %

The following statements are also valid for the implementation of other lower legal per se BAC limits, because the general deterrent effects are very similar in all cases of threshold lowering. To avoid replications, these statements are not repeated in every subchapter, but only the variations are presented. The majority of the empirical studies evaluated the general deterrent impact of the criminal per se threshold lowering from 0.10 % to 0.08 % in the United States of America (Villaveces, 2003; Tippetts et al., 2005), although in Europe no member state has currently a legal per se BAC limit above 0.08 %, at least not in case of administrative infringements. Additionally, it must be mentioned that the results of American and European studies are quite similar (e. g.: international review of Mann et al., 2001). Therefore, the American results can be transferred to the European situation.

It can be stated that the general deterrent effect of per se BAC limit reductions is mainly not based on the public knowledge of a certain threshold, but on the public perception that the state will no longer accept drunk driving and will combat it (Tippetts et al., 2005). This development leads, in the consequence, to a decrease of the social approval pertaining to DUI. This assumption was confirmed by the German roadside survey (for details see: 6.2.3), which revealed that not the raising of the legal BAC threshold, but the lack of enforcement led to an increase of alcohol related injuries, mainly caused by the high-risk groups. Nevertheless, a considerable number of drivers orientate themselves on the legal per se limit for guidance about safe drinking and driving.

The elevation of the general deterrent impact, which is connected with almost every per se limit reduction, commonly increases with the size of the reduction (Foss, Steward & Reinfurt, 2001). Thus, in most cases a lowering of only 0.1 % is not connected with great general deterrent effects.

For the lowering of the legal per se BAC threshold from 0.10 % to 0.08 %, strong empirical evidence was found in significant reductions of the alcohol related fatality rates and for the significant increase of the general deterrence levels. The range of the reductions varies widely

among the different states (Hingson, Heeren & Winter, 2000; Shults et al., 2001 with reference to Apsler et al., 1999 and Scopatz, 1998). The study of Bernat, Dunsmair & Wagenaar (2004) also revealed that the general deterrent impact of the threshold lowering was independent from the baseline rates. In addition, the observed general deterrent effects have the potential to be longer-lived (Voas, Tippetts & Taylor, 2002). Although some studies observed a common downward trend regarding the number of alcohol related fatalities (Foss, Steward & Reinfurt, 2001), this trend (which already begun one or more years before the lower limit was enacted) was never affected negatively by the introduction of the lower per se BAC limit (Voas, Tippetts & Taylor, 2002). This downward trend is mostly not attributable to one single legal intervention, but to a bundle of different measures, accompanied by a high level of enforcement efforts (Voas, Tippetts & Fell, 2000).

High-BAC drivers are also significantly or at least measurable deterred by the lowering of the legal threshold (Voas, Tippetts & Fell, 2000; Hingson, Heeren & Winter, 1996; Eisenberg, 2003; Chamberlain & Solomon, 2002; Shults, 2001), even when the high BAC levels were not part of the initial target group. Most reviewed studies observed that reductions of the legal per se limits did affect drivers with other BAC levels than the drivers who were originally aimed by the law amendment. Therefore, the reduction of the legal per se thresholds has general deterrent impact on each BAC level, also the high-BAC´s (Mann et al., 2001). This effect is in most cases limited to a lowering of the actual BAC of the former high-BAC drivers and does not lead to a complete abstinence from alcohol among this group.

Other studies were not able to uncover any significant general deterrent impact due to the implementation of the lower legal per se limit (Foss, Steward & Reinfurt, 2001).
Some empirical studies found better results for the 0.10 % than for the 0.08 % per se laws among adolescents aged 21 to 24 years, while among drivers up to 21 years and older than 25 years the converse result was observed (Dee, 2001). Eisenberg (2003) observed this poor outcome among all adolescent drivers younger than 21 years. An explanation for this phenomenon could be, that all adolescents up to 21 years in the United States, where the mentioned studies were conducted, already commit a law violation by consuming any alcoholic beverages, thus, the additional traffic law violation lost some of its general deterrent impact.

Moreover, in most cases the general deterrent impact, measured in the decrease of the alcohol related fatalities, occurred immediately after the new legal regulation went into effect. Some studies even showed an anticipated general deterrent effect, what may mainly be due to high levels of public awareness, but also to an increase of the enforcement activities (Fell & Voas, 2006; Eisenberg, 2003; Chamberlain & Solomon, 2002 with reference to the German experience). This is confirmed empirically by higher reductions among the high-BAC drivers, who feature commonly higher awareness pertaining to legal interventions and law changes than social drinkers (Voas et al., 2000). But the initial general deterrent effects of lower legal thresholds are commonly higher than the successive ones (Voas et al., 2000). Thus, it is recommendable that the implementation of a lower legal per se limit is accompanied by media efforts to increase public awareness, because otherwise the observed general deterrent impact will be at best only modest (Hingson, Heeren & Winter, 1999 with reference to Blomberg, 1992).

Some researchers recommended a simultaneous enactment of lower per se limits and administrative licence withdrawal laws (Hingson, Heeren & Winter, 2000), because they enhance the celerity of the sanctioning procedure. The administrative licence withdrawal laws

permit the deprivation of the driving licence at the spot by the police officer at the roadside. Others even came to the conclusion that the enactment of these administrative licence measures and not the lowering of the legal per se limit must be considered as the decisive general deterrent (Hingson, Heeren & Winter, 1999 with reference to NHTSA, 1991 and Rogers, 1995; Chamberlain & Solomon, 2002; for adolescent drivers: Eisenberg, 2003). These licence measures are evaluated in detail in Deliverable 6.2.

Highly visible enforcement efforts (for details see: 8.2) are urgently necessary to sustain the enhanced level of the perceived apprehension risk, which is commonly caused by well-publicized threshold reductions (Tippetts et al., 2005; Chamberlain & Solomon, 2002; Deshapriya & Iwase, 1998), because otherwise a decay after a short period of time can be observed when the perceived risk of detection is in fact lower (Mann et al., 2001). In this context, Homel (1994) concluded that the increase of the enforcement level (in the specific case by the implementation of a random breath testing law) and not the lowering of the per se limit was responsible for the reduction of the alcohol related fatalities. Therefore, the simultaneous enactment of random breath testing laws was recommended.

6.2.2.2 From 0.08 % to 0.05 %

It was found a general consensus among scientific researchers that a 0.05 % per se BAC threshold should be the maximum (Deshapriya & Iwase, 1996). The 0.05 % per se limit is connected with a high level of public support (Fell & Voas, 2006), which must be considered as one key factor to achieve high levels of legal conformity.

Strong empirical evidence was found for significant reductions of alcohol related fatalities due to the lowering of the legal per se BAC limit (Deshapriya & Iwase, 1996; Fell & Voas, 2006). This counts also for alcohol related fatalities among younger drivers up to 25 years (Brooks & Zaal, 1992). Two further European studies were reviewed in the analysis of Mann et al. (2001). One study (Mercier-Guyon, 1998) came to the conclusion that the lower per se limit did not lead to a significant drop of the alcohol related fatalities in the year of the law implementation, but in the year after, a (delayed) reduction was measured. An Austrian evaluation (Bartl & Esberger, 2000) reported a small and significant reduction of the incidences of drivers under the influence of alcohol due to the implementation of the 0.05 % per se BAC limit. Considerable reductions of the alcohol related fatalities were also reported in a study, conducted in Belgium in the early 1990´s, which was reviewed by Chamberlain & Solomon (2002). Nevertheless, some studies came to the contrarily result of no measurable impact (Bernhoft & Behrensdorff, 2003; Chamberlain & Solomon, 2002 with reference to an empirical study from South Australia, 1991). Another study (Brooks & Zaal, 1992) showed that the implementation of this lower per se limit was connected with significant reductions among low-BAC drivers up to 0.08 % and high-BAC drivers with at least 0.15 %. The observed reductions among moderate-BAC drivers were small and not significant. This outcome may be a confirmation of the hypothesis that an enacted lower per se limit leads to reduced alcohol consumption even among frequent drinkers, but the change in the drinking and driving behaviour goes not so far that these drivers become absolutely sober (see also: Homel, 1994). So, they participate in traffic, but with measurable lower BAC levels. This is also a benefit for traffic safety. Former studies came to the result that the implementation of a 0.05 % per se BAC limit was always connected with higher reductions among high-BAC drivers than among drivers with lower BAC values, even when they were not the main target group of the legal interventions (Norström, 1998; Brooks & Zaal, 1992 with further references).

Additionally, the lowering of the limit was, commonly, connected with an elevation of the

public knowledge of the correct legal per se BAC threshold and with a significant change of the personal drinking habits (for Denmark: Bernhoft & Behrensdorff, 2003). This outcome can be mainly attributed to an increase of the social disapproval for DUI.

6.2.2.3 From 0.05 % to lower values

The idea behind the enactment of per se BAC limits lower than 0.05 % is almost the same as in case of zero-tolerance legislation for adolescent drivers. These low values are intended to send a right and clear message to potential offenders: any amounts of alcoholic beverages in traffic are forbidden due to their dangerousness. This approach may be right, but compasses the issue not completely, because it mainly concentrates on the general deterrent and not the general preventive mode of functioning. In the latter field, the level of social acceptance is a very important element.

A study, which was conducted in Japan, concluded that the implementation of a 0.03 % per se legal limit was connected with measurable reductions of the alcohol related variables. One important element for this outcome was seen in the law-abiding culture of the Japanese, connected with high levels of societal support for DUI countermeasures (Desapriya et al., 2007).

Nevertheless, these results are not indisputable as some empirical research from the Scandinavian states shows (where the lowering of the legal per se limit to 0.02 % was examined). A questionnaire survey (Aberg, 1993), conducted in Sweden, came to the conclusion that the lower per se BAC limit did not change the drinking and driving patterns of the population in a significant way. This evaluation revealed slight increases of the self-reported incidence of DUI. Moreover, a highly significant increase of the self-reported DUI delinquency in the future was uncovered, what may be due to a reduction of the social acceptance of this type of law. But the evaluation of Assum (2010) came to the contrary result. Finally, the disapproval regarding DUI decreased in a highly significant manner, especially among experienced DUI offenders. Another study (Assum, 2010) came to more sophisticated results. He observed a measureable increase of social disapproval for DUI offences with BAC values which were in the main focus of the legal intervention, while DUI offences outside (with very high BAC levels) were connected with slight decreases of social disapproval.

Additionally, the risk of apprehension declined in a highly significant manner after the lower per se BAC limit was implemented (Aberg, 1993). This was also confirmed by the study of Assum (2010). In contrast, the study of Norström (1998) reported a significant decrease of the alcohol related injuries due to the implementation of the 0.02 % per se BAC limit. This study also reported a significant increase of drivers with BAC values up to 0.15 % and a significant decrease of drivers with BAC values exceeding 0.15 %. Assum (2010) concluded that the reductions of the alcohol related fatalities were not significant and that drivers with higher BAC levels were not affected at all. Norström & Laurell (1997, reported in the review of Chamberlain & Solomon, 2002) observed highest reductions among high-BAC offenders with at least 0.15 %.

Consequently, some empirical evidence supports the general deterrent impact of per se limits below 0.05 %, but the outcome is very much dependent on the societal environment as a whole. Hence, it is not possible to give a uniform recommendation for further declines of the legal per se BAC thresholds.

6.2.3 Effects of an enhancement of the legal per se BAC threshold

The common international trend is the lowering of the per se BAC limits and not their enhancement (Chamberlain & Solomon, 2002). Anyhow, the results of the German Roadside Survey (Krüger & Schöch, 1998) are interesting from the scientific point of view. A unique situation was evaluated, a graduated increase of the legal per se BAC limit from 0.00 % to 0.05 % and to 0.08 %. Before this law change took place, the percentages of alcohol related injuries were almost the same, although in the examination state a 0.00 % per se BAC limit was enacted, while the comparison state had a 0.08 % per se limit in effect. After the limit was elevated, the incidence of DUI increased in the examination state. But this outcome was mainly not due to negative implications of the higher limit among the vast majority of drivers and social drinkers, but to a wrong understanding of the message behind this legal regulation among the high-risk groups of young drivers and problem drinkers. This also led to measurable increases of the consumed amount of alcoholic beverages among these high-risk groups, especially young males. This outcome is mainly due to the connection between the enhancement of the per se BAC thresholds and the reduction of the stabilizing effects of the legal regulations. In contrast, the social drinkers still disapproved DUI, even when the higher per se limit was implemented, while the levels of disapproval were lowered among the high-risk groups. The development among the high-risk drivers was additionally abetted by the lack of enforcement which occurred in conjunction with the law change. This led to a reduction of the perceived apprehension risk and, therefore, to a decline of the sanctioning certainty. Apart from this outcome for high-risk offenders (who cannot be completely removed off the roads even if zero-tolerance legislation is implemented), the results for the majority of the social drinkers were not disillusioning.

7. Impairment laws

In case of impairment legislation, which is used in Norway in case of DUID since 1959, it must be proven in each single case that the driving skills of the driver are affected negatively (e. g.: by the conduction of a coordination test). The following three aspects must be proven within the court session:

- alcohol or a drug was present in the driver´s body fluids at the time of the driving,
- the present substance affected the driver at this time and
- this substance rendered the driver incapable of operating the vehicle safely.

The evidence to establish a substance related traffic offence typically relies on expert testimony. This makes the punishment procedure more complicated, costly and prolongs it. So, the general deterrent impact of enforced impairment laws is commonly relatively poor (OECD, 2010), what is mainly due to a lower certainty of sanctioning in the narrow sense.

Impairment laws are in fact the consequence of the lack of dose-effect relations in case of psychoactive substances other than alcohol. They take it into account that a certain amount of alcohol or other psychoactive substances has not the same physiological impact on each persons´ physical and mental conditions. Thus, the imposed sanctions are commonly more justly, leading to higher rates of acceptance and, therefore, to better general preventive effects. This approach only focuses on the posed risk for traffic safety, independent from the consumed amount of psychoactive substances. Hence, the above mentioned risk that traffic law is used as a vehicle to enforce general objective targets of drug policy (see: 6.1) is much lower than in case of per se and especially zero-tolerance legislation.

An advantage of the impairment legislation is the wide range of application, because it is also suitable for legal substances, especially legally used medicines, and for the combination of

alcohol with other psychoactive ingredients. The potential traffic safety risk due to medicinal impairment is very similar to the one of alcohol or illicit drugs, but the motivation for consumption is different, namely healing versus intoxication. Of course, this approach could be restricted to cases in which the driver ignores the advices of the physician, which results in a small range of application and additional enforcement difficulties. Finally, it is questionable in how far the self-responsibility of the driver should be extended and how comprehensive the focus is put on traffic safety. As far as the desire to enhance traffic safety is concerned, it is possible to sanction cases in which the driver did fail to check his fitness after the consumption of any legal or illegal psychoactive substance or came to the "wrong" result. Thus, this approach is connected with a higher level of self-responsibility, but it also emphasizes the freedom of action of the respective driver. Hence, it seems not suitable for drivers who are proven to belong to the above mentioned high-risk groups, because they are commonly not disciplined enough to self-assess their driving suitability thoroughly.

Especially in the case of medicinal impairment the imposed sanction must consider very precisely the form of guilt. Probably, the very vast majority of these drivers do not drive impaired due to intention, but to negligence. Clearly, people taking medications need more information to facilitate their decision whether or not the medicine affects their ability to drive safely. This demand mainly concerns physicians and pharmacists, but also raises the claim for further comprehensive public information campaigns.

The main disadvantage of this type of law is the quite complicated enforcement procedure (for details see: 8.2.3), leading to wider gaps of sanctioning than in case of per se legislation. Additionally, impairment laws are always somewhat subjective with reference to the cognition of the controlling police officers.

8. Enforcement and media efforts

8.1 The life-cycle of legal regulations and the importance of enforcement and media efforts

With reference to the lifecycle-model (Chang & Yeh, 2004), which is suitable to describe the effects of each traffic safety policy (especially of legally threatened sanctions or changes of thresholds), it must be remarked that mass media coverage as well as enforcement efforts aiming at diminishing the emergence phase. Within this period of time, the targeted population has to become familiar with and aware of the new legislation in favour of an early beginning of the growth phase. The plateau of maturity should be sustained for a long period of time, but this is only possible with strong and well-publicized enforcement behind. At best, the beginning of the decline phase should be delayed as long as possible. Both elements have to be in balance to complement each other and to produce measurable general deterrent effects (see also: Voas et al., 1997). This counts also for zero-tolerance laws (Grosvenor, Toomey & Wagenaar, 1999).

8.2 Enforcement

8.2.1 General statements

The importance of enforcement of legal regulations can be illustrated at best with a sentence of Bonte (1993): "A law that is not enforceable is no law." The enforcement must be considered as one key factor to achieve high levels of general deterrence. Enforcement efforts of the police with the target of driving under the influence of psychoactive substances imply different objectives: deterring potential offenders and detecting actual offenders by creating an objective and a subjective risk of apprehension and, additionally, increasing the public

awareness of legal regulations. The major aim of the collectivity of enforcement measures is the implementation of general and not of special deterrence. Increased enforcement efforts, which enhance the risk of apprehension, are the main preconditions for an elevated conviction probability and, in the consequence, the key for an effective DUI/DUID policy (Nichols & Ross, 1990). In addition, enforcement activities have commonly only general deterrent impact among the driving population if they are conducted continuously and connected with a high level of accompanying media coverage (Erke, Goldenbeld & Vaa, 2009; De Jong & Hingson, 1998). One study even came to the result that not the real density of the enforcement efforts, but only the level of media coverage was the only significant general deterrent element (Mercer, 1985). Especially younger drivers suffer from a lack of awareness regarding the implementation of enforcement measures (Solomon, 2008). After the cessation of these efforts, the traffic benefits for traffic safety may also disappear after a more or less shorter period of time.

Detection is a two stage process, which comprises the stopping of the driver, as a question of control density or degree of surveillance, and the detection of signs of impairment, as a question of control efficiency or quality of controls (Löbmann, 2002). This applies in case of impairment legislation, but also in all other cases, where the offender is not obliged to provide a body fluid sample without suspicion, i. e. in all countries without having random breath or drug tests implemented. The detection strategy is more important for high-BAC drivers and hard-core consumers of drugs, because they can hardly be deterred. But detection is the main precondition for the imposition of further procedures (e. g.: rehabilitative measures). Therefore, an enhancement of the control density is less effective in causing measurable general deterrent impact among the high-risk driver population than an increase of the control efficiency (Schöch, 1997). This was corroborated by the SARTRE 3 data (2004b), which showed a significant connection between self-reported drink driving and actual police controls, i. e. the higher the control density, the higher the rates of self-reported drink driving. This can lead to the assumption that the quality of enforcement measures is not regarded as very high due to the fact, that still a considerable number of impaired drivers pass the tests without being detected. As especially hard-core drinkers face police controls rather often due to their driving habits, among them the perceived risk of detection is poor (Wieczorek, Mirand & Callahan, 1994).

In contrast, the deterrence strategy is more suitable for the majority of social drinkers, young drink drivers and occasional drug users. Consequently, the SARTRE 3 study (2004b) was able to detect a correlation between the frequency of self-estimated likelihood of alcohol checks by the police and the incidence of drink driving, because an increased subjective likelihood led to a decrease of DUI. These differences must be urgently considered when enforcement measures are planned and conducted, because an elevation of the enforcement activity is not unconditionally connected with an increase of the general deterrent level and, thus, with an enhancement of traffic safety (ESCAPE, 2003).

With reference to the results of the SARTRE 3 results it must be acknowledged that the enforcement activities among the European member states in general are rather low. Enforcement must, particularly, improve in case of drugged driving, because the risk of apprehension in this field is still rather low. For example, in Norway, where very persistent traffic enforcement is executed, the percentages of randomly detected DUID offenders range between 10 % and 15 %, while the vast rest is detected in conjunction with striking behaviour (Christophersen & Morland, 1997). These values were confirmed for Finland as well (Ojaniemi et al., 2009).

Enforcement efforts are regularly very costly. Therefore, a cost-benefit analysis is essential to support the planning of future measures. Within Deliverable 3.3.1, three scenarios were hypothetically tested with regard to their cost-effectiveness: 50 % increase of the enforcement level regarding drugs/medicines (amphetamine, benzodiazepine, cocaine, methamphetamine, opiates, cannabis), 300 % increase of the enforcement level regarding drugs/medicines connected with a 10 % reduction of the enforcement level regarding alcohol and 1,000 % increase of the enforcement level regarding drugs/medicines. The scenarios were run through in The Netherlands, Belgium and Finland. It was observed that the 1,000 % increase is never effective, while the best benefit-cost ratio was achieved by the implementation of the 50 % increase. In this context, it was emphasized that DUI is still a present problem.

The question for the appropriate enforcement strategy cannot be answered without regard to the underlying approach, in particular impairment or zero-tolerance. This applies for DUI, but also for DUID. Therefore, it is necessary to outline the main elements which must be taken into consideration in relation to these approaches. Afterwards, the different measures are presented in detail.

8.2.2 Per se legislation

In case of per se laws, the enforcement is rather easy, because the officer has in general only to require a sample of bodily fluid for further forensic tests. In case of zero-tolerance legislation, suspicion-based enforcement strategies seem not very promising due to slight signs of obvious impairment at low alcohol levels. The same may count for DUID. So, in the latter two cases the implementation of random testing laws (for details see: 8.2.4.4) is urgently recommended.

8.2.3 Impairment legislation

In case of impairment legislation, it is essential that the police officer protocols the signs of impairment in each case very thoroughly, because these records are the main basis for a court conviction. This is a time-consuming procedure and, as often mistakes are made, the rates of dismissals are, regularly, higher than in case of per se legislation. This leads to lower risks of apprehension and conviction and, consequently, to a decrease of the general deterrent level. A considerable number of impaired drivers, especially the ones from the high-risk group of hard-core drinkers, are able to hide the signs of impairment to go through control sessions undetected. Thus, only severely and obviously impaired drivers will be apprehended (OECD, 2010). Additionally, it is regularly necessary that the police officers are specially trained to recognize and assess impairment and recognize these signs. This is again time-consuming and especially costly. A valuable input for these activities can be seen in the evaluation of all applicable drug recognition programmes in Deliverable 3.2.2.

A very promising manner of increasing the certainty of sanctioning, in particular the risk of detection, in case of DUID was implemented Norway in 1996. From this point of time, each requested blood sample shall be tested for alcohol and 25 other illicit psychoactive substances, independent from the suspicion of the police (Christophersen & Morland, 1997; Morland, 2004). Although this may be a very recommendable way of dealing with DUID, this procedure is rather costly. A further important step in the direction of increasing the detection rates of DUID offenders can be seen in the mandatory blood test of drivers involved in an accident (EMCDDA, 2007).

8.2.4 Different enforcement strategies in detail

The enforcement measures can be divided into two main sections: alcohol as the classical area of enforcement and illicit drugs and medicines as a relatively new, less explored area. It is important to know which strategies worked successfully in case of DUI to adopt or improve them for the combat against DUID. As far as enforcement strategies are concerned, the proven best practices among European member states are very likely to be successful also in other states, because classical law infringements like DUI are less influenced by societal peculiarities (ESCAPE, 2003).

Regarding the enforcement of the prohibition of illicit drugs and medicines in traffic, there is not such a well-proven device like the breathalyzer in effect, but the recent research has developed rather valid screening tests on the basis of saliva (Deliverable 3.3.1). This is an important step forward. In contrast, it must be noted that an increase of the automation of the police enforcement efforts contain the risk of a court overload if the system only adheres to the judicial procedure (ESCAPE, 2003).

Drug impaired drivers can be found at all times of day and on all days of the week, what is primarily due to the longer substance detection period. In contrast, alcohol impaired drivers accumulate excessively at nighttimes and weekends. The strategy for DUID controls or checkpoints, therefore, will need to be revised to enhance the effectiveness of the practice in identifying drivers who are impaired by drugs (OECD, 2010). Enforcement efforts targeted at commercial drivers under the influence of psychoactive substances must take into consideration that these drivers can be apprehended more likely during daytimes and on highways (Transportation Research Board, 1987).

It seems reasonable to conduct highly visible testing sessions at places and times with high traffic, but low offender density (e. g.: early morning hours) to achieve measurable general deterrence (Dunbar, Pentilla & Pikkarainen, 1987; see also: Fell et al., 2008; Wells, Preusser & Williams, 1992) and to choose places with inverse characteristics to detect a considerable number of traffic offenders, who belong to the high-risk group of hard-core offenders. But in the latter case, it is important to conduct unobtrusive controlling sessions. Such a strategy was performed in The Netherlands in 1988 with great effectiveness. Additionally, it is important to conduct these efforts continuously.

8.2.4.1 Sobriety checkpoints

Sobriety checkpoints are predetermined locations at the roadside, where all passing drivers or specific samples of them are pulled out of the moving traffic and checked for psychoactive impairment through police officers. These efforts serve two objectives. On the one hand, they increase the apprehension risk of impaired drivers, to detect them and remove them from the road (Lacey et al., 2008), on the other hand, they deter potential offenders from future DUI/DUID offences (De Jong & Hingson, 1998). Of course, the second aspect is only valid among offenders who can be deterred, i. e. regularly not hard-core drinkers or consumers. These checkpoints can be equipped as alcohol, drug or mixed alcohol-drug control stations. One common advantage of sobriety checkpoints is the less severe intervention in the personal rights of the controlled driver during the testing session in comparison to random breath testing and random stopping laws (see: 8.2.4.4). Thus, there are less legal objections - especially from the constitutional point of view - against their implementation.

Three different main types of checkpoint designs exist:

- At **random checkpoints** not every driver is checked for impairment, but only randomized persons. Of course, in most cases only these motorists are controlled who already show signs of impairment, but sometimes obviously sober drivers are checked, especially for general deterrent reasons.
- At **selective checkpoints** only persons are examined when the police officer achieves a certain degree of suspicion of impairment. This is also the legal precondition for requesting a breath sample, otherwise the officer only can ask for voluntary cooperation.
- At **compulsory checkpoints** every driver is checked and has to undergo a mandatory breath test.

In this context, it must be distinguished between the stopping and the testing session, because both of them can be organized as random, selective or compulsory. Of course, it is possible to mix the different designs (e. g.: random stopping - selective testing; compulsory stopping - random testing). The applied testing approach, namely random, targeted or only in accident situations, should be clearly related to the pursued aims (Gillard, 2004), which were already named above (see: 8.2.1).

Sobriety checkpoints are empirically proven to be connected with measurable, but not always significant general deterrent impact (Villaveces et al., 2003; Ross, 1994; Kenkel, 1993; OECD, 2010; Evans, Neville & Graham, 1991), especially if they are well-conducted and highly publicized (Lacey et al., 2008; Levy, Shea & Asch, 1989). Additionally, it is empirically proven that the implementation of sobriety checkpoints mainly affects drivers at lower BAC levels (Wells, Preusser & Williams, 1992). The studies review of Löbmann (2001) emphasized that the empirical results are sometimes mixed or even contradictory.
A meta-analysis, which was conducted within the EU-project PEPPER, came to the conclusion that the general deterrent effectiveness of randomly organized sobriety checkpoints was superior to the other two types, while the worst results were connected with compulsory sobriety checkpoints, where every pulled out driver is tested (Erke, Goldenbeld & Vaa, 2009). Comparisons between random and selective sobriety checkpoints came to the conclusion that the outcome for the first ones is better (Elder et al., 2002; Shults et al., 2001), because the risk of being tested in the second type of checkpoint is rather low due to relatively short interview sessions to observe signs of impairment (De Jong & Hingson, 1998). Drivers can avoid detection through normal behaviour, which can be observed especially among frequent drinkers. About half of the impaired drivers remain undetected during the short stopping and testing sessions. In this context, the term “normal behaviour” of frequent drinkers is a little bit misleading, because this type of offender is - due to the alcohol illness - only able to perform the daily affairs like driving with a certain alcohol level in the blood. This is also true for frequent consumers of other psychoactive substances.

Compulsory breath testing checkpoints are connected with the lowest levels of general deterrent impact among all three types of checkpoints. The named meta-analysis also came to the conclusion that the effectiveness of sobriety checkpoints regularly declines with an increasing duration. This development may be mainly due to the habituation of the offenders regarding the location of the checkpoints. Hence, it is quite simple for informed drunken drivers to avoid this enforcement measure. At least few empirical studies confirmed that the implementation of sobriety checkpoints is connected with stable and long-lived decreases of alcohol related fatalities and, therefore, with measurable general deterrent impact (Levy, 1988). Consequently, it must be recommended that these checkpoints are conducted on a

frequent, but unpredictable schedule (De Jong & Hingson, 1998). It can be concluded that the subjective uncertainty of police checks is one major general deterrent factor. Additionally, the checkpoints have to be conducted at regularly changing locations. The change between different fixed locations will solve the problem only temporarily, because it can be expected that DUI/DUID offenders will get knowledge about these checkpoints and, therefore, they will be able to avoid them again. In line with these statements, a review (Löbmann, 2002) came to the conclusion, that the observed traffic safety outcome in case of mobile controls was much more promising than the one for fixed sobriety checkpoints. While in the first case eleven of the 13 reviewed studies reported a positive outcome on alcohol related variables, only six of the 15 studies for sobriety checkpoints did. As a consequence, The Netherlands executed the change from fixed checkpoints to mobile controls since 1987.

To sum it up, sobriety checkpoints can be considered as a persistent general deterrent measure as far as attention is paid to the above mentioned aspects.

8.2.4.2 Saturation patrols

Saturation patrols are mobile and target specifically at drivers who display classic signs of impaired driving behaviour. Commonly, they are designed as additional police patrols during high-risk times like weekend nights and/or at high-risk locations like bars. It is empirically proven that this type of enforcement measure is connected with immediate and measurable reduction of alcohol related accidents, even among drivers with higher BAC levels (Voas & Hause, 1987).

8.2.4.3 Roadcheck blitzes

Roadcheck blitzes or enforcement crackdowns are enforcement efforts which are conducted with high levels of personal and technical equipment. They are always conducted for a certain period of time, especially during high-risk times. The design of these enforcement measures differs widely, but in most cases they are a combination of sobriety checkpoints and saturation patrols. The main advantage of these crackdowns in comparison to the sole implementation of sobriety checkpoints is the avoidance of habitual effects among the targeted driver population.

Regularly, it can be concluded that these crackdowns are rather effective general deterrents (Fell et al., 2008). This countermeasure is able to reduce the incidence of drunk driving even among the high-risk groups of adolescent drivers (Zwicker et al., 2007) and of high-BAC drivers (Solomon et al., 2008). The preconditions for these spurring outcomes, mainly attributed to an increase of the perceived apprehension risk, are high levels of media coverage and of visibility for other drivers (Solomon et al., 2008), but also a continuous conduction. The publication of the common testing results in the media after a testing session may be an additional general deterrent element.

8.2.4.4 Random breath or drug testing/stopping laws and evidential screening

Random breath testing laws make it possible to stop single cars at every place at the roadside and request a breath sample of the driver, independent from causes or hints for impairment (Homel, Carseldine & Kearns, 1988). In case of random stopping laws, the driver is at first stopped by the police for checking the car and the driving licence and only if the officer detects any suspicion of impairment, the driver has to undergo a breath test. In case of random testing, this test must be operated mandatorily. Due to few signs of impairment at low BAC levels, random stopping laws are hardly recommendable for the enforcement of zero-tolerance laws. The implementation of random breath testing laws can cause conflicts with the

presumption of innocence, which contains constitutional protections against illegal search and seizure (Ross, 1994). It depends on the stringency of this presumption in the respective national constitutional law and its interpretation by the Supreme Courts if this law type can be implemented on the national level or not. One advantage of random stopping laws in comparison to random testing laws is the less severe intervention in the personal freedom rights of the controlled person.

Both law types have the potential to enhance the objective and the subjective risk of apprehension (Moore et al., 1993). Thus, the general deterrent impact of random stopping laws is quite similar to the one of random breath testing laws (Homel, Carseldine & Kearns, 1988 with further references). The general deterrent effect of random breath testing laws is very stable (Löbmann, 2001; Transportation Research Board, 1987 with reference to the Australian experience; Briscoe, 2004 with reference to Henstridge et al., 1997 and Homel, 1986). A review (Löbmann, 2002) came to the conclusion that all analysed studies revealed a positive outcome for traffic safety. In some cases, the implementation is connected with an immediate drop of the alcohol related crash rates (Tay, 2005). Due to the fact that random breath tests are not conducted at fixed locations like sobriety checkpoints, the first ones lead to higher reductions of alcohol related accidents (empirical studies review of Peek-Asa, 1999). This counts particularly if the testing sessions are conducted highly visible and are accompanied by a high level of media coverage (Peek-Asa, 1999; Homel, Carseldine & Kearns, 1988).

Additionally, the implementation of random breath testing laws is, regularly, connected

- with a reduction of the self-assessed safe BAC level,
- with a reduction of the social acceptance of drink driving and
- with an increase of public support for this countermeasure (Homel, Carseldine & Kearns, 1988; Moore et al., 1993; Dunbar, Pentilla & Pikkarainen, 1987 with reference to Arthurson, 1985).

So, it also has a measurable general preventive impact on the offenders, but higher levels of general prevention are observable among non-drinkers and not among drinkers.

Among European member states, the check of drivers for alcohol is the exception, but not the rule (SARTRE 3, 2004a). In addition, states which have implemented random breath testing laws show measureable higher rates of self-reported checks among the interviewees than countries without having this type of law in force. Two main results can be drawn from the prior statements. Firstly, a correlation between the self-reported frequency of being checked for alcohol and the individually estimated risk of being checked exists. This leads to the assumption that the objective apprehension risk is an important element to influence the perceived apprehension risk. Secondly, the estimated likelihood of being tested doubles in member states with random breath testing laws in force in comparison to those states without.
However, the implementation of random breath testing laws may not deter the high-risk groups of drivers with high BAC values or the ones who consume different psychoactive substances simultaneously, but at least these drivers are detected. Additionally, one study of Moore et al. (1993) came to the conclusion that drivers with prior DUI convictions showed lower rates of general deterrence than drivers without convictions. The same results were observed for self-reported drinkers versus non-drinkers. Nevertheless, empirical evidence exist that random breath testing laws have a general deterrent impact among high-BAC drivers (Dunbar, Pentilla & Pikkarainen, 1987). This is also valid for the group of younger drivers (Tay, 2005). A precondition for this outcome may be that the enforcement measures are explicitly targeted to these groups of drivers.

Within the EU-project IMMORTAL (Deliverable D-P2, 2005) a cost-benefit analysis of generally increased random breath test efforts among four member states (The Netherlands, Czech Republic, Norway, Spain) has been conducted hypothetically. In all states, an increase of random breath testing measures was highly cost-effective, while the cost-benefit ratio for doubling the random roadside testing efforts was higher than for tripling them.

The next step after the implementation of random breath tests is the enactment of evidential breath tests, because the enforcement activities may increase if the police is not forced to take a blood sample from each driver, who is detected with a BAC above the legal per se limit. The highest reductions of alcohol related accidents occurred in member states where both measures are combined (ESCAPE, 2003), indicating a close connection between the DUI rates and the objective risk of apprehension. Evidential breath testing means that the breath sample result - documented by a print from the test device - has the same evidentiary value as the blood sample result. Evidential breath testing, which was implemented in Austria in the 1990´s, speeds up procedures. Consequently, it is possible to conduct more police tests within the same time, because it is no longer necessary to take the offender to a medical doctor for the drawing of a blood sample. The precondition for this development is - besides constitutional issues like the assumption of innocence - the operation with evidential breathalysers. But this measure may not lead to a reduction of the evidential preciseness, especially as far as criminal code convictions could be imposed. In these cases, the offender must have the legal opportunity to request a blood test, even if he is not able to give an explanatory statement for this request. Additionally, the implementation of evidential breath testing laws must acknowledge the inconvertibility of breath to blood alcohol values. Thus, a separate system besides the BAC related system must be implemented in this case.

In case of drivers under the influence of drugs and illegally used medicines, it can be assumed that the highest levels of general deterrence are achievable with the implementation of random drug testing laws. There is no reason apparent why the positive outcome among drunken drivers cannot be transferred to drugged drivers (Deliverable 3.2.2 with reference to Homel, 1998). In case of DUID offenders, the above mentioned detection-based enforcement strategy must be preferred to the deterrence-based strategy, at least as drivers with problematic consumption behaviour and recidivists are concerned. In case of youth DUID offenders, the deterrence-based strategy may be appropriate to a large extent. For a wider application of this countermeasure it is urgently necessary to improve the sensitivity and to lower the costs and the duration of these on-road testing sessions (Deliverable 3.3.1). Random drug testing relies on the use of oral fluid screening devices that can be deployed at roadside. The different screening devices were thoroughly evaluated within the two ROSITA-projects (further information: Verstraete, 2004), but they were not able to identify an appropriate on-road screening device, which met all the demanded requirements. Especially the failure rate was too high (EMCDDA, 2007). Within the DRUID-project, an important step forward was done, because it was possible to recommend the best devices for different purposes (Deliverable 3.2.2). In Australia, this counterstrategy had been implemented since December 2004 in conjunction with zero-tolerance legislation. Screening devices cannot detect every available psychoactive substance due to the large variety, but they must concentrate on the most prominent ones with the highest prevalence rates in traffic. These may differ between the respective member states. Nevertheless, especially for the detection of cannabis, the substance with the highest prevalence rates in traffic, the improvement of the current technical devices is urgently necessary. Before the implementation of this type of law it must be weighed up on the national level between the freedom rights of the controlled person and the efficiency of the legal prosecution system.

Random breath/drug testing laws are only effective in case of per se laws, because in case of the impairment approach they are not useful. The impairment legislation requires some adverse effects on the driving skills, which must become obvious during. So, in general only those drivers are stopped who already have shown some abnormalities, which are sufficient for the request of a breath/blood sample. Consequently, the legal regulation need not contain the permission for random tests. Especially in case of zero-tolerance laws, the simultaneous implementation of random breath testing laws is urgently recommended (Shults et al., 2001), because otherwise the high level of general deterrence caused by the enactment of the zero-limit will decay after a short period of time.

The above named statements are also valid for evidential drug tests, but the research in this field is far behind the one in case of alcohol. By now, no evidential on-road screening device exists, which is able to supply results with the court-needed degree of evidence. This holds especially true for the detection in saliva of the most prominent drug cannabis. So, the later DUID conviction must rely on the blood test result. This may lead to a preferential treatment of DUID offenders in comparison to DUI offenders, particularly, as far as the legal regulation contains the permission of evidential breath testing. Of course, the level of evidence, which has to be provided by the screening devices, is very much dependant on the classification of these offences as administrative or criminal ones. In the second case, the evidential requirements are necessarily higher than in the first ones.

Refusals to provide a breath or body fluid sample must carry sanctions equivalent to those for the most severe impaired driving offence, which may be problematic if administrative and also criminal sanctions are foreseen for DUI/DUID side by side. Otherwise, there is often little or no evidence to base charges or support convictions upon.

The implementation of random testing laws for alcohol and for other psychoactive substances is urgently recommendable. The same counts for evidential screening laws.

8.2.4.5 Preliminary breath testing laws

These legal regulations consider the result of the breath test as sufficient evidence for impaired driving and also as basis for legal countermeasures like licence plate impoundment or other pre-conviction measures. Even short-term arrests are justified as far as they have the objective to reinstate the fitness to drive by drying-out. These laws aim at an increase of the punishment certainty and celerity (Saffer & Chaloupka, 1989), but, at first, their main objective is the danger defence by getting the risky drivers off the road immediately. Due to the right to a hearing, they have the occasion during the court session to prove that they were not impaired during the drive. Their effectiveness may be enhanced by a combination of fixed risk thresholds or zero-tolerance laws.

Some empirical studies showed measurable, but mostly not significant reductions of alcohol related fatalities (Legge & Park, 1994; Evans, Neville & Graham, 1991), even among younger drivers (Chaloupka, Saffer & Grossmann, 1993; Kenkel, 1993; Saffer & Chaloupka, 1989). The results for adolescents are not unambiguous, because a number of studies revealed an increase of DUI due to the implementation of this kind of law (Whetten-Goldstein et al., 2000; Ruhm, 1996; Eisenberg, 2003; Young & Likens, 2000). It is also empirically confirmed that the implementation of preliminary breath testing laws is connected with reductions of the incidence of high-BAC drivers (Eisenberg, 2003), while other evaluations came to the contrary result (Benson, Rasmussen & Mast, 1999).

The implementation of preliminary drug testing laws may lead to comparable mixed results, but as far as no valid on-road screening devices are developed, this issue does not arise in practice.

8.2.4.6 Implied consent laws

These laws contain the assumption that each licence holder had implicitly agreed in breath or blood tests with his application for a driving licence. Implied consent laws have the objective to increase the certainty of sanctioning through the imposition of penalties in case of breath test refusals. Additionally, the swiftness of the sanctioning procedure is enhanced. Regularly, the sanctions differ between the first refusal and repeated refusals and in both cases the penalties are commonly more severe than for exceeding the legal per se BAC limit. At least, they are the same as for reaching the highest BAC level, because otherwise test refusals would be provoked.

Only weak empirical evidence can support the general deterrent impact of implied consent laws, because all analysed studies showed at best non-significant reductions of the alcohol related fatality rates (Ruhm, 1996). The study of Whetten-Goldstein et al. (2000) only showed measurable general deterrent impact among adolescent drivers, but not among older drivers. The study of Benson, Rasmussen & Mast (1999) came to the conclusion that the implementation of this type of law causes measurable general deterrent impact among high-BAC drivers. It has been argued that a combination with preliminary breath testing laws would improve the results (Rhee & Zhang, 1993). Finally, it can be stated that this law type works mainly by the detection of impaired drivers and not by their deterrence. Thus, the main target group must be hard-core drinkers and drugged drivers, because the mechanism of deterrence is for them of limited effectiveness.

8.3 Media efforts

The level of public awareness, caused by media campaigns, is an important element for both general deterrence and general prevention (Solomon et al., 2008; Mercer, 1985; Mann et al., 2002 with reference to Vingilis, 1990 and Vingilis et al., 1988). This counts for the implementation of all types of new legal regulations, but also for enforcement measures (Berger et al., 1990; Epperlein, 1987). Publicity campaigns avoid the so called learning curve among the targeted offenders and lead, in the consequence, to a more immediate deterrent effect. Media pertaining to enforcement measures increases the perceived risk of apprehension. A studies review (Elder et al., 2004) came to the result that specific media campaigns were able to result in measurable additional reductions of the incidence of DUI, although the level of enforcement or the legal consequences remained unchanged. But it may be feared that this outcome is not long-lived. If accompanying media efforts in case of threshold changes for DUI/DUID are connected with some information about the scientific background, the social acceptance probably will increase much more than in cases where the reasons for the legal change remain concealed. The following explanations are restricted to campaigns which focus either on legal measures or enforcement activities. Therefore, educative or other primary preventive measures are not covered by this topic.

At the “First European Conference on the Evaluation of Drug Prevention” (cited by: Krüger et al., 2004), a four-stage-model regarding mass media campaigns was compiled: physical contact with the message, awareness, understanding and acceptance/absorption. Although this model was invented for preventive purposes, it can be applied in cases of punishment and deterrence, because the underlying mechanism of communication is the same in all named

cases. At the latest at the second stage, it is important to target media campaigns to special groups of drivers and also to specific substances, because otherwise it will be very likely that the messages of these campaigns will be ignored to a wide extent (EMCDDA, 2007) or cause unintended effects (e. g.: messages that tell the public not to drive after taking too much of a drug, imply that moderate drug use is acceptable). But the level of awareness concerning law changes among problem drinkers is significantly higher than among non-drinkers. Thus, this target group can hardly be influenced by additional media efforts. The same should count in case of regular drug consumption or addiction. In contrast, younger drivers are less aware in relation to older drivers (Solomon et al. 2008). Therefore, comprehensive media efforts targeted at younger drivers are proven to enhance the level of general deterrence (Tay, 2005). This is also valid for adolescent drugged drivers.

For high levels of impact not only television campaigns should be taken into consideration, but also radio and print media (De Jong & Atkin, 1995). In this context, is empirically proven that high budgets are not a guarantee for higher impact on the targeted driver population (Donovan, Jalleh & Henley, 1999). Additionally, media efforts which also focus on social and health norms are able to cause better outcomes due to the potential to change individual behaviour (Elder et al., 2004).

9. Conclusions

9.1 Recommendations

9.1.1 General issues concerning legal regulations

- Legal interventions must be based on the latest scientific-empirical basis.
- The most effective strategy in the combat against DUI/DUID is a combination of information, prevention, rehabilitation, treatment and moderate repression.
- Issues of general drug and traffic safety policy must be distinguished precisely, but each law change within these two fields must be made with respect to the other to ensure the entity of the legal system.
- Each accident, prosecution and conviction statistic should distinguish between alcohol, illicit drugs and medicines.
- The distinction between legal and illegal substances seems not suitable in all cases, but the approach legal versus illegal consumption seems more promising, also for medicinal drugs.
- Each law change must be accompanied by a balance of high levels of publicity and increased enforcement efforts.
- Legal regulations which enhance the punishment certainty and celerity, respectively, show a higher general and special deterrent impact than an increase of the sanctioning severity.
- DUID legislation must focus much more on special deterrence than DUI legislation and has to concentrate on the vast majority of adolescent drivers.

9.1.2 Sanctioning of impaired driving

- Legal regulations with special targets (e. g.: adolescent or high-BAC drivers) have significantly greater general and special deterrent impact than unspecified regulations among both first- and multiple-offenders.
- The imposed sanctions must consider the seriousness of the offence and the posed risk, at least in case of criminal sanctions. Consequently, fixed sentences in case of criminal court convictions are not proportional.
- Incarceration periods cannot be considered as an effective general or special deterrent.
- Jail penalties should be avoided among first-offenders, at least in cases without aggravating circumstances, due to the activation of a labelling-process. For these offenders diversion with remedial interventions is much more effective.
- The maximum duration of jail penalties for impaired driving without aggravating circumstances should be six months.
- Probation achieves higher special deterrence than unconditional incarceration periods among high- and low-risk offenders, but only if it is ensured that the offender is closely supervised.
- The effectiveness of well-executed probation in case of DUID is very much dependent on accompanying individual restrictions and obligations.
- Fines have only general and special deterrent impact if the height creates a substantial burden, at best by measuring it at the individual income of the offender.
- The minimum height for first-offences should be around € 500,--. This should be equal to one fourth to one third of an average monthly income in the respective country.

9.1.3 General statements concerning per se and impairment approach

- Each lowering of the legal per se BAC limit is regularly connected with a considerable increase of general deterrence and a decrease of the social acceptance of driving under the influence of alcohol.
- The peccadillo risk and the societal, historical and legal environment must be considered thoroughly before enacting scientifically indicated lower thresholds.
- In case of zero-tolerance laws it is necessary to implement lower effect limits as cut-off values.
- Impairment laws seem to be the most appropriate way to deal with legally used medicines in traffic.

9.1.4 Specific statements concerning risk thresholds and zero-tolerance laws

- The standard legal per se BAC threshold should not be higher than 0.05 %.
- The reduction of the general per se BAC level can reduce the prevalence of drivers with BAC levels outside the main target group, especially high-BAC drivers.
- Zero-tolerance laws are effective to decrease DUI among young and novice drivers. A per se BAC threshold of 0.02 % is regularly connected with higher levels of general prevention and almost the same levels of general deterrence than a BAC threshold of 0.00 % among this target group.
- The implementation of lower per se thresholds for convicted DUI offenders than for normal drivers is an effective general deterrent. The threshold in this case must be at least 50 % lower than the standard per se BAC level, but the best general deterrent results are achievable with zero-tolerance laws.

9.1.5 Enforcement efforts

- Enforcement efforts must be targeted at specific driver groups and have to distinguish between deterrence-based and detection-based strategies.
- Enforcement measures must be accompanied by comprehensive media coverage.
- Enforcement efforts must be conducted continuously, but with an unpredictable schedule.
- The level of general deterrence among social drinkers will increase if more testing sessions would be conducted in the early morning hours and not only in the evenings and at the weekends.
- In case of deterrence-based strategies, enforcement measures must be conducted with high visibility for all drivers, while in case of detection-based strategies this visibility is not recommendable.
- Sobriety checkpoints have to change their location after several testing sessions.
- Enforcement crackdowns are effective general deterrents by avoiding habitual effects among the offenders.
- Random breath/drug testing laws are the most effective enforcement measures. The accompanying implementation of evidential analytical procedures is recommendable, but the aggrieved party must have the legal right to request a blood sample in each case.
- The general results of enforcement activities (e. g.: number of apprehended drivers; detected BAC or substance levels in average) should be published in the media afterwards.

- The most important factor when impairment laws are enforced is a very thorough examination and logging of the signs of impairment by the police officers. This requires a comprehensive education of them.

9.1.6Media campaigns

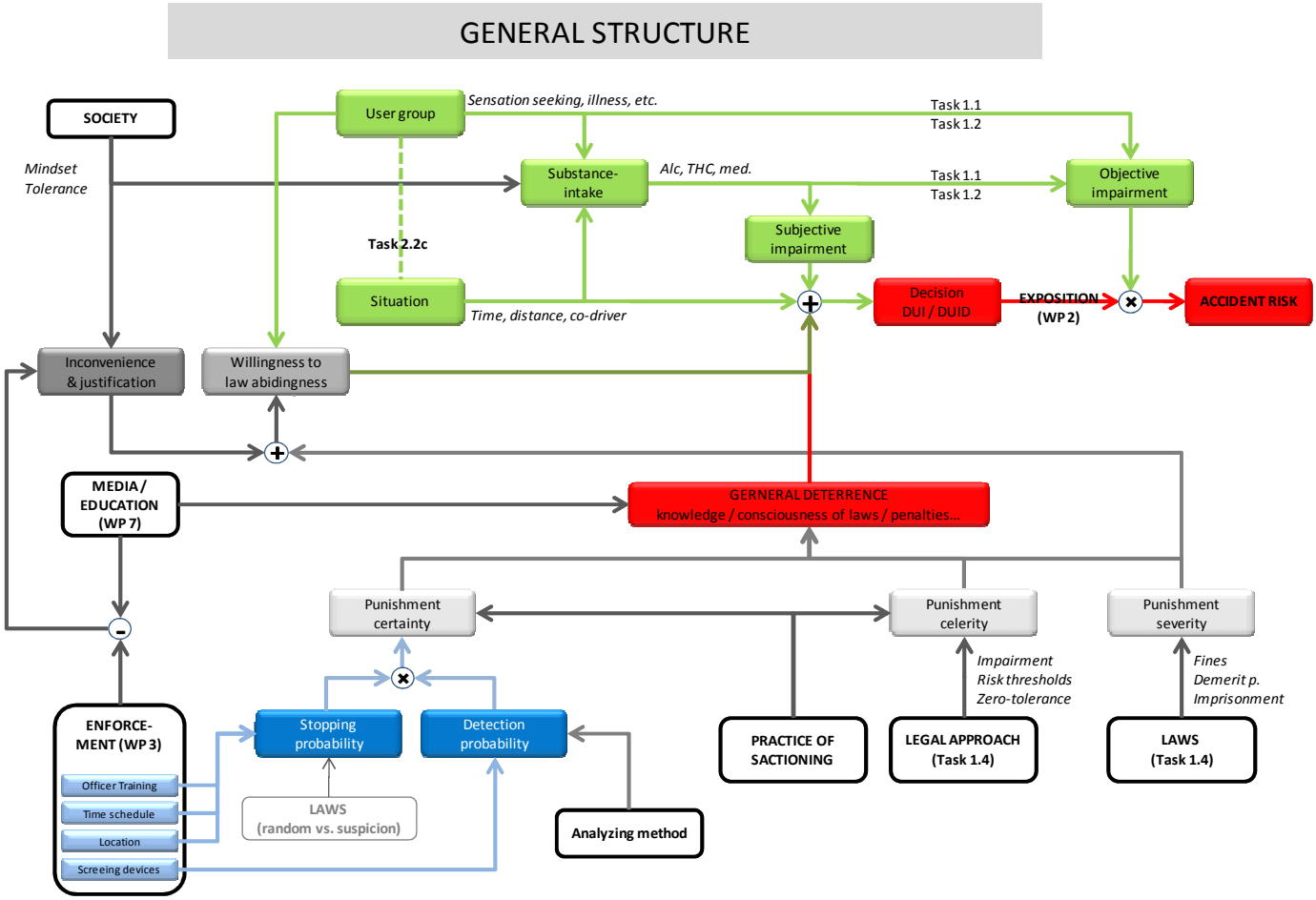
- Media campaigns must comprise the main scientific background of legal interventions and have to be targeted at specific offender groups and substances.
- Enhanced media efforts among hard-core drinkers or drug consumers are hardly effective.
- In contrast, younger drivers are often unaware of legal interventions and, therefore, additional publicity and education campaigns seem promising.

9.2 Draft of a "model-tool"

In the following a model-tool is drafted to depict the effectiveness of different legal interventions in relation to the above mentioned five risk groups in traffic. As far as the respective measure is not evaluated empirically, the estimated effectiveness is presented. The main aim of this model-tool is to simplify the decision-making of policymakers and stakeholders by giving an overview of the most effective strategies with respect to the risk groups in traffic.

Risk group	Fines	Jail penalties	Zero-tolerance	Lower thresholds	Media efforts	Enforcement strategy
Adolescents/novices	↑	↗	↑	↘	↑	Deterrence
Drug drivers	↗	↘	↗	–	↗	Deterrence + detection
Problem drinkers and consumers	↘	↘	↗	→	↘	Detection
Multi-drug consumers	↘	↘	–	–	→	Deterrence + detection
Recidivists	↘	↘	↗	→	↘	Detection

In the following, the interdependencies of different societal, behavioural and legal variables are depicted.



FREE (INDEPENDENT) VARIABLES:

USER GROUP & SITUATION (FIXED):
Personality/illness combined with situations (e. g.: amphetamines ⇨ late night, THC ⇨ whole day, alcohol ⇨ evening)

SOCIETY (FREE):
Mindset/tolerance/right for mobility…
Availability of drugs…

LEGAL APPROACH (FREE):
Impairment/risk thresholds/zero-tolerance

LAWS (FREE):
Enhancement/implementation of fines/demerit points…

RANDOM VS. SUSPICION BASED CONTROLS
I. e. the juridical bases of stopping procedure

ENFORCEMENT (FREE):
Efforts of police/toxicology to stop and detect DUI/DUID

MEDIA / EDUCATION (FREE):
Efforts to announce enforcement and legal regulations/efforts to explain modifications of legal regulations and enhanced enforcement to drivers (justification)

PRACTICE OF SANCTIONING
Is the offence prosecuted by immediate action (withdrawal, suspension) or by a slow juridical procedure (court trial, which includes a higher requirement of evidence and, therefore, has influence also on the punishment certainty)

ANALYZING METHOD
Blood, breath…
The analyzing method has not only influence on the detection probability, but also on the punishment celerity, which is ignored for clarity reasons

DEPENDENT VARIABLES:

SUBSTANCE INTAKE:
Is dependent on the user *group/situation and* the mindset in *society*

SUBJECTIVE IMPAIRMENT:
Is dependent on the *substance intake* (and dose)
User group is disregarded for reasons of clarity (e. g.: subjective impairment is lower for addicts)

OBJECTIVE IMPAIRMENT:
Is dependent on the *substance intake* (and dose) *and user group*
When the user group are ill people, they may suffer from objective impairment by the illness and impairment is decreased by the medicinal drug

STOPPING PROBABILITY:
Is dependent on how good officers are trained to recognize DUI/DUID drivers *(officer training)* and *time schedule*, *location* of control sites

DETECTION PROBABILITY:
Is dependent on *screening devices* on the road and *analyzing methods* in toxicology
Officer Training is also relevant, but disregarded for reasons of clarity (e. g.: because a DUI/DUID driver may be stopped and controlled, but not sent to give a blood sample)

PUNISHMENT CELERITY:
Is dependent on the legal approach and the practice of sanctioning
Impairment approach will lead to slow juridical procedures due to obligatory court trials
Per se laws can lead to rather quick juridical procedures if in case of limit exceeding, a court trial is not mandatory

PUNISHMENT SEVERITY:
Is dependent on the laws/legally threatend sanctions (practice of sanctioning)

PUNISHMENT CERTAINTY:
Is dependent on the stopping probability and detection probability and the practice of sanctioning
It is important to note that this combination is multiplicative
Only if the driver is stopped AND the substance is detected, punishment certainty will be the consequence

GENERAL DETERRENCE:
Is dependent on punishment celerity, punishment severity, punishment certainty and media/education
Laws, penalties, etc. can only have an effect if they are known in the society (legal knowledge)

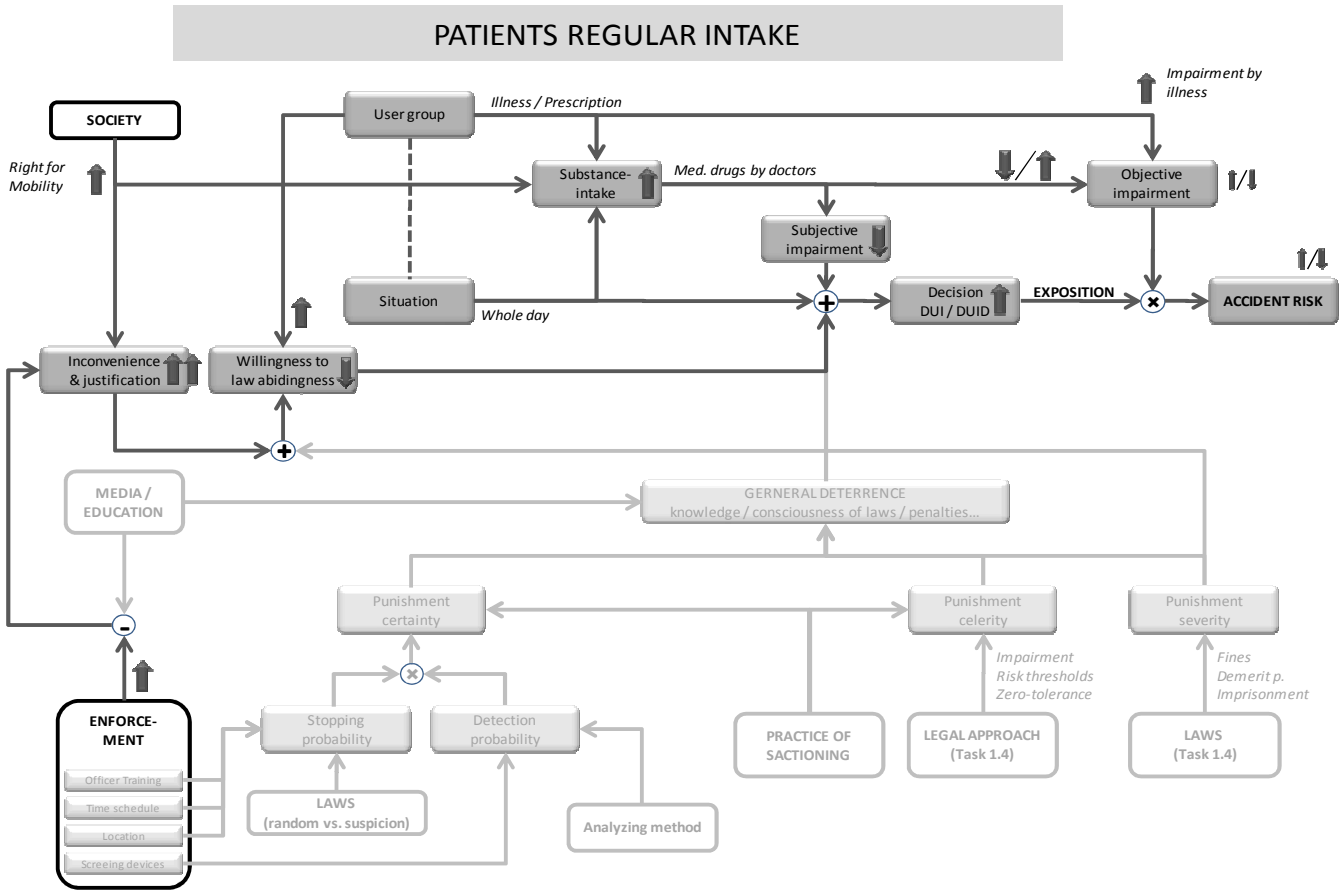
INCONVENIENCE AND JUSTIFICATION:
Is dependent on society, enforcement and media/education
The negative nexus means that the effect of high enforcement on inconvenience can be LOWERED by MANY MEDIA CAMPAINS to explain and justify this enforcement

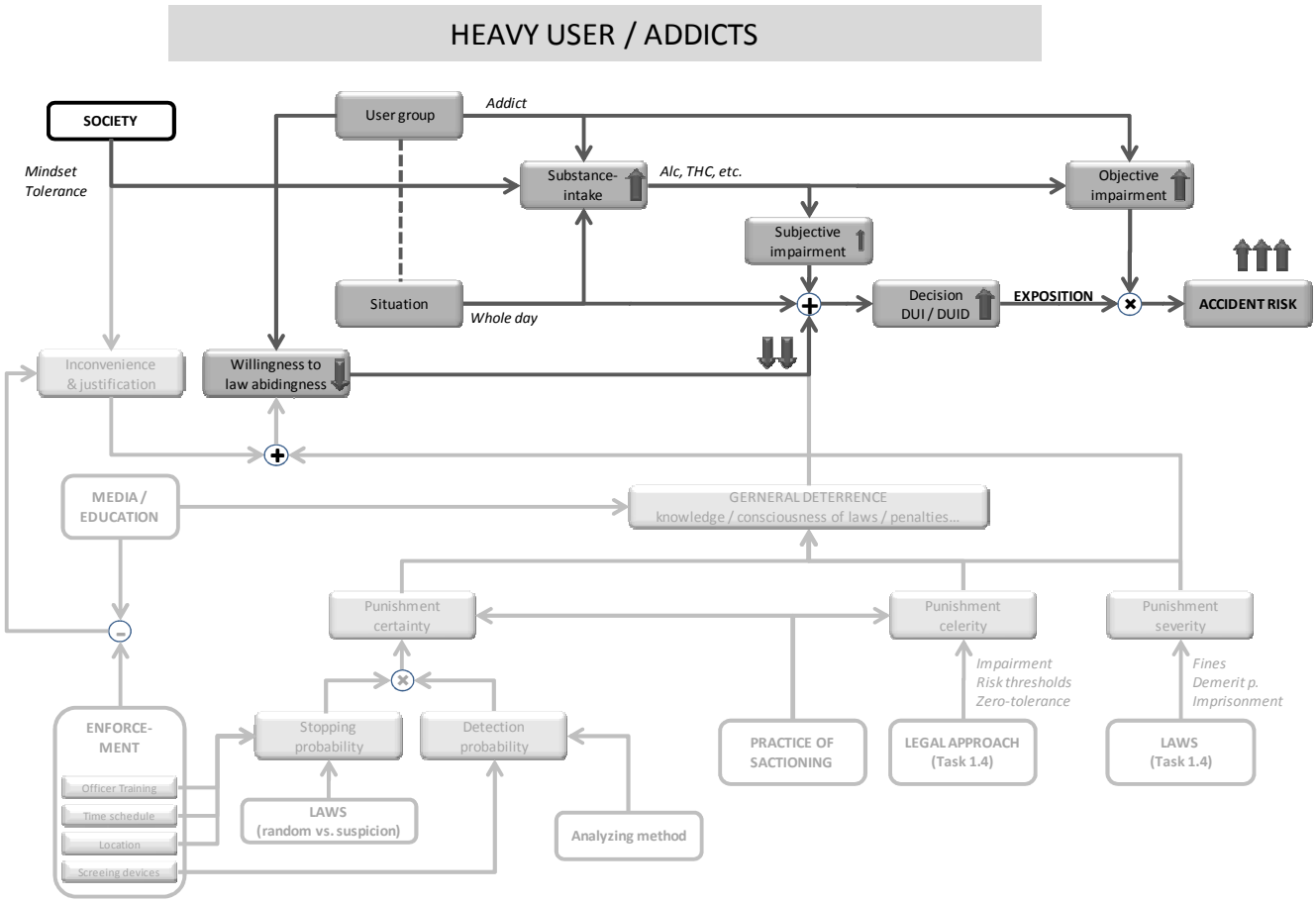
It describes the threshold of what a society (dependent on the mindset) will endure on e. g. control measures, surveillance, etc.
E. g. a frequent, long lasting control of patients on medicinal drugs will lead on the one hand to a very high inconvenience on drivers, which can hardly be justified by media campaigns. Consider on the other hand, the case of terror warnings, where frequent control measures are justified by media campaigns and, therefore, are accepted by society.

WILLINGNESS TO LAW ABIDINGNESS:
Is dependent on inconvenience, user group and laws
E. g. the willingness to law abidingness will decrease in patients, who are frequently controlled and have, therefore, a low appreciation of these measures, particularly if severe laws/sanctions exist
The willingness to law abidingness will increase in normal drivers in case of appropriate laws (even if they are frequently controlled) if media campaigns explain the necessity of the legal regulations and these enforcement efforts, because their a priory willingness to law abidingness is high
The willingness to law abidingness in addicts or heavy users is 1) low due to their personality and 2) the influence of laws is (almost) irrelevant, because they need to take psychoactive substances and, therefore, do not make up a rational choice before they drive under the influence of psychoactive substances

DECISION DUI/DUID:
Is dependent on subjective impairment, situation, willingness to law abidingness and the general deterrent effect
Additionally, it is probably dependent on media campaigns („after 2 glasses of beer you will have 0.5 permille“), but this relationship is ignored for clarity reasons
E. g. normal drivers, who show a priory probably a high willingness to law abidingness, will decide for DUI/DUID if either the subjective impairment is rather low or the situation makes a drive by car much more comfortable than other modes of transportation. A high subjective impairment will only lead to DUI/DUID if the willingness to law abidingness is decreased, because of inappropriate hard laws or the general deterrent effect is too low, mainly due to a low stopping/detection probability (= punishment certainty)

ACCIDENT RISK:
Is dependent on the positive *decision for DUI/DUID* (which leads in combination with the proportion of the user group in the population and their driving frequency to the exposition in traffic) and objective impairment
It is important to note that this combination is multiplicative
I. e. even a very high objective impairment does not lead to a remarkable increase of accident risk in traffic if the exposition (prevalence) is very low
But an increase of DUI/DUID will not lead to a remarkable increase of the accident risk if there is hardly any impairment


PATIENTS REGULAR INTAKE
SOCIETY
Right for Mobility
User group
Illness / Prescription
Impairment by illness
Substance-intake
Med. drugs by doctors
Objective impairment
Subjective impairment
Situation
Whole day
Decision DUI / DUID
EXPOSITION
ACCIDENT RISK
Inconvenience & justification
Willingness to law abidingness
MEDIA / EDUCATION
GERNERAL DETERRENCE knowledge / consciousness of laws / penalties...
Punishment certainty
Punishment celerity
Punishment severity
Impairment Risk thresholds Zero-tolerance
Fines Demerit p. Imprisonment
ENFORCE-MENT
Officer Training
Time schedule
Location
Screeing devices
Stopping probability
Detection probability
LAWS (random vs. suspicion)
Analyzing method
PRACTICE OF SACTIONING
LEGAL APPROACH (Task 1.4)
LAWS (Task 1.4)


HEAVY USER / ADDICTS
SOCIETY
Mindset Tolerance
User group
Addict
Substance-intake
Alc, THC, etc.
Objective impairment
Subjective impairment
Situation
Whole day
Decision DUI / DUID
EXPOSITION
ACCIDENT RISK
Inconvenience & justification
Willingness to law abidingness
MEDIA / EDUCATION
GERNERAL DETERRENCE knowledge / consciousness of laws / penalties...
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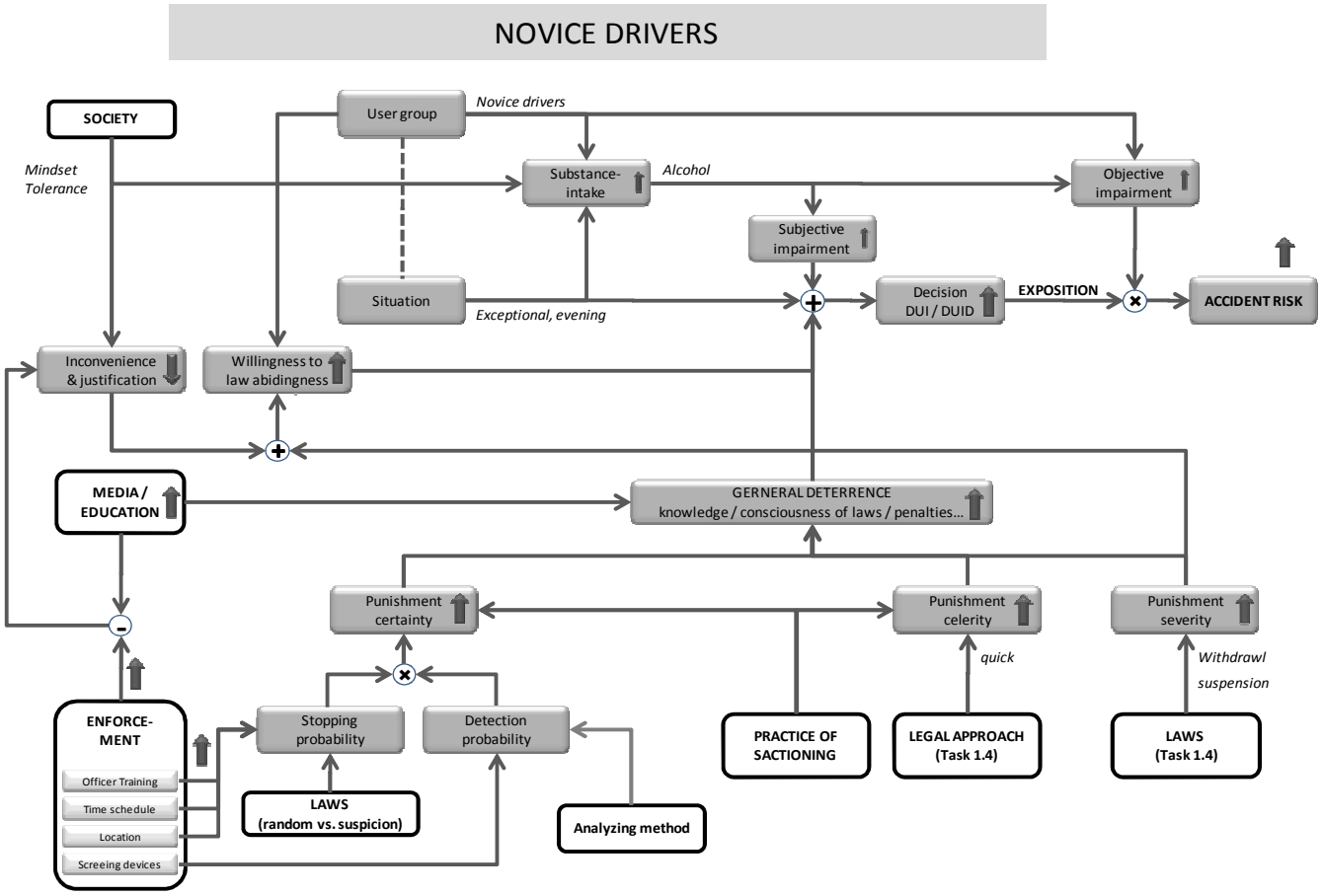
NOVICE DRIVERS
SOCIETY
Mindset
Tolerance
User group
Novice drivers
Substance-intake
Alcohol
Objective impairment
Subjective impairment
Situation
Exceptional, evening
Decision DUI / DUID
EXPOSITION
ACCIDENT RISK
Inconvenience & justification
Willingness to law abidingness
MEDIA / EDUCATION
GERNERAL DETERRENCE
knowledge / consciousness of laws / penalties...
Punishment certainty
Punishment celerity
Punishment severity
quick
Withdrawl
suspension
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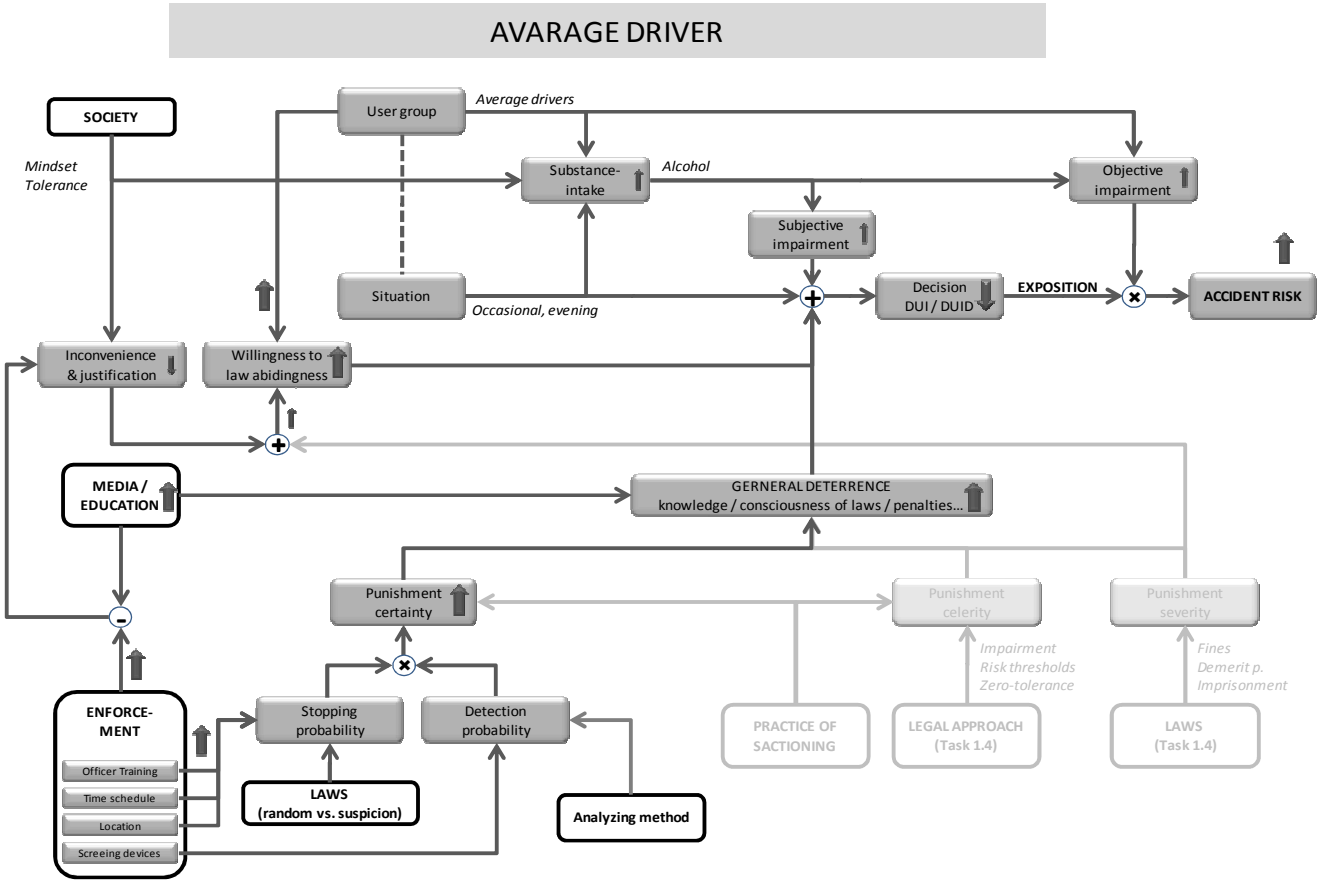
AVARAGE DRIVER
SOCIETY
Mindset
Tolerance
User group
Average drivers
Substance-intake
Alcohol
Objective impairment
Subjective impairment
Situation
Occasional, evening
Decision DUI / DUID
EXPOSITION
ACCIDENT RISK
Inconvenience & justification
Willingness to law abidingness
MEDIA / EDUCATION
GERNERAL DETERRENCE
knowledge / consciousness of laws / penalties...
Punishment certainty
Punishment celerity
Punishment severity
Impairment
Risk thresholds
Zero-tolerance
Fines
Demerit p.
Imprisonment
ENFORCE-MENT
Officer Training
Time schedule
Location
Screeing devices
Stopping probability
Detection probability
LAWS (random vs. suspicion)
Analyzing method
PRACTICE OF SACTIONING
LEGAL APPROACH (Task 1.4)
LAWS (Task 1.4)

10. Annex: Presentation of the detailed results of the empirical studies

10.1 General deterrence of DUI policies and law changes

10.1.1 Increase of the punishment severity

10.1.1.1

Authors:
Ross, Mc Cleary, La Free (1990)
Location and time of the study:
Mariacopa County (Arizona); 1980-1986
Analysed measure:
General deterrence of a law enacted in 1982 in Arizona, containing a common increase of the punishment severity for DUI (especially: implementation of mandatory jail sentences and enactment of a legal prohibition of plea bargaining to avoid the mandatory jail terms)
Size of the sample:
About 35 vehicle related fatalities per month
Design and methods of research:
Interrupted time-series quasi-experimental research on fatal accidents data
Results:
Only a non-significant reduction of fatal accidents after the implementation of the new law was observed *(p. 162)*.
The magnitude of drinking and driving had not decreased, so the elevation of the punishment severity was not connected with a deeply deterrent impact. One possibility for this outcome may be that drunk drivers had not regarded one day in jail as a severe penalty, especially compared with the alternative of licence actions *(p. 162)*.
The findings of this study were supported by another independent study of Epperlein (1987) *(p. 163)*.
The result of this study was quite clear: the question whether the threat of a mandatory brief jail sentence can be an effective general deterrent, is an open one. Most of the individual case studies failed to find evidence for the effectiveness of jail periods *(p. 163)*.
This study came to the conclusion that long-term imprisonment is effective in removing offenders off the roads and, so, preventing further offences, but such policy is unacceptable expensive. Additionally, this positive effect for traffic safety ends up with the release of the offender *(p. 163)*.

10.1.1.2

Authors:
Kinkade, Leone (1992)
Location and time of the study:
Santa Clara County (California); 1987-1989
Analysed measure:
General deterrent effects of enhanced sanction severity in case of DUI (especially: implementation of per se limits, implied consent regulations, mandatory minimum penalties and restrictions of plea bargaining)
The respective law became effective in 1982
Size of the sample:
About 16,000 arrest records per year
19 interviews with experts
Design and methods of research:
Interrupted quasi-experimental time-series analysis on DUI misdemeanants arrest rates before and after the implementation of the tougher DUI law from 1977 to 1986

Elite interviews (structured interviews and open-ended questions) of policymakers

Results:

The implementation of tougher DUI laws did often not lead to an increase of the number of arrestees if an enhancement of enforcement efforts was not conducted simultaneously *(p. 243)*.

Santa Clara was affected by the problem of jail overcrowding caused by the more severe DUI law, because the jail population increased within the first two years after the law implementation about 60 %, while the jail capacity expanded only 28 % *(p. 246)*.

The number of DUI arrestees declined by 8.1 % one year after the law change, but the upward-trend already begun one year before the law change in 1981 *(p. 247)*.

In 1979 and 1980, the number of arrestees raised in each case about 19 %, while in the following years the rates steadily declined (1981: -1.18 %; 1982: -6.40 %; 1983: -8.10 %; 1984: -4.93 %; 1985: -10.87 %; 1986: -1.21 %) *(p. 249)*.

The new law had the inverse effect according to its intention, because an increase of the number of DUI arrestees was intended *(p. 251)*.

Through the experts´ interviews, it became obvious that the problem of jail overcrowding did not affect the officials´ decision to send the offenders to prison or not, but that the major influence for this decision came from the new stricter law. So, the number of DUI offences declined in deed, what may be attributable to the general deterrent impact of the enhanced sanction severity *(pp. 247, 251)*.

Moreover, policymakers must be aware of the unintended consequences connected with the implementation of new laws (e. g.: jail overcrowding) *(p. 255)*, because if the resources for a strict enforcement of the law amendment are not available, the intended general deterrent impact will diminish after a very short period of time.

10.1.1.3

Author:

Briscoe (2004)

Location and time of the study:

New South Wales (Australia); 2003

Analysed measure:

General deterrent effect of doubling the statutory penalties for DUI (minimum and maximum licence disqualification periods and maximum level of fines), which were enacted in September 1998 and were targeted at mid-range (between 0.08 % and 0.15 %) and high-range (above 0.15 %) BAC drivers

Size of the sample:

Total of 164,573 accidents with personal damage (4,684 fatalities and 210,084 casualties)

Design and methods of research:

Interrupted time-series analysis

Examination of the single vehicle night time injury or fatality rates between 1994 and 2001

Results:

While some empirical studies showed a general deterrent effect of the penalty increase for DUI (e. g.: Borschos, 2000; Peck, 1991; Rogers & Schoening, 1994), several others found no measureable effect or even a negative impact for traffic safety (e. g.: Hingson et al., 1987; Mayhew et al., 1995; Ross, 1984). With reference to Nagin (1998) and Ross (1984), it was assumed that in some of the latter cases the observed outcome may be due to a lack of an increased apprehension risk through effective enforcement measures *(p. 920)*.

The fatality rate did not change in a significant manner during the whole examination period, but the legal intervention seemed to slow down the common downward trend, which was

observable in the years before (change in the underlying trend after law implementation => coefficient: +0.002) *(p. 921)*.
The rates of all single vehicle night time accidents showed a different development. After a steady and significant downward trend between 1994 and 1997 (number of accidents in 1997: 1,427) this trend stopped and a significant increase begun, peaking at 1,643 accidents in 2001. Also the trend-line - based on the regression line - showed a downward trend, which stopped right at the time of the penalties increase and an upward trend started (coefficient of the change: +0.012) *(p. 921)*.
One possible explanation for the observed upward trend may be the reduction of police presence on the road, resulting in a significant decline of the number of conducted random breath tests (1996: 2.7 million; 1999: 1.9 million). This would be a confirmation of the hypothesis that an increase of the penalties for DUI has no deterrent effect if it is not accompanied by a high level of police enforcement *(p. 925)*.
Moreover, the target population was not really aware of the law change, because only a low level of media coverage concerning the new law was observed *(p. 925)*.

10.1.1.4
Authors:
Rogers, Schoenig (1994)
Location and time of the study:
California; 1990
Analysed measure:
General deterrent impact of legislative reforms, which were implemented in 1982 and contained increased sentences, higher standards of sanctioning uniformity and a legal per se limit
Design and methods of research:
Time-series analysis
Comparison of the alcohol related single vehicle night time injury and fatality rates and had-been-drinking accidents (accidents where the police officer indicated that the driver was under the influence of alcohol) between 1979 and 1986
Results:
The night time casualty rates in the pre-intervention period showed a steady decrease, which stopped about six months after the implementation of the legislative reforms. Up from that point of time, the rates remained very stable until the end of the whole post-intervention period, showing one higher increase in 1986 *(pp. 66, 67)*.
Almost the same pattern was observed among the had-been-drinking accidents *(p. 68)*.
Although the level of significance was reached, it was emphasized that the decrease-trend already began before the legal interventions were implemented. Thus, it was doubted that the new law was the only factor which contributed to the decline of alcohol related accidents *(pp. 73, 74)*.

10.1.2 General deterrent impact of punishment certainty, celerity and severity

10.1.2.1 Punishment certainty and severity
Authors:
Jones, Donelly, Swift, Weatherburn (2006)
Location and time of the study:
New South Wales (Australia); August 2004-March 2005

Analysed measure:
General deterrence of both increasing the hazard of apprehension through random roadside drug testing and doubling the sentence severity for driving under the influence of cannabis (DUIC)
Size of the sample:
320
Design and methods of research:
Face-to-face, structured interviews (duration of each interview session: about 35 minutes) with recent cannabis users, who belong to one of the high-risk groups among DUIC offenders
Employment of an experimental deterrence paradigm
The interviewed persons were confronted with a hypothetical scenario in which they had to estimate their individual likelihood of driving under the influence of cannabis under the given circumstances (according to the hazard of being caught by the police in the "certainty-groups" and to the problems which arise from the imposed penalty in the "severity-groups").
Four groups concerning the certainty and severity (high/low) were created and participants were block-randomised to one of these groups before the interviews, while in each group both certainty and severity were represented in the scenario (high severity-low certainty, low severity-high certainty and vice versa).
In the high certainty part, the participants had to think of a random drug testing law, while this was not mandated in the low certainty group.
In the high severity part, people were confronted with hypothetical fines of $ 1,000 and licence disqualifications of at least 12 months, whereas the penalties in the low severity group were halved *(p. 855)*.
Results:
Among the randomised participants of each group, no significant differences according to age, gender composition and previous DUIC offences existed.
The belief of a low apprehension risk for DUIC in practice among the four groups ranged from 74 % to 85 % *(p. 857)*.
A high certainty of punishment led to a decrease of the likelihood to DUIC. This effect was independent of the interviewees´ gender and cannabis dependence *(p. 857)*. Therefore, also chronic users are at least partly deterred by a high punishment certainty.
The mean score according to the likelihood of DUIC were the following in the respective groups:

High certainty-high severity:	32
High certainty-low severity:	27
Low certainty-high severity:	54
Low certainty-low severity:	59

The differences among the high and low severity scenarios were not significant, but they were as far as the certainty conditions were concerned *(p. 858)*.
The main effect terms for the punishment severity were age, prior convictions for traffic offences and other offences. But these terms were not significant and, therefore, omitted for the final examination *(p. 858)*.
As a conclusion, the general deterrent effect of a highly perceived apprehension risk is significantly greater than the deterrent effect of an increased punishment severity *(p. 858)*.
The majority of the participants were likely to drive after the use of cannabis, although it affects their driving skills negatively and, so, leads to an increase of the accident risk. One reason for this may be the widely held belief among cannabis users that they are better-than-average drivers *(p. 859)*.

10.1.2.2 Punishment certainty and severity

Authors:

Grosvenor, Toomey, Wagenaar (1999)

Location and time of the study:

Minnesota, Wisconsin; 1992-1997

Analysed measure:

Effects of the classical elements of general deterrence among adolescent drivers

Size of the sample:

8,908 high-school seniors, holding a valid driving licence (1992: 4,440; 1995: 4,469)

Design and methods of research:

Cross-sectional regression analysis

Two questionnaire surveys were conducted (1992 and 1995)

Results:

The results for the perceived likelihood of apprehension differed measurable, because 40 % reported a high apprehension risk, while 43 % estimated the risk as rather low *(pp. 189, 190)*.

Moreover, the perceived risk of apprehension was much lower among binge drinkers than among non-binge drinkers ($p = 0.0001$) *(p. 190)*.

This study did not uncover a significant relationship between the perceived punishment severity and the incidence of binge drinking ($p = 0.833$) *(p. 190)*.

Furthermore, there was a significant interaction between the level of perceived certainty and binge drinking (regression coefficient: 0.0478), indicating that an increase of the subjective punishment certainty will lead to lower levels of binge drinking and consequently of DUI. Among social drinkers, the relationship between alcohol consumption and punishment certainty did not reach the level of significance *(p. 190)*.

As a result, especially among the high-risk group of adolescent drivers an increase of the punishment severity cannot be regarded as an effective general deterrent element. Although zero-tolerance laws were considered to be a valuable countermeasure to combat DUI among young drivers, these laws will be only effective general deterrents if they are accompanied by a high level of enforcement and publicity *(p. 190)*.

Finally, a simultaneous increase of the sanctioning swiftness will lead to additional deterrent impact among the targeted population *(pp. 190, 191)*.

10.1.2.3 Punishment certainty

Authors:

Wieczorek, Mirand, Callahan (1994)

Location and time of the study:

New York; 1994

Analysed measure:

General deterrent impact of detection risk

Size of the sample:

453 licence holders

Design and methods of research:

Cross-sectional relation analysis

Telephone surveys

Results:

The interviewees were asked how they would estimate the likelihood of getting caught by the police if driving after the consumption of six standard drinks - which contain a higher amount of alcohol than the legal limits permits - *(pp. 315, 316)*.

74 % of the interviewees answered that they would estimate the risk as very high - which was equal to more than ten percent - *(p. 317)*.

No significant differences were revealed among the interviewees who reported drunk driving within the last twelve months and those who did not report DUI. Among the low-risk interviewees, 26 % reported DUI within the last twelve months, while only 22 % did this in the high-risk interviewees. Moreover, no significant differences pertaining to the risk of detection were observed in relation to the frequency of alcohol consumption. While in the group of low-likelihood 12 % answered to be heavier drinkers, in the other group only 10 % did so *(p. 317)*.
Although the level of significance was not reached, drivers featuring lower perceptions of getting caught by the police for DUI are more often problem alcohol consumers.
The effectiveness of the deterrence theory was not confirmed by this study *(p. 320)*.
With reference to the outcome - especially as far as young males were concerned -, heavier drinkers continue DUI despite a higher level of awareness pertaining to the risk of apprehension *(p. 321)*.

10.1.2.4 Punishment certainty, celerity and severity

Authors:
Nagin, Pogarsky (2001)
Location and time of the study:
Arizona; 1999-2000
Analysed measure:
General deterrent effectiveness of punishment severity, certainty and celerity
Size of the sample:
252 college students
Design and methods of research:
Regression analysis
Data regarding the incidence of self-reported drink driving were gathered through a questionnaire survey
Results:
The regression coefficient for punishment severity was significant (-1.01) and connected with an average 6.8 % reduction of the probability of DUI. The value for certainty was even highly significant (-0.49) and connected with a reduction of 3.3 %. The value for the sanctioning celerity was positive, but non-significant (+0.37), indicating that this element of general deterrence is combined with an increase of the drunk driving likelihood *(pp. 877, 878)*.
Additionally, the researchers computed regression coefficients by using an enhanced baseline. The element punishment severity did now not reach the significance level, but at least it was again connected with a negative prefix (-0.88). Moreover, the value of -0.51 for certainty was again highly significant and negative. Finally, the sanctioning swiftness coefficient remained positive and non-significant (+0.52) *(p. 881)*. So, the observed outcome was rather robust.
The whole study is only based on estimations pertaining to one single sanction, driving licence suspension. This may have led to some bias.

10.1.3 Perceived general deterrent impact of different legal measures

Authors:
Freeman, Watson (2009)
Location and time of the study:
Queensland (Australia); June and August 2002
Analysed measure:
General deterrent impact of different legal factors on the self-reported offending behaviour
Size of the sample:
780 licence holders

Design and methods of research:
Telephone surveys of randomly selected drivers
Results:
The following self-reported general deterrent estimations were outlined *(p. 115)*:

	Very low	Very high
Risk of apprehension:	3.2 %	69.2 %
Fine:	3.0 %	67.0 %
Licence disqualification:	2.5 %	73.5 %
Jail:	1.9 %	84.4 %

Among a mixed population of drivers, jail penalties have the highest general deterrent impact, while the results for fines were worst. As predictably, the deterrent impact of licence disqualification was also rather high. A little bit surprising was the relatively bad outcome for the element "risk of apprehension", because in line with prior research this factor can be considered as the key factor for general deterrence. So, this study did reveal rather strong evidence for the general deterrent impact of the sanctioning severity, which is definitely very high in case of incarceration.

Additionally, a logistic regression analysis was conducted and the following regression coefficients were computed *(p. 117)*:

	Separate models	Combined models
Risk of apprehension:	-0.13	-0.38
Fine:	+0.23	+0.26
Licence loss:	-0.28	-0.22
Jail:	-0.02	+0.06

In both models, the only significant variable was the apprehension risk, what confirmed the high value of strong enforcement measures. The outcome for jail penalties changed when the structure of the models was altered, because in the case of separated models the regression coefficient was at least negative, while it was positive in the case of combined models. The outcome for fines remained worst, while the results for licence disqualification confirmed once more the high level of general deterrent effectiveness.

10.1.4 Implementation of a high-BAC law

Authors:
Mc Cartt, Northrup (2004)
Location and time of the study:
Minnesota (USA); 1997-2000
Analysed measure:
General deterrent effects of the implementation of a high-BAC law for drivers with a detected BAC level of at least 0.20 %, which was enacted in January 1998 and contained more severe administrative pre-conviction and criminal post-conviction sanctions (e. g.: licence plate impoundment for first-offenders and vehicle forfeiture for repeat-offenders)
Design and methods of research:
Interrupted time-series design
Comparison of alcohol test results in 1998 and 2000
Semi-structured interviews with about 20 DUI experts

Results:
In 1998, 85.6 % of the first-offenders with a BAC exceeding 0.20 % received high-BAC administrative dispositions and/or high-BAC court convictions and 65 % even received both. So, the enforcement of the law was operated like intended by the policymakers and, consequently, the legal regulations were able to unfold their deterrent qualities, especially through a high standard of sanctioning certainty *(p. 273)*.
The percentages of high-BAC offences declined statistically significant from 1998 to 2000 (first-offences: from 16.9 % to 15.5 %; repeat-offences: from 21.0 % to 20.4 %) *(p. 273)*.
The percentages of alcohol test refusals - indicating that the driver had an actual BAC level exceeding the legal threshold - for first-offenders declined significantly from 12.7 in 1997 to 11.5 % in 1998 and 10.7 % in 1999 and 10.5 % in 2000, while the refusal rate for repeat-offenders remained constant *(p. 273)*.
As a result, the high-BAC law had an initial effect as a deterrent *(p. 277)*. Legal regulations which target special groups of drivers are commonly connected with higher levels of general deterrence than unspecific regulations.
Due to a lack of accompanying publicity, the offenders were likely unaware of the more severe high-BAC penalties and so a learning curve, which lasts a certain period of time, among the offenders could be observed *(p. 276)*.

10.2 Special deterrence of DUI policies and law changes

10.2.1 Implementation of a high-BAC law

Authors:
Mc Cartt, Northrup (2004)
Location and time of the study:
Minnesota (USA); 1997-2000
Analysed measure:
Special deterrent effects of the implementation of a high-BAC law for drivers with a detected BAC-level of at least 0.20 %, which was enacted in January 1998 and contained more severe administrative pre-conviction and criminal post-conviction sanctions (e. g.: licence plate impoundment for first-offenders and vehicle forfeiture for repeat-offenders)
Size of the sample:
1997: 32,625
1998: 33,662
1999: 35,832
2000: 35,737
About 20 DUI experts
Design and methods of research:
Interrupted time-series survival design
Analysis of driver licence files between 1997 and 2000
Semi-structured interviews with DUI experts
Results:
The rates of recidivism after one year were lower in 1998 than in 1997 for first-offenders (6.7 % versus 7.3 %) and total repeat-offenders (7.9 % versus 9.0 %). The rate of recidivism after two years was similar in 1998 and 1997 for first-offenders (12.6 % versus 12.9 %), the rate was lower in 1998 for repeat-offenders (15.7 % versus 17.5 %). Additionally, there were significant differences in the survival rates after six months, one year, 18 months and two years *(p. 274)*. The recidivism rates of drivers with BAC-levels between 0.17 % and 0.19 % did not decline, what can mainly be attributed to the fact that these persons were not targeted by the law. Furthermore, the enforcement of the law was operated like intended by the

policymakers and, therefore, it enhanced the sanctioning certainty as the most important special deterrent factor.
The outcome would likely have been improved if the level of accompanying publicity would have been higher, because a considerable number of offenders was likely unaware of the new law. Through media efforts, this learning curve among the offenders is avoidable *(p. 276)*.
As a result, the high-BAC law had an initial deterrent effect *(p. 277)*.

10.2.2 Special deterrent impact of punishment certainty, celerity and severity

10.2.2.1 Punishment severity

Authors:
Wheeler, Hissong (1988)
Location and time of the study:
Harris County (Texas); January 1984
Analysed measure:
Evaluation of the special deterrent impact of probation, fines and jail sentences on DUI offender (three days for first-offenders, 15 to 30 days for repeat-offenders)
Size of the sample:
397 DUI offenders
Design and methods of research:
Regression analysis
Analysis of the subsequent deviant behaviour of a randomly selected DUI population for a follow-up period of 36 months
Results:
This study did not reveal significant differences in the recidivism rates pertaining to the different sanctions. The recidivism rates among DUI first-offenders were the following:
jail penalties: 8 %, probation: 11 %, fines: 14 % *(pp. 35, 36)*.
This study confirmed the hypothesis that severe penalties are at least among first-offenders, who are only seldom chronic alcoholics, able to cause measurable special deterrent effects. But the results are mainly affected by the organisation of the prison regime.
A well-known phenomenon was the incidence of significant sooner recidivism among persons with prior DUI records than among first-offenders, what was also observable in this study.
Among DUI repeat-offenders, probationers had the lowest recidivism rates (10 %) compared to those who were fined (19 %) and who were jailed (25 %) *(p. 35)*. One main reason for this spurring outcome of probationers were the better predictions concerning their future legal behaviour, especially in comparison to the unconditionally jailed offenders. Moreover, the effects of probation surveillance procedures and DUI education classes caused additional benefits.
The total recidivism rate among all types of offenders was 12.8 %.
An offender without a prior DUI conviction had an 89 % likelihood of not becoming a recidivist until the end of the third year after the commitment of the first offence, whereas an offender with a DUI-history only had a probability of 79 % *(p. 38)*.
Moreover, first-offenders who received an unconditional jail penalty of more than two weeks only had slightly better success rates compared with probationers. The situation among repeat-offenders was quite different, because among this group the probationers had a 15 % better outcome than the unconditional jail inmates *(pp. 38, 39)*. Consequently, unconditional jail penalties, which reflect the highest level of punishment severity, have much more deterrent impact among first- than among repeat-offenders.

When evaluating public policy options for DUI offenders, four factors should be taken into consideration:

- Cost effectiveness
- General deterrence
- Sentence equity (this factor can be considered as an element of general deterrence)
- Potential for education and rehabilitation (potential to change behaviour: aspect of special prevention)

(p. 39).

10.2.2.2 Correlation between sentence severity and different types of offenders

Authors:

Mann, Vingilis, Gavin, Adlaf, Anglin (1991)

Location and time of the study:

Ontario (Canada); 1979

Analysed measure:

Specific deterrence of miscellaneous aspects of sentence severity on different offender groups

Size of the sample:

Total: 2,739 (first-offenders: 2,045; second-offenders: 502; multiple-offenders: 192)

Design and methods of research:

Correlational design

Regression analysis with a chosen follow-up period of three years on post-conviction alcohol related accidents and recidivism

Three offender-types were examined (first-, second- and multiple-offenders)

Results:

First-offenders

There was no significant relationship uncovered between prior alcohol related accidents and any of the follow-up variables *(p. 486).*

A quite strange outcome was the increase of the recidivism rates in case of increasing height of the fines *(p. 486).*

The following values were computed *(p. 487)*:

	Subsequent DUI convictions	Alcohol related accidents
Fine	2.56 ($p<0.05$)	1.63
Jail	-0.25	1.46
Probation	-0.02	-0.92

The number of subsequent DUI convictions is a much more reliable indicator than the number of the alcohol related accidents, what is in this study mainly due to the lacking restriction to accidents causing injuries or fatalities. The number of accidents is deeply affected by the wide dark field, which would be minimized in the case of casualty crashes.

Multiple-offenders

The following values were computed *(p. 488)*:

	Subsequent DUI convictions	Alcohol related accidents
Fine	-0.33	-1.14
Jail	-0.04	-2.14 ($p<0.05$)
Probation	-0.92	-0.93

The very bad outcome for incarceration periods seems to be affected by the circumstance that jailed drivers in general have poorer predictions concerning their future legal behaviour. So, the high numbers of alcohol related accidents are not a sign for the lack of the deterrent impact of jail periods, but they are a confirmation of the judges´ prior estimations.

General statements of the researchers
This study found no significant connection between height of fine or length of probation/jail period and outcome.
The imposition of less severe sentences other than licence suspension had beneficial effects on traffic safety compared to more severe penalties *(p. 489)*.
This study found only significant results for first- and multiple-offenders, but not for second-offenders. A reason for this may be that second offenders are an inhomogeneous group. Among these offenders, the outcome is much more related to other factors than in the other two offender groups which were not examined in this study (e. g.: alcohol problems) *(p. 489)*.

10.2.2.3 Impact of sentence severity, certainty and celerity in relation to traditional **sanctions**
Authors:
Freeman, Liossis, Schonfeld, Sheehan, Siskind, Watson (2006)
Location and time of the study:
Queensland (Australia)
Analysed measure:
Special deterrent impact of traditional sanctions (e. g.: fines, licence disqualification) in relation to punishment severity, certainty and swiftness
Size of the sample:
166 recidivist drink drivers
Design and methods of research:
Regression analysis
Self-reported perceptions and intentions to re-offend gathered through personal or telephone interviews
Results:
Referring to other empirical studies (e. g.: Beirness, Mayhew & Simpson, 1997), hard-core drinkers - who are in most cases repeat-offenders - are difficult to deter, because the threat of criminal sanctions cannot be observed among most of them due to the lack of making up a rational decision before the commitment of the crime *(pp. 53, 54, 62)*.
The main objectives of the imposition of legal sanctions are punishment, retribution, reform and incapacitation *(p. 54)*.
The social control theory concentrates on non-legal sanctions, which seem to be at least as important as legal sanctions. The most important non-legal sanctions are social disapproval and internal loss. With reference to Ahlin, Rauch, Zador, Baum & Duncan (2002) and Smith (2003), especially the perceptions of peers and friends have a strong deterrent or encouraging effect on drinking drivers *(p. 55)*.
Most of the interviewees were suspended from driving for a period ranging between six and 60 months and also received a fine of $ 500 *(p. 57)*.
Although 68.1 % reported more than ten DUI offences in their whole lifetime, “only” 76.5 % reported that re-offending is extremely unlikely or at least unlikely *(p. 58)*.
Moreover, 51.8 % perceived a high certainty of punishment and even 86.2 % considered the sanctions as severe, but there was a great lack of perceived celerity, because only 15.6 % thought that the sanctioning process was swift *(p. 58)*. These findings revealed one main reason for the lack of deterrence of the classical legal sanctions, because it is empirically

proven that the punishment celerity is one superior general and special deterrent. The computed regression coefficients were the following:
certainty: +0.06; severity: -0.14; swiftness: +0.01. None of these values reached the level of significance *(p. 60)*. The results indicate that even among the risk group of recidivists the severity of sanctions has a measurable special deterrent effect.
Additionally, the threat of social loss after drunk driving was only in 19.3 % considered as high *(p. 58)*. Thus, the special deterrent effect of the social or informal sanctioning factors cannot be regarded as rather impressive. These findings can be attributed to the circumstance that the greatest impacts of social sanctions can be observed among adolescent drivers, while this effect decays with incremental age *(p. 61)*.
Finally, the imposition of the traditional sanctions is not enough to deter repeat-offenders and restrain them from drunken driving, but treatment is also needed to solve the underlying drinking problem *(p. 62)*.

10.3 General prevention and deterrence of jail sanctions

10.3.1 General prevention of jail sanctions

Authors:
Grube, Kearney (1983)
Location and time of the study:
Yakima (Washington State); November 1979
Analysed measure:
General preventive and deterrent effects of the implementation of a mandatory two day jail sentence law, which was accompanied by an extensive public information campaign
Size of the sample:
238 adult licenced drivers; 32 law enforcement officers
Design and methods of research:
Telephone survey
Mailed questionnaire surveys among the enforcement officers to assess their perceptions according to the new law and examination of the breathalizer log books of the police to increase the reliability of these self-reported results
Examination of the alcohol related fatal accident rates for a three-year baseline period (1976-1978) and for a one-year follow-up period (1979)
Results:
60.1 % of all respondents were aware of the new policy. At the first glance, it seemed to be not very high, but in deed this level was only achievable through the extensive publicity efforts *(p. 237)*.
Among the reported alcohol drinkers, the level of awareness concerning the DUI law change was significantly higher than among the reported non-drinkers (67.7 % versus 44.2 %) *(p. 237)*.
8.7 % of the respondents, who had heard of the jail sentence, said it was a good idea, 7.0 % said it was not a good idea, while 4.2 % were unsure. Consequently, the compliance rate was not as high as intended and, therefore, the general preventive impact was only modest, too *(pp. 237, 238)*.
46.2 % of the respondents thought that the law change had reduced the social acceptance of drinking and driving, while 30.8 % had the opposite perception and 22.4 % were unsure. This element of general prevention was in the concrete case much more effective than the above mentioned compliance rate *(p. 237)*.
66.1 % of the respondents, who stated to drink at least occasionally, argued that the new law decreased the likelihood of drunk driving, 30.2 % said that it had no effect on their drinking

and driving behaviour and 3.7 % were unsure. As a result, the new law had a measurable general deterrent effect among the main target population *(p. 238)*.
83.8 % of the law enforcement officers reported that the law change had not influenced their stopping behaviour pertaining to a driver suspect for DUI *(p. 238)*. This result was confirmed by the examination of the breathalizer log books of the respective enforcement officers, which did not show significant differences in the frequency of the breathalizer usage.
The percentage of DUI offenders who received at least two days in jail lifted from 43.1 % in 1978 to 73.0 % in 1979. Although this increase was a highly significant value, it must be emphasized that the new law contained a mandatory two day jail period for each DUI offence. Consequently, the judicial enforcement was not performed very strictly. This was also confirmed by the decrease of the conviction rate from 97.0 % in 1978 to 85.9 % in 1979 *(p. 240)*.
Beyond the perceived certainty of punishment, the social acceptance of the legitimacy of the sanctions was also an important factor to achieve law-abiding behaviour *(p. 244)*.
The comparison of the fatal accident data from the rest of the state led to the conclusion that the law change had not reduced the incidence of drinking and driving significantly *(pp. 242, 243)*. Therefore, the general deterrent impact of the mandatory jail law cannot be considered as very high.
The major impediments for this failure were a lack of public awareness - although a public information campaign was conducted - and a wide variability in judicial enforcement, what led to a reduction of the social acceptance of the law change *(p. 244)*.

10.3.2 General deterrence of jail sanctions

10.3.2.1

Authors:
Benson, Rasmussen, Mast (1999)
Location and time of the study:
48 U. S. states; 1994
Analysed measure:
General deterrent impact of minimum jail terms for first-offenders (ranging between one and three days) and for second-offenders (ranging between two and 180 days)
Design and methods of research:
Time-series analysis
Comparison of the alcohol related fatality rates between 1984 and 1992, distinguishing between drivers with low-BAC levels of at least 0.01 % and high-BAC levels of at least 0.10 %
Results:
Mandatory jail terms for first-offenders were connected with a negative, but non-significant regression coefficient of -0.04167 among low-BAC drivers and also with a non-significant value of -0.0355 among high-BAC drivers *(p. 219)*. Both values indicated that the implementation of mandatory jail term laws was at least connected with some general deterrent impact.
As far as mandatory jail terms for second-offenders were concerned, the situation changed only among low-BAC drivers, because the corresponding regression coefficient was connected with a positive prefix (+0.000617), while the coefficient for high-BAC drivers remained negative and non-significant (-0.00032) *(p. 219)*.

10.3.2.2

Authors:
Evans, Neville, Graham (1991)

Location and time of the study:
50 U. S. states; 1987
Analysed measure:
General deterrent impact of mandatory jail terms for first-offenders
Design and methods of research:
Time-series regression analysis
Comparison of the alcohol related single vehicle night time fatality data from 1975 to 1986
Results:
The computed regression coefficient for the implementation of mandatory jail terms for first-offenders was positive (+0.066). Although nowhere was noted if this value reached the level of significance, it indicated that this type of law is not connected with any general deterrent impact among the target group, but with harm for traffic safety by increasing the number of alcohol related fatalities *(p. 285).*

10.3.2.3
Authors:
Sloan, Reilly, Schenzler (1995)
Location and time of the study:
45 U. S. states; 1991-1993
Analysed measure:
General deterrent impact of the implementation of mandatory minimum jail terms
Size of the sample:
49,199
Design and methods of research:
Regression analysis
Relevant data were derived from interview surveys
Results:
The regression coefficient related to the likelihood of binge drinking probit was non-significant -0.001 for the implementation of mandatory minimum jail laws *(p. 68).*
Although these laws have measurable general deterrent impact *(pp. 69, 70)*, the outcome was rather poor.
The effectiveness of criminal sanctions is mainly based on the kind of the laws´ implementation *(p. 73).*

10.3.2.4
Author:
Kenkel (1993)
Location and time of the study:
Pennsylvania; 1990
Analysed measure:
General deterrent impact of mandatory jail penalties for first-offenders
Size of the sample:
About 28,000 (about 12,000 males and 16,000 females)
Design and methods of research:
Regression analysis
Self-reported data were derived from an interview survey conducted in 1985
Two evaluation groups were disentangled: young adults up to 21 years and all ages of respondents matched

Results:
Among the matched group of interviewees, mandatory jail terms for first-offenders were connected with significant regression coefficients among both males and females (-7.003 and -10.280, respectively) *(pp. 889, 890)*.
As far as the evaluation was restricted to younger drivers, the following regression coefficients for males and females were revealed: -7.758 and -11.321, respectively. It was nowhere noted if these values reached the level of significance *(pp. 893, 894)*.

10.3.2.5
Authors:
Jones, Joksch, Lacey, Schmidt (1988)
Location and time of the study:
Tennessee (USA); December 1984-November 1987
Analysed measure:
General deterrence of a mandatory two day jail sentence for first-offenders, which was enacted by law in July 1982
Design and methods of research:
Time-series analysis of the single vehicle night time fatal accident data for the time period 1977-1986
Alabama and Kentucky served as comparison states, without having mandatory jail sentence laws enacted
Results:
After the implementation of the law, the rates of single vehicle night time fatalities increased significantly, but after a short period of time it was followed by a significant decline, which reached the pre-intervention level *(p. 3)*. Thus, the single vehicle night time fatalities were reduced slightly and non-significantly by the new law *(p. 20)*. Thus, no decrease of single vehicle night time fatal accidents was observed that could be attributed to the mandatory jail sanction *(p. 23)*.
Finally, the implementation of the mandatory two day jail sanction had no measurable general deterrent impact among the target group.

10.3.2.6
Authors:
Ross, Klette (1995)
Location and time of the study:
Norway, Sweden; 1993
Analysed measure:
General deterrent effects of abandonment of mandatory jail sentences for DUI (completely in Sweden in 1990 and mainly related to first-offenders with low-BAC levels in Norway in 1988)
Design and methods of research:
Interrupted time-series intervention analysis
Comparison of the accident data from 1980 to 1991 and 1992, respectively
Results:
In Norway the percentage of unconditional jail sentences for offenders with BAC levels less than 0.10 % declined from 56 % under the old law to 5 % under the new law. The percentages of drivers with BAC levels less than 0.15 % also declined from 75 % to 24 %, while the percentages according to offenders with BAC levels more than 0.15 % remained constant. In Sweden, the number of drivers with BAC levels exceeding 0.15 % declined from 75 % to 40 % *(p. 152)*.

One major problem of this analysis was the possible influence by the reduction of the legal BAC level to 0.02 %, which was implemented simultaneously *(p. 153)*.
Another impediment was the increase of the punishment certainty in both states through enhanced enforcement efforts (especially: sobriety checkpoints) *(p. 153)*.
Norway observed a statistically significant 22.6 % decline of the fatalities at the time of the law implementation, while the decline in Sweden was at least significant 15 % *(pp. 154, 156)*.
Furthermore, in Norway a small, but not significant 2.9 % decline in injuries occurred, but fatalities are in any case a better index for the general deterrent effect of a law change than injuries due to the much smaller size of the dark field *(p. 154)*.
The retreat from mandatory jail sanctions had no negative impact on traffic safety *(p. 155)*.
The success of the Scandinavian DUI policy had not been the result of one single legal measure, but of a complex bundle of different measures against the distribution of alcohol in the society in general (e. g.: Scandinavian alcohol taxes are among the highest in the world). So, sustaining mandatory jail sanctions cannot be regarded as one of the effective general deterrents *(p. 156)*.

10.3.2.7
Authors:
Whetten-Goldstein, Sloan, Stout, Liang (2000)
Location and time of the study:
All 50 U. S. states including the District of Columbia; 1997
Analysed measure:
General deterrent effects of mandatory minimum jail terms for first-offenders
Design and methods of research:
Quasi time-series analysis (fixed effects design)
Cross-sectional comparison of the alcohol related fatality rates from 1984 to 1995 distinguishing between drivers aged 15 to 20 years and drivers aged 21 to 64 years
Results:
The imposition of mandatory minimum jail terms for first-offenders was connected with a positive regression coefficient among both minors and adults, meaning that the implementation of this type of law is connected with an increase of the fatality rates. The regression coefficients for minors were +2.881 for alcohol related fatalities and +1.605 for single vehicle night time fatal accidents. The respective values for adults were +1.861 and +0.066, respectively *(pp. 730, 731)*.
Although none of these values reached the level of significance, jail sanctions cannot be considered as an effective general deterrent. This statement is especially valid for first-offenders, who are in mostly law-abiding. Therefore, the vast majority of the population and even a considerable number of the judges perceive this kind of sanction as much too severe for a first-offence. This leads to a reduction of the social acceptance level.

10.3.2.8
Authors:
Villaveces, Cummings, Koepsell, Rivara, Lumley, Moffat (2003)
Location and time of the study:
All 50 U. S. states and the District of Columbia; 2000
Analysed measure:
General deterrent impact of mandatory jail sanctions for DUI first-offenders
Size of the sample:
792,184 vehicle fatalities (26 % were alcohol related)

Design and methods of research:
Time-series regression analysis
Comparison of the alcohol related fatality rates from 1980 to 1997
Results:
The enactment of laws which contain obligatory jail terms as a sanction for DUI first-offenders was connected with a slight, not significant enhancement of the alcohol related fatality rate from 4.6 % to 4.8 % *(pp. 133, 134)*.
This phenomenon may be explained by the low level of social acceptance of this type of sanction for first-offenders. Consequently, it is not able to prevent deviant behaviour.

10.3.2.9
Author:
Eisenberg (2003)
Location and time of the study:
All 50 U. S. states including the District of Columbia; 2002
Analysed measure:
General deterrent impact of mandatory jail sanctions for first-offenders
Design and methods of research:
Weighted least squares regression model
Comparison of the alcohol related fatality rates between 1982 and 2000, distinguishing between involved drivers with BAC levels above 0.01 % and at least 0.10 %
Results:
The regression coefficients for both high- and any-BAC fatalities were +0.0010 and -0.0067, respectively *(p. 260)*. None of these values was significant, but the results show that especially among the vast majority of drivers with lower BAC levels some general deterrent impact can be observed, while the problem group of high-BAC drivers is negatively affected by this type of sanction. The proxy single vehicle night time fatal accident rate was also connected with a negative, non-significant regression coefficient of -0.0155. Among drivers aged below 21 years, the regression coefficient was significantly positive (+0.2290), indicating that mandatory jail sanctions led to an increase of alcohol related driving among this problem group *(p. 260)*.

10.3.2.10
Authors:
Legge, Park (1994)
Location and time of the study:
48 U. S. states; 1989
Analysed measure:
General deterrent impact of jail sanctions for first-time offenders
Design and methods of research:
Pooled cross-sectional time-series regression analysis
Comparison of the single vehicle night time fatal accident rates, pooled across three years (1980, 1984, 1987)
Results:
With reference to several studies (Legge, 1991; Jones et al., 1988; Ross & Voas, 1989), higher fines or jail penalties showed almost no measurable effect, even if the general public was aware of them *(p. 596)*.
The standardized regression coefficient for jail sanctions in the case of first-offenders was +0.050 *(p. 600)*. Although this was not a significant value, it showed the potential of jail sanctions to increase the incidence of DUI offences among the general public.

Therefore, the hypothesis was supported that swift and certain sanctions are connected with a greater general deterrent impact than severe sanctions like jail penalties *(p. 602)*.
Pertaining to alcohol addicts, the problem of impaired driving can only be solved by treatment, but not by punishment or education *(p. 604)*.

10.3.2.11
Authors:
Zador, Lund, Fields, Weinberg (1989)
Location and time of the study:
18 U. S. states
Analysed measure:
General deterrence of mandatory jail sanctions for first-offenders
Design and methods of research:
Cross-sectional time-series analysis
Comparison of the alcohol related fatality rates in the years 1978-1985
Drivers younger than 21 years were excluded from this analysis due to special legal regulations
Results:
This study distinguished between the weekday (Monday including Thursday), weekend (Friday including Sunday) and daytime according to the incidence of drivers with high-BAC levels (0.10 % or above) *(p. 471)*:
Low incidence (prevalence rates between 10 % and 29 %): weekday: 6:00 a.m.-3:59 p.m.; weekend: 7:00 a.m.-2:59 p.m.
Moderate incidence (prevalence rates between 30 % and 49 %): weekday: 4:00 a.m.-5:59 a.m.; 4:00 p.m.-6:59 p.m.; weekend: 6:00 a.m.-6:59 a.m.; 3:00 p.m.-5:59 p.m.
High incidence (prevalence rates between 50 % and 69 %): weekday: 3:00 a.m.-3:59 a.m.; 7:00 p.m.-11:59 p.m.; weekend: 4:00 a.m.-5:59 a.m.; 6:00 p.m.-10:59 p.m.
Very high incidence (prevalence rates between 70 % and 89 %): weekday: Midnight-2:59 a.m.; weekend: Midnight-3:59 a.m.; 11:00 p.m.-11:59 p.m.
The researchers computed the percent reductions of alcohol related fatalities due to the implementation of the mandatory jail terms for first-offenders and distinguished between four incidence levels of high-BAC drivers *(p. 477)*:

Low:	-2.3 %	(not significant)
Moderate:	+5.8 %	(not significant)
High:	+3.4 %	(not significant)
Very high:	-8.2 %	(significant at the 5 % level)
All:	-2.2 %	(significant at the 5 % level)

Although the results were not very promising, at least they uncovered that this countermeasure can curb drunken driving in certain situations and under certain circumstances, but, obviously, the general deterrent effect seemed not strong enough to have an impact on drunken drivers in the moderate and high risk times.
Moreover, the implementation of laws containing mandatory jail sentences for first-offenders led to a slightly significant 5.1 % decrease of fatal injured males in the high and very high incidence times. During the low and moderate incidence times, this countermeasure was connected with a non-significant 1.2 % increase *(p. 478)*.
Additionally, the regression estimations were attributed to different age groups:

21-24: -2.8 % (not significant)

25-34: +1.6 % (not significant)
35-54: -4.6 % (significant at the 10 % level)
55-65: -3.3 % (not significant)

So, the implementation of mandatory jail terms for first-offenders produced among three of the four age groups a measurable general deterrent impact, but the highest impact was measured among the middle-agers of 35 to 54 years, while the younger drivers between 25 and 34 years even showed the inverse effect with a positive regression coefficient.

10.3.2.12
Author:
Ruhm (1996)
Location and time of the study:
48 states of the U. S.; 1992
Analysed measure:
General deterrent effects of jail sanctions for first-offenders
Design and methods of research:
Time-series analysis
Comparison of the single vehicle night time fatality rates between 1975 and 1988 among all drivers and among drivers younger than 21 years
Results:
With reference to Kenkel (1993), Sloan & Githens (1994) and Sloan et al. (1995), the implementation of obligatory jail terms for DUI offences can be connected with measurable general deterrent effects among the targeted driver population. But with reference to Wilkinson (1987), Chaloupka et al. (1993) and Evans et al. (1991), it was emphasized that these studies revealed no impact of jail sanctions *(p. 437)*.
The implementation of mandatory jail sanctions for first-offenders was connected with negative regression coefficients (-0.0339 among all drivers and -0.0407 among younger drivers) *(p. 449)*.
Although nowhere was mentioned if these values were significant, this study showed measurable general deterrent impact of this DUI countermeasure. This may be due to the fact that among the main target group of first-offenders only a low percentage of problem drinkers is included. The vast majority of social drinkers can be deterred with this kind of sanction, although it is empirically proven that the sanctioning severity has only modest general deterrent impact.

10.3.2.13
Authors:
Sloan, Reilly, Schenzler (1994)
Location and time of the study:
48 U. S. states; 1992
Analysed measure:
General deterrent impact of mandatory minimum jail terms for DUI
Design and methods of research:
Time-series analysis
Comparison of the alcohol related fatality rates between 1982 and 1990
Three age groups were comprised: 18 to 20 years, 21 to 24 years and 25 to 64 years

Results:
The results indicated that the highest general deterrent impacts of minimum jail terms were measurable among the oldest driver group. The computed regression coefficients were the following *(p. 64)*:

18-20 years: -0.019
21-24 years: -0.009
25-64 years: -0.021

Only the last value reached the level of significance. This study revealed that mandatory minimum jail terms for DUI were connected among all age groups with measurable general deterrent impact, even among the adolescent drivers, who represent one of the main risk groups in traffic.

10.3.2.14
Authors:
Wagenaar, Maldonado-Molina, Erickson, Ma, Tobler, Komro (2007)
Location and time of the study:
18 U. S. states, which implemented statutory minimum jail penalty laws for DUI first-offences between 1976 and 2002
Analysed measure:
General deterrence of mandatory minimum jail sanctions for DUI
Design and methods of research:
Quasi-experimental time-series design
Comparison of alcohol related accident rates with low- (0.01-0.07 g/dl), medium- (0.08-0.14 g/dl) and high- (from 0.15 g/dl onward) BAC levels and of single vehicle night time fatality rates
Results:
Part 1: Studies review
Only two of the 20 jail penalty studies found out a significant general deterrent effect of this DUI countermeasure *(pp. 983, 986, 987).*

Part 2: Empirical study
The situation according to the implementation of mandatory minimum jail penalty laws led to the following results. A significant decline of the single vehicle night time fatalities was recorded in five of the 18 states (range: 23.4 % to 54.3 %), but only three states implemented mandatory jail sentences alone and not in combination with other countermeasures. Two states showed a significant increase of 23.8 % and 82.6 %, while the remaining eleven states did not show any significant change of the respective rates *(p. 991).*
In 15 of the 18 jail-states, the BAC levels of the involved drivers were available. Within the low-BAC range only one state observed a significant 95.1 % reduction, while no significant increases were reported. Among the mid-range drink drivers, three states showed significant declines of the accident rates between 0.7 % and 1.0 %, while one states had a significant 0.5 % increase. Finally, the number of high-BAC crash drivers was reduced in three states significantly (range: 27.4 % to 46.7 %), but two states reported significant elevations of 38.2 % and 61.0 % *(p. 991).*
The amount of the mandatory jail sentence had no effect on traffic safety outcome, but it must be noted that the maximum duration of jail penalties within this study was only ten days *(p. 992).*

The conclusion of this study was that mandatory minimum jail penalties have at best a modest general deterrent effect among DUI first-offenders *(p. 992)*. As a consequence, jail penalties should be targeted at multiple-offenders *(p. 993)*.

10.3.2.15 Studies review
Authors:
Nichols, Ross (1990)
Analysed measure:
Special deterrence of jail sanctions
Results:
The main recommendation of this review was that DUI policy should focus on increasing the risk of detection and punishment for offenders in lieu of increasing the sanctioning severity *(p. 33)*.
A major impediment of any evaluation in the field of deterrent impact of legal sanctions is the fact that law changes often are complex packages of different interventions, so the effectiveness of each single component is hardly measurable *(p. 35)*.
This studies review only contained one study, which was not already analysed within this document. The study of Falkowski (1984) was able to provide some evidence for the general deterrent impact of a mandatory two day jail sanction for DUI first-offenders, which was implemented in Minnesota. While the neighbouring state without having enacted such a legal regulation reported only slight reductions of the night time fatalities, the evaluation state reported a reduction of 20 % *(p. 40)*. These results were confirmed by a study of Cleary & Rogers (1986), which reported a significant decrease of the alcohol related fatalities in comparison to the neighbouring states *(p. 41)*.
The certainty of punishment increased with the implementation of mandatory penalties, while it decreased with the implementation of discretionary actions *(p. 45)*.

10.4 General deterrence of fines

10.4.1
Authors:
Whetten-Goldstein, Sloan, Stout, Liang (2000)
Location and time of the study:
All 50 U. S. states including the District of Columbia
Analysed measure:
General deterrent effects of mandatory minimum fines for first-offenders
Design and methods of research:
Quasi time-series analysis (fixed effects design)
Cross-sectional comparison of the alcohol related fatality rates from 1984 to 1995, distinguishing between drivers aged 15 to 20 years and drivers aged 21 to 64 years
Results:
With reference to Wilkinson (1987) and Chaloupka et al. (1993), fines have a measurable general deterrent impact if they are furnished as mandatory minimum penalties of at least $ 500 for first-offenders *(p. 725)*.
This study revealed that the enactment of a mandatory minimum fine for first-offenses was connected with a significant regression coefficients among minors as far as alcohol related fatalities were concerned (-0.346) and even a highly significant value as far as the proxy single vehicle night time fatal accidents were regarded (-0.388) *(p. 730)*.
Among adult drivers, none of the both regression coefficients reached the level of significance, but at least they were connected negative prefixes (alcohol related fatalities: -0.052; single vehicle night time fatal accidents: -0.075) *(p. 731)*.

The much better outcome among minor drivers can be explained with the higher general deterrent impact of fines due to the limited financial means among this target group.

10.4.2
Authors:
Sloan, Reilly, Schenzler (1995)
Location and time of the study:
45 U. S. states; 1991-1993
Analysed measure:
General deterrent impact of the implementation of mandatory minimum fines
Size of the sample:
49,199
Design and methods of research:
Regression analysis
Relevant data were derived from interview surveys
Results:
The computed regression coefficient for mandatory minimum fines in relation to the likelihood of binge drinking probit was -0.081, which was not significant *(p. 68)*.
These laws have the potential to cause general deterrence *(pp. 69, 70)*, but only on a moderate level.

10.4.3
Authors:
Legge, Park (1994)
Location and time of the study:
48 U. S. states; 1989
Analysed measure:
General deterrent impact of fines for first-time offenders
Design and methods of research:
Pooled cross-sectional time-series regression analysis
Comparison of the single vehicle night time fatal accident rates, pooled across three years (1980, 1984, 1987)
Results:
The standardized regression coefficient for fines in the case of first-offenders was +0.002, which was not a significant value *(p. 600)*. So, the empirical results show the little general deterrent effect of fines. This may be due to the circumstance that in the United States the height of fines is quite often only modest and not measured by the individual income of the offender.
Consequently, swift and certain sanctions are connected with greater general deterrent impact than severe sanctions *(p. 602)*.

10.4.4
Authors:
Chaloupka, Saffer, Grossmann (1993)
Location and time of the study:
48 U. S. states; 1990
Analysed measure:
General deterrent effect of mandatory fines
General deterrent effect of mandatory minimum fines

Design and methods of research:
Time-series analysis of the alcohol related fatality rates from 1982 to 1988
The results distinguish between all drivers and drivers between 18 and 21 years
Results:
The computed regression coefficients for mandatory fines were +0.191 among all ages of drivers *(p. 173)* and +0.131 among the adolescent drivers *(p. 174)*. Both values were significant and showed that fines cannot be considered as an effective general deterrent, neither among all matched drivers nor among younger drivers.
The regression coefficients for mandatory minimum fines showed the contrarily results with significant values of -0.262 among all drivers *(p. 173)* and -0.221 among the young drivers *(p. 174)*. These results confirm that the severity of the sanctioning has at least some general deterrent impact, especially as far as monetary sanctions are concerned. The outcome is also in line with prior research, which concluded that the implementation of fines for DUI is only effective if the height reaches a certain level to create a measurable financial burden for the offender.

10.4.5
Authors:
Young, Likens (2000)
Location and time of the study:
48 U. S. states; 1995
Analysed measure:
General deterrent impact of fines for DUI first-offenders
General deterrent impact of mandatory minimum fines for first-offenders
Design and methods of research:
Time-series logistic regression analysis
Comparison of the alcohol related fatality rates between 1982 and 1990
Two evaluation groups were created: all ages of drivers and drivers between 18 and 20 years
Results:
Among all ages of drivers, the enactment of fines for first-offenders was connected with a positive regression coefficient of +0.185, which was a highly significant value. This outcome indicated that fines cannot be considered as an effective general deterrent factor *(p. 116)*. The coefficient among adolescent drivers was again positive and highly significant (+0.304), indicating that fines in general cannot be regarded as a recommendable DUI countermeasure *(p. 118)*.
As far as all ages of drivers were concerned, the regression coefficient for the implementation of mandatory minimum fines was significant -0.0005 *(p. 116)*. As it was a measurable better value than for fines in general, fines can be considered as a deterrent factor if a certain height is met. A rather similar outcome with a significant regression coefficient of -0.001 was revealed among adolescent drivers *(p. 118)*. Among the second group, the limited financial means may have contributed partly to the promising outcome.

10.4.6
Authors:
Whetten-Goldstein, Sloan, Stout, Liang (2000)
Location and time of the study:
All 50 U. S. states including the District of Columbia
Analysed measure:
General deterrent impact of mandatory minimum fines for first-offenders

Design and methods of research:
Quasi time-series analysis (fixed effects design)
Cross-sectional comparison of the alcohol related fatality rates between 1984 and 1995, distinguishing between drivers aged 15 to 20 years and drivers aged 21 to 64 years
Results:
The implementation of mandatory minimum fines for first-offenders was connected with a significant regression coefficient of -0.346 *(p. 730)*.
This result confirmed the hypothesis that fines are connected with considerable general deterrent impact if they reach a certain height which is able to create a substantial burden.

10.4.7
Authors:
Benson, Rasmussen, Mast (1999)
Location and time of the study:
48 U. S. states; 1994
Analysed measure:
General deterrent impact of minimum fines for first-offenders (ranging between $ 100 and $ 500) and for second-offenders (ranging between $ 300 and $ 1,000)
Design and methods of research:
Time-series analysis
Comparison of the alcohol related fatality rates between 1984 and 1992, distinguishing between drivers with low-BAC levels of at least 0.01 % and high-BAC levels of at least 0.10 %
Results:
Mandatory fines for first-offenders were connected with a regression coefficient of +0.000055 among low-BAC offenders and of +0.000108 among high-BAC drivers, indicating that none of the offender groups is deterred by this kind of sanction, but the level of significance was not reached in both cases *(p. 219)*.
As far as mandatory fines for second-offenders were concerned, the situation changed. Among low- and high-BAC drivers the regression coefficient was negative, but again not significant (-0.00002 and -0.00004, respectively) *(p. 219)*. The increased height of the fines in case of second-offences was the main reason for the increased general deterrent impact.

10.4.8
Authors:
Mullahy, Sindelar (1994)
Location and time of the study:
United States; 1992
Analysed measure:
General deterrent impact of mandatory minimum fines for first-offenders
Size of the sample:
About 43,000 interviewees
Design and methods of research:
Regression analysis
Data, containing information about self-reported drunk driving behaviour, were derived from a state-wide interview survey conducted in 1988, distinguishing between males and females
Results:
The results for males and females were negative (-0.0004 and -0.0004, respectively) *(pp. 389, 391)*. The implementation of mandatory fines among males was connected with highly significant reductions of the incidence of DUI, while among females the regression

coefficient only reached the level of five percent standard significance. Therefore, this type of law is connected with higher levels of general deterrence among males. Unfortunately, this outcome was not further explained by the authors.
Finally, it was warned to overestimate the results due to the well-known weakness of self-reported data *(p. 392)*.

10.4.9
Authors:
Wagenaar, Maldonado-Molina, Erickson, Ma, Tobler, Komro (2007)
Location and time of the study:
26 U. S. states, which had implemented mandatory minimum fine laws for DUI first-offences between 1976 and 2002
Analysed measure:
General deterrence of mandatory minimum fines for DUI
Design and methods of research:
Quasi-experimental time-series design
Comparison of alcohol related accident rates with low- (0.01-0.07 g/dl), medium- (0.08-0.14 g/dl) and high- (from 0.15 g/dl onward) BAC levels and of single vehicle night time fatality rates
Results:
Part 1: Studies review
Six of the 19 fine-studies observed a significant general deterrent impact. It was concluded that there was only some evidence for the general deterrent effect of fines for DUI, which have in general measurable greater impact among youth drivers than among adults *(pp. 983-985)*. One reason for this phenomenon may be that young people mostly have more limited financial means than adults and, thus, the subjective severity of fines for this target group is higher.

Part 2: Empirical study
Six of the 26 states which implemented mandatory minimum fine laws showed a significant decrease of single vehicle night time fatalities (declines ranging from 23.4 % to 47.1 %), but in four cases the implementation of the respective laws was accompanied by several other DUI countermeasures (e. g.: mandatory licence revocation), so the attribution of the observed outcome to one single measure is hardly possible *(pp. 989, 990)*.
In three states, the number of single vehicle night time accidents increased, while 17 states did not record significant changes *(pp. 989, 990)*.
The BAC levels of the crash-involved drivers were only available from 19 states. The implementation of mandatory minimum fine laws was only in one state connected with a significant 28.7 % decrease of the alcohol related accidents with drivers having low-BAC levels, while in another state a 40.7 % significant decrease was observed. The outcome improved in case of mid-BAC drivers, because among this group three states reported significant reductions of the crash rates (range: 25.3 % to 65.3 %), while only one state observed a significant increase of 51.1 %. Among high-BAC drivers, even five states concluded a significant reduction of drunk driving incidence (range: 35.4 % to 80.7 %), but also two states showed significant elevations of 31.7 % and 38.2 %, respectively *(pp. 989, 990)*.
The empirical evidence for the implementation of mandatory minimum fine laws is not very strong, because the observed outcome among the different states varied widely, although the design of research was constant *(p. 992)*.

10.4.10 Matched results for jail penalties and fines
Author:
Sen (2001)
Location and time of the study:
Canada; 1995
Analysed measure:
General deterrence of jail terms and fines for first-offenders (connected with illegal per se and implied consent laws)
Design and methods of research:
Interrupted time-series analysis
Comparison of the alcohol related fatality rates between 1976 and 1992
Results:
Refusing to provide a blood or breath sample is in Canada also considered as a law violation (so called implied consent law) and leads to the same penalties like the exceeding of the legal BAC level *(p. 151)*.
The computed regression coefficient for jail terms and fines for first-offenders were significant and negative (-0.1972), indicating that these types of laws have the potential to decrease the incidence of drink driving *(p. 156)*.
Although the results seemed to support the general deterrent potential, these findings must be interpreted cautiously. The first impediment was the matching of the results for jail terms and fines. Consequently, it was not possible to attribute the respective effects to the corresponding countermeasure. Secondly, the differentiation between the different countermeasures on the basis of coefficient estimates could in single cases lead to insignificant results, because the evaluated measures were enacted simultaneously and therefore they work together as a whole or not *(p. 159)*.
Additionally, police officers and judges were reluctant to impose criminal sanctions on DUI offenders connected with a criminal record, although this offender type is mostly law abiding *(p. 162)*.

10.5 Special deterrence of jail sanctions and probation

10.5.1
Author:
De Jong (1997)
Location and time of the study:
Manhattan; 1984
Analysed measure:
Specific deterrent effects of a custodial sentence for DUI-offences
Size of the sample:
Interviewees: 5,747
Provided urine samples: 4,847
Final sample (containing only criminal court cases): 4,898
Design and methods of research:
Survival analysis
Data were drawn from a combination of data sets to analyse pre-trial misconduct
Male arrestees were asked to participate in a drug use interview
At the end of the interview, they were asked to supply a urine sample, which was tested for illicit drugs

Results:
Arrest probabilities (hazard rates) peaked slightly in weeks 0–5, followed by an initial swift decrease in week 5–15. Out to the end in week 180, a moderate decrease was observed *(p. 566)*.
Individuals with few bounds to society (measured in job, family and education) were more likely to recidivate following an incarceration period *(p. 569)*.
Among offenders with several ties to society, a formal sanction had hardly any deterrent impact, but the threat of informal sanctions among this group was quite high. Consequently, the latter can be regarded as a more effective deterrent *(p. 569)*.
Experienced arrestees were more difficult to deter than first-time arrestees *(p. 569)*. This may be due to the circumstance that repeat-offenders often are chronic alcoholics and, therefore, do not make up a rational choice before committing a crime.
Jailed first-time arrestees were more likely to recidivate than similar offenders who received another sanction *(p. 569)*.
No relationship between incarceration and time until re-arrest and also not between length of incarceration and recidivism was observed among first-offenders. As far as repeat-offenders were concerned, the evaluation revealed that incarceration had no effect on the likelihood of recidivism, but it led to a delay of re-offending behaviour. In this context, for experiences arrestees, longer incarceration periods seem to be connected with higher level of special deterrence than short ones *(pp. 571, 573)*.
For first-time arrestees, incarceration appears to increase future criminal behaviour, because it activates a labelling process. So, this type of criminals can be deterred effectively by diversion with imposing an alternative kind of sanction (e. g.: drug treatment and intensively supervised probation) *(p. 574)*.

10.5.2
Authors:
Jones, Joksch, Lacey, Schmidt (1988)
Location and time of the study:
Tennessee (USA); December 1984-November 1987
Analysed measure:
Specific deterrence of mandatory a two day jail sentence for first-offenders, which became effective by law in July 1982
Design and methods of research:
Time-series analysis of the traffic violation files (including DUI) of a total of nine cohorts (1977-1985) for a follow-up period of 36 months
Results:
The recidivism rate among repeat-offenders was one year after the initial conviction at about 10 % and after two years between 15 % and 20 % *(p. 32)*. So, the special deterrent impact of the mandatory jail sanction decreased steadily.
The DUI recidivism rate after one year for the cohort convicted in 1983 was about 11 % lower than for the cohorts convicted in the three years before, but the origin for this effect was unknown. Moreover, the lower rate has not been maintained, because the 1984 cohort already reached the pre-intervention level and the 1985 cohort even exceeded it *(p. 47)*.
This study showed a significant difference in the level of awareness regarding the implementation of the new law with respect to drinking frequency of the offenders *(p. 69)*.
This study showed only an immediate, but temporary effect on drink driving recidivism.

10.5.3
Authors:
Taxman, Piquero (1998)
Location and time of the study:
Maryland; 1997
Analysed measure:
Special deterrent effects of unconditional jail penalties and probation
Size of the sample:
Total: 3,671 DUI offenders (2,528 first- and 1,143 multiple-offenders)
Design and methods of research:
Regression analysis with a follow-up period of four years
Two evaluation groups were chosen: first-offenders and all offenders matched together
Results:
The results present below contain the relative risk of reconviction for each variable. While 1.00 means the same risk like in the reference group and below 1.00 a lower risk, a value above 1.00 indicates a higher risk of subsequent convictions:

Full sample *(p. 135)*:

Jail sentence:	1.04	(not significant)
Unsupervised probation:	1.09	(not significant)
Supervised probation:	1.16	(not significant)

First-offenders *(p. 138)*:

Jail sentence:	0.72	(not significant)
Unsupervised probation:	1.02	(not significant)
Supervised probation:	1.04	(not significant)

A very surprising result was the bad outcome of supervised probation in comparison to unsupervised probation among both first- and multiple-offenders, because other studies showed the contrarily result. Unfortunately, this phenomenon was not explained by the authors. In general, the positive outcome in the other studies was mainly attributed to the close surveillance procedure conducted by the probation officers. So, the observed outcome was mainly due to a lack of supervision in practice. Additionally, the conditions for probationers in case of unsupervised probation were much stricter than with supervision. But if the surveillance in fact does not take place, the supervised probationers experience a less severe sanction. Consequently, the sentencing severity in this case serves as a measurable special deterrent. This may also explain the very good outcome for unconditional jail penalties.
One major impediment of this study was the exclusion of the offenders´ alcohol and drug use history *(p. 139)*.

10.5.4
Author:
De Young (1997)
Location and time of the study:
California; 1990-1991
Analysed measure:
Special deterrence of jail terms

Size of the sample:
88,552 DUI first-offenders
Design and methods of research:
Quasi-experimental regression study
Comparison of the reconviction rates within a follow-up period of 18 months
Results:
Among the examined first-offenders, the highest recidivism rates belonged to the jailed offenders (regression coefficient: +0.15067; highly significant), but they were also the ones with the worst prior records concerning future legal behaviour *(p. 994)*. The bad outcome was mainly due to the negative influence of the jail term on the offenders´ future legal behaviour. Consequently, jail terms were considered as ineffective in reducing DUI recidivism *(p. 996)*.

10.5.5
Authors:
Shapiro, Votey (1984)
Location and time of the study:
Sweden; 1980
Analysed measure:
Special deterrent effects of jail penalties
Size of the sample:
46,000 DUI offenders, who were convicted between 1976 and 1979
Design and methods of research:
Regression analysis
Differentiation between three age groups (up to 25 years, between 26 and 55 years and older than 56 years)
Results:
The regression coefficients for jail penalties were the following *(p. 600)*:

up to 25 years	between 26 and 55 years	56 years upward
-0.457	+0.182	-0.588

None of these values reached the level of significance. While jail terms showed at least measurable special deterrent impact among younger and older offenders, the vast majority of the middle-aged drivers was affected in the converse way. A very spurring outcome was the rather good result of jail penalties as far as the high-risk group of young drivers were concerned.
One reason for the relatively good outcome of jail penalties was the fact that this study was conducted in Sweden, which has a long tradition of strict (especially jail) penalties for DUI. Therefore, the results cannot be generalized on other states, because as far as sanctioning of DUI is concerned, Sweden always captures an exceptional position *(p. 600)*.
Furthermore, the special deterrent impact among multiple-offenders, who often are alcoholics, may decline due to the lack of making up a rational choice before driving after drinking *(p. 601)*.

10.5.6
Authors:
Skurtveit, Christophersen, Beylich, Bjorneboe, Morland (1998)
Location and time of the study:
Norway; 1995-1997

Analysed measure:
Special deterrent impact of the abandonment of the imposition of mandatory jail terms with a duration of three weeks for each DUI offence, which became effective by law in 1988
Size of the sample:
For each cohort and for each BAC level a randomly selected subsample of 200 blood samples was chosen
Design and methods of research:
Cohort survival analysis
Four different cohorts were examined: 1986, 1989, 1991, 1992
Comparison of the results of blood analyses of re-arrestees before and after the law became effective
Three different BAC ranges were examined: 0.06 % - 0.09 %, 0.13 % - 0.16 %, 0.23 % - 0.26 %
Results:
For the cohort of 1986 a follow-up period of nine years was chosen *(p. 23)*.
The respective re-arrest rates for mid-, high- and very high-BAC levels for the different cohorts were the following *(p. 25)*:
1986: 28 % 31 % 33 %
1989: 20 % 26 % 34 %
1991: 15 % 21 % 25 %
1992: 12 % 15 % 28 %

So, the abandonment of mandatory jail penalties for DUI did not cause any special deterrent harm among the mid- and the high-BAC offenders, because their rates declined steadily. But the level of significance was only reached in the mid-range group *(p. 27)*. The development among the very high-BAC offenders was not so clear, because the abandonment led at first to a small increase of the re-arrest rates, while in the 1991 cohort a measurable decline was observed. In the last cohort, a small increase was uncovered, but the outcome was measurable better than for the 1986 and 1989 cohort.

10.5.7
Authors:
Weinrath, Gartrell (2001)
Location and time of the study:
Alberta (Canada); 1995-1999
Analysed measure:
Special deterrent impact of jail sanctions for DUI offenders
Size of the sample:
Total: 514 DUI offenders
Up to three-offenders: 325
Four-plus offenders: 189
Design and methods of research:
Regression analysis
Follow-up periods ranging between 24 and 45 months were chosen
Official reconviction data were used
Results:
All offenders attended either an impaired driver or another addiction programme *(p. 112)*. So, the outcome may be biased due to the fact that such rehabilitative measures are proven to result in lower reconviction rates.

The regression coefficients for the correlation between the recidivism risk and the length of the incarceration period were negative in all examined cases, indicating that an increase of the duration led to a decrease of the reconviction rates *(p. 114)*:

All cases:	-1.074 (significant at the 5 % level)
Maximum of three prior DUI convictions:	-1.094 (significant at the 10 % level)
At least four prior DUI convictions:	-1.272 (significant at the 10 % level)

At least, it was proven that incarceration periods had a measurable special deterrent effect among four-plus offenders, who are very likely to be chronic alcoholics *(p. 116)*.
The recidivism rates among the whole sample in relation to the length of the incarceration period were the following *(p. 116)*:

91-120 days:	29 %
121-184 days:	20 %
185-366 days:	26 %
More than 366 days:	22 %

The highest reconviction rates were connected with offenders who received jail terms up to four months, while the results for offenders receiving jail sanctions with durations between six and twelve months did not differ significantly, but were in both cases measurable better. Additionally, incarceration periods longer than one year were not connected with additional special deterrent benefits *(pp. 116, 117)*.
Consequently, durations of six months for jail penalties can be regarded as optimal from the special deterrent point of view *(p. 117)*.

10.5.8 Studies review
Authors:
Nichols, Ross (1990)
Analysed measure:
Special deterrence of jail sanctions
Results:
The main recommendation of this review was that DUI policy should focus on increasing the risk of detection and punishment for offenders in lieu of increasing the sanctioning severity *(p. 33)*.
A major impediment of any evaluation in the field of deterrent impact of legal sanctions is the fact that law changes often are complex packages of different interventions, so, the effectiveness of each single component is hardly measurable *(p. 35)*.
The reported studies from Europe evaluating the special deterrent effect of jail sanctions were altogether conducted within the 1970´s and therefore they are no longer meaningful *(p. 36)*.
In general, the reviewed studies were hardly able to provide empirical evidence for the specific deterrent impact of jail sanctions for both first- and repeat-offenders.

- The study of Salzberg and Paulsrude (1983), which was conducted in Washington State and evaluated a law containing mandatory jail terms for first- and multiple-offenders, came to the result that the reconviction rate among the post-intervention population was higher than among the pre-intervention population. But the outcome was biased due to the simultaneous increase of the enforcement level *(pp. 37, 38)*.

- A Californian regression analysis of Tashima and Peck (1986) evaluated the special deterrent impact of five different sanction combinations among first-offenders for a follow-up period of one year. All offenders received fines, but the further sanctions differed: licence suspension, jail, education/treatment plus jail, licence restriction, education/treatment plus licence restriction. The alcohol related crash rates were highest among the two jail combination offenders. As far as the reconviction rates were concerned, these offenders who only received jail periods had the worst outcome pertaining to subsequent convictions for DUI *(p. 38)*.

As a conclusion, the implementation of jail sentences for DUI offenders has the potential to cause a long-term social learning effect regarding the seriousness of drink driving *(p. 43)*.
The certainty of punishment increased with the implementation of mandatory penalties, while it decreased with the implementation of discretionary actions *(p. 45)*.

10.6 Special deterrence of fines

10.6.1
Author:
Yu (1994)
Location and time of the study:
New York; 1988
Analysed measure:
Special deterrent effects of punishment swiftness and severity, analysed for fines
Size of the sample:
13,801 DUI first- and multiple-offenders
Design and methods of research:
Logistic regression analysis, using three different statistical models (one additive and two interactive)
Analysis of drivers´ records for DUI reconvictions within an observation period of 36 months
Results:
The celerity of punishment was estimated to be the most effective general deterrent *(p. 356)*, but this statement may also be valid for the special deterrent level.
A swift imposition of the sanctions has a much greater deterrent effect on the offenders than a delayed one *(p. 357)*.
This study came to the result that the most superior deterrent sanctions for first-offenders were fines, because they reduced the likelihood of recidivism in a highly significant manner (regression coefficients: -0.076 to -0.110, depending on the model), whereas licence actions were not very effective in reducing the recidivism risk of first-offenders (regression coefficient: at best -0.002, but the other models even led to a positive coefficient). Moreover, the recidivism risk declined significantly with the increase of the amount of the fines. The celerity variable alone was not able to provide significant general deterrent impact with its regression coefficient of -0.001 *(p. 360)*.
These results were also transformable for the likelihood of being re-convicted for a third DUI offence, but in this case, the highly significant deterrent effect of fines had doubled (regression coefficients ranging between -0.202 and -0.232), while the positive impact of licence actions disappeared completely, led to an increase of the recidivism risk connected with a positive regression coefficient of 0.018. The regression variable of sanctioning celerity was again negative and non-significant with a value of -0.010 *(p. 360)*.
One reason for the overwhelming effect of the fines may be that they are - in contrast to licence actions - hardly avoidable *(p. 360)*.

The little general deterrent impact of punishment swiftness may be due to the fact that especially multiple-offenders are often chronic alcoholics and, therefore, hardly to deter by the classical elements of deterrence *(p. 361)*.
So, the researcher concluded that also the elevation of the punishment severity had a positive special deterrent effect *(p. 362)*. But this statement cannot be generalized, because a number of other empirical studies came to the conclusion that an increase of the punishment severity had no or only short-termed deterrent effects.
To better up the evaluated special deterrent effect of fines, policymakers have to improve the fine-collecting system to avoid a decline of the deterrent impact by producing a vast amount of unpaid bills.

10.6.2
Authors:
Taxman, Piquero (1998)
Location and time of the study:
Maryland; 1997
Analysed measure:
Special deterrent effects of fines
Size of the sample:
Total: 3,671 DUI offenders (2,528 first-offenders and 1,143 multiple-offenders)
Design and methods of research:
Regression analysis
A follow-up period of four years was chosen in relation to subsequent reconvictions
Two evaluation groups were created: first-offenders and all offenders matched together
Results:
Fines have been served as successful deterrents in Europe (with reference to Homel, 1981 and Nichols & Ross, 1989), but in the USA the impact was quite weak (with reference to Morris & Tonry, 1990 and Ross, 1992). One reason for this phenomenon may be the modest height of fines for DUI in the United States compared with the heights in European countries, especially in Scandinavia *(p. 132)*.
The results presented below contain the relative risk of reconviction for each variable. While 1.00 means the same risk like in the reference group and below 1.00 a lower risk, a value above 1.00 indicates a higher risk of subsequent convictions:

Full sample *(p. 135)*:
Fines: 1.08 (not significant)

First-offenders *(p. 137)*:
Fines: 1.15 (not significant)

A quite surprising result was the worse outcome of fines for first- in comparison to multiple-offenders, what was nowhere further explained by the authors. Very likely, the explanation from above concerning the modest height of fines in the United States can be also consulted in this case.
One major impediment of this study was the exclusion of the offenders´ alcohol and drug use history *(p. 139)*.

10.6.3
Authors:
Moffatt, Poynton (2007)

Location and time of the study:
New South Wales (Australia); 2005
Analysed measure:
Special deterrent impact of fines in relation to their height
Size of the sample:
7,072 low-, 21,610 mid- and 10,145 high-range BAC offenders, who received a court-imposed fine
Design and methods of research:
Regression analysis
Comparison of re-offending rates (so called court appearance data) of DUI offenders, who received a court-imposed fine between 1998 and 2000
The results distinguish between low-, mid- and high-range BAC offenders
A follow-up period of five years was chosen
Results:
Almost all traffic offenders received besides the fine also a court-imposed licence measure *(p. 5)*.
The researchers applied a statistical model to estimate the special deterrent impact of fines. Within this analysis they revealed no significant regression coefficient for all three offender types (low range: +0.0001; mid range: -0.00006; high range: +0.00001) *(pp. 8, 9)*. Finally, the special deterrent impact of fines is not very high, because only among mid-range BAC drivers a little effects was measurable. So, the height of the fine is no reliable predictor for recidivism.
The best predictor for future DUI offences is the offender´s criminal history *(p. 10)*.
This study confirmed the very limited special deterrent effect of the sentence severity.

10.6.4
Authors:
Shapiro, Votey (1984)
Location and time of the study:
Sweden; 1980
Analysed measure:
Special deterrent effects of fines
Size of the sample:
46,000 DUI offenders who were convicted between 1976 and 1979
Design and methods of research:
Regression analysis
Differentiation between three age groups (up to 25 years, between 26 and 55 years and older than 56 years)
Results:
The respective regression coefficients for the different sanctions were the following *(p. 600)*:

up to 25 years	between 26 and 55 years	56 years upward
-0.140	+0.019	+0.085

Although none of these values reached the level of significance, among the drivers up to 25 years the imposition of fines was at least connected with a negative regression coefficient, indicating that fines are connected with a measurable special deterrent impact. This promising outcome among younger offenders may be due to their limited financial means, consequently, connected with a higher level of deterrence through the sensible financial burden.

But the results cannot be generalized on other states simply, because as far as sanctioning of DUI is concerned, Sweden always captures an exceptional position *(p. 600)*.
Additionally, the special deterrent impact among multiple-offenders, especially if they were alcoholics, may decline due to the lack of making up a rational choice before driving after drinking *(p. 601)*.

10.6.5 Comparison between jail penalties and fines
Authors:
Martin, Annan, Forst (1993)
Location and time of the study:
Hennepin County (Minnesota); 1982
Analysed measure:
Special deterrent effects of fines for DUI first-time offenders compared with a two day jail sanction
Size of the sample:
383 DUI offenders
Design and methods of research:
Quasi-experimental regression design with a follow-up period of 23 months
Data were collected on all first-offender DUI cases adjudicated by two judges (one "jail" judge and one "no jail" judge) during a period of eleven months
Results:
The "jail" judge sentenced 73 % of the first-time offenders to a jail period, while the "no jail" judge condemned only 14 % to this sanction *(p. 563)*.
While the "no jail" judge sentenced 56 % of the offenders to a high fine of more than $ 200, the "jail" judge applied this sanction in only 2 % of all cases *(p. 563)*.
16 % of all offenders were re-convicted for a DUI infringement within the follow-up period *(p. 563)*.
The recidivism rates of the offenders who were sentenced to a small or large fine with no jail and those who received jail plus a small fine did not differ significantly *(p. 563)*.
13 % of the "no jail" offenders and 18 % of the "jail" offenders were re-convicted for DUI with a BAC level of more than 0.10 % within the 23 months follow-up *(p. 563)*.
The number of recidivists among misdemeanants younger than 25 years was significantly higher than among older offenders (24 % versus 9 %) *(p. 564)*.
The rates of subsequent convictions among the four subcategories were the following (the small group of nine offenders who received both jail and a high fine were omitted for the further examination):

No jail and fine $ 200 or less:	19 %
No jail and fine over $ 200:	10 %
Jail and fine $ 200 or less:	16 %
Jail and fine over $ 200:	56 %

The sanctioning celerity is a further major general deterrent *(p. 726)*.
The number of alcohol related fatalities decreased after both law amendments in a significant manner *(p. 727)*. The downward trend according to the first law change already begun in 1965. Consequently, no significant differences were found for the likelihood of reconviction among drivers getting the other three sanctions.
Neither jail nor a high fine had a measurable special deterrent effect.
One reason for this may have been that some offenders experienced two days in jail as a less severe sanction than a fine more than $ 200, what is a peculiarity of the so called relative

severity of various sanctions. In this context, the sample contained 46 % younger people with lower incomes.

10.7 Focus on offenders with alcohol problems

10.7.1

Authors:

Yu, Evans, Clark (2006)

Location and time of the study:

New York; 2002

Analysed measure:

Specific deterrence of different DUI countermeasures compared with personal factors like alcohol addiction and perceived risk of punishment

Size of the sample:

433 DUI offenders, who were condemned to participate in an alcohol treatment therapy

Design and methods of research:

Regression analysis

Self-reported interviews

Comparison of the official DUI records to verify the respondents´ answers

Results:

An increase of the perception of certainty and celerity of the sanctioning led to a significant decrease of DUI, whereas the impact of punishment severity had only a very moderate impact on alcohol related outcomes *(p. 170)*.

The crude regression coefficients - derived from the official DUI record data - for certainty (-0.021), severity (-0.083) and celerity (+0.029) changed when the results were simultaneously controlled for alcohol problems of the offenders. The coefficients were diminished for severity (-0.040) and certainty (-0.003), but the outcome concerning celerity improved measurable (-0.047) *(p. 172)*. Although none of these values reached the level of significance, these results led to the conclusion that only swift sanctions had a significant special deterrent impact on offenders suffering from alcohol problems.

The regression coefficients - computed for the self-reported likelihood of subsequent DUI - showed some aberrations. While the value for certainty was again negative and not significant (-0.070), the coefficient for severity was even positive, but non-significant (+0.013). The coefficient for punishment celerity was also not significant, but positive (+0.023) *(p. 172)*. These results indicate that only in case of sanctioning severity the official records led to other outcomes than the self-reported data. This outcome uncovered that the sanctioning severity is individually not regarded as an effective special deterrent element. The results changed, if the regression coefficients accounted for alcohol problems of the offenders. The values for punishment certainty and celerity changed to a positive prefix (+0.008 and +0.038, respectively), but the value for severity became negative (-0.021) *(p. 172)*. None of these coefficients was significant. Nevertheless, a clear tendency was revealed that the sanctioning severity was the only effective deterrent element among offenders suffering from alcohol problems. But the results must be interpreted cautiously, because self-reported data always suffer from a certain weakness (with reference to Hindelang, Hirschi & Weiß, 1981).

Alcohol problems always hinder the offender to make a rational choice before committing a certain crime despite a prior severe, swift and/or certain sanction *(p. 172)*.

So, punitive sanctions alone will never solve the problem of addicts on the road, but only a combination with alcohol treatment will have deterrent impact among this high-risk group *(p. 173)*.

10.7.2
Author:
Yu (2000)
Location and time of the study:
New York State; 1989
Analysed measure:
Correlation between special deterrence of jail penalties, fines and alcohol problems of the offenders
Size of the sample:
521 DUI multiple-offenders (second-, third- and fourth-offenders)
Design and methods of research:
Logistic regression analysis
Questionnaire survey
Results:
With reference to Snowden et al. (1986), Gruenewald et al. (1990), Yu & Williford (1993) and Myerholtz & Rosenberg (1997), the incidence of alcohol problems increases with the number of DUI offences *(p. 261)*.
One reason for the high recidivism rate among DUI offenders are existing alcohol problems, so these offenders do not violate the law after having made up a rational choice *(p. 261)*.
Alcohol problems of the offenders were the best predictors according to DUI recidivism. This statement must be limited to the first- and second-offence, but it failed to predict the third- and fourth-offence, which were mainly committed by drivers with alcohol addiction *(p. 266)*. But the likelihood of alcohol problems increases with the number of DUI convictions and, thus, the opinion of the researcher cannot be generalized.
The kind and the severity of the imposed penalty had only very little impact on the offenders´ future legal behaviour if they have alcohol problems. Consequently, the result of this study was that treatment must be considered as the right way to reduce recidivism rates among these offenders *(p. 267)*.
The logit regressions were best for second-, third- and fourth-offences for jail (-0.158; -0.075; -2.170, but only the last value was highly significant), followed by fine (-0.132; -0.051; -0.292). In all cases, a measurable special deterrent impact of the classical sanctions can be observed, but jail sanctions were the only ones which achieved once a highly significant outcome, while fines did not show any significant impact *(p. 267)*.
The combination of punitive and rehabilitative measures would lead to higher levels of special deterrence than the imposition of one of these countermeasure types alone, because so the underlying drinking problem can be combated best. The precondition for a successful procedure is in any case a careful screening *(p. 268)*.

10.8 General deterrent effects of lowering the legal per se BAC threshold

10.8.1 Reduction from 0.10 % to 0.08 %

10.8.1.1
Authors:
Bernat, Dunsmuir, Wagenaar (2004)
Location and time of the study:
18 U. S. states and the District of Columbia
The respective BAC laws became effective between August 1983 and October 2000
Analysed measure:
General deterrent effects of the decrease of the criminal per se BAC threshold from 0.10 g/dl to 0.08 g/dl

Design and methods of research:
Interrupted time-series analysis
Comparison of the fatal single vehicle night time crash rates
Involved drivers younger than 21 years were excluded due to special legal regulations
At first the change of the accident rates within each state was analysed and after this the developments across all states were examined
The study used data from three years prior to the law change and also of a three year follow-up period
The numbers of other traffic fatalities and of administrative licence revocations were used as covariates
Results:
Most of the cited studies (e. g.: Apsler et al., 1999; Research and Evaluation Associates, 1991) came to the conclusion that the lowering of the legal per se BAC limit contributed to a significant reduction of traffic fatalities, especially to those under the influence of alcohol. But the magnitude of the decline varied considerably among the different studies (e. g.: between 4 % and 40 % among the different countries in a study of the NHTSA, 1994) *(p. 1090)*.
The vast majority of the studies examining state-pooled results found out that the enactment of 0.08 % per se laws was connected with a reduction of fatal single vehicle night time crashes ranging between 5 % and 8 % *(p. 1090)*.
This study observed a reduction of the crash rates ranging between 3 % and 50 % in 13 states, an elevation ranging between 4 % and 32 % in four states, while in two states the fatality rate was not affected by the legal intervention. In the average of all 19 U. S. states, the implementation of the lower BAC level led to a significant reduction of 7 %. After potential confounders were omitted, the value was 5.2 %, which was also significant *(p. 1093)*.
The fatal crash rates decreased significantly only in California, Kentucky and Utah (regression coefficients: -0.239, -0.638 and -0.460, respectively). In contrast, in Kansas a statistically significant increase (regression coefficient: +0.240) was observed *(p. 1094)*.
The effect sizes according to single vehicle night time fatal accidents ranged from +0.72 to +0.02 (percent change +32 to 0) and from -0.11 to -1.63 (percent change -3 to -50). The average among all 19 U. S. states counted an effect size of -0.13 and a percent change of -7 % *(p. 1095)*.
A further important result was the confirmation of the hypothesis that changes in fatality rates after legal interventions were independent from the baseline rates *(p. 1095)*.
The examination of the covariate administrative licence revocation revealed that this countermeasure was connected with a further 10.8 % reduction of fatal accidents. Therefore, the simultaneous enactment of lower BAC per se laws and administrative licence revocation laws will lead to superior beneficial traffic safety impacts due to a high level of accompanying general deterrence *(p. 1095)*.
This study found no empirically proofed evidence for a significant interaction between the 0.08 % per se BAC limit and administrative licence actions *(p. 1095)*.
Moreover, the effects of the legal change were significant longer-term effects *(p. 1096)*.

10.8.1.2
Authors:
Foss, Steward, Reinfurt (2001)
Location and time of the study:
California; 1991-1995
Analysed measure:
General deterrent effects of lowering the legal per se BAC limit from 0.10 % to 0.08 %, which became effective by law in October 1993

Design and methods of research:
Time-series analysis
Comparison of fatal crash rates between January 1991 and December 1996
Before-after design with a 24 months baseline and a 24 months follow-up period was used to compare the development of fatalities in North Carolina with 37 other U. S. states which did not implement a 0.08 % per se BAC level
Results:
The comparison with other states was necessary, because North Carolina already had had a low rate of alcohol related fatalities. Consequently, the lower limit could not produce such great benefits for traffic safety as in other states with higher baseline rates *(p. 512).*
This study came to the result that the intervention had not affected the downward crash trend which already begun in the years before the implementation of the new law. So, the lower limit did not cause any significant additional traffic safety benefits *(p. 512).*
Moreover, the height of the BAC of fatally injured drivers remained more or less constant during the time period from 1991 to 1995, so, the new law had no additional general deterrent effects *(p. 513).*
The rate of fatally injured drivers with low-BAC levels at least 0.01 % declined significantly from 23.1 % in 1991 to 20.4 % in 1995 *(p. 513).*
In the compared 37 other U. S. states, also a significant, but smaller decrease of the BAC of fatally injured drivers was observed (from 27.2 % in 1991 to 24.9 % in 1995). The difference in the declines between North Carolina and the other states was not significant *(p. 513).*
The same results were found by comparing the rates for high-BAC drivers. In North Carolina the percentage declined from 20.1 % to 18.7 %, while in the other states the fatality rate decreased from 23.0 % to 21.0 % *(p. 514).*
In North Carolina, the level of enforcement, especially through a great number of sobriety checkpoints, was very high compared with other American states. As a result, the number of arrestees increased from 74,867 in 1993 to 83,605 in 1994 *(p. 515).*
The main explanation for this lack of success may be that the reduction of the BAC limit from 0.10 % to 0.08 % was too small to have a measureable impact on the peoples´ drinking and driving behaviour *(p. 515).*
Moreover, the social acceptance of drunk driving already decreased since several years, so the implementation of a lower legal level is hardly able to influence this common downward trend *(p. 515).*
A third factor which may have been contributed to the failure of general deterrent effectiveness could be the lack of accompanying publicity in relation to the new law *(p. 515).*
Consequently, the evaluation of the deterrent effects of a lower legal limit is mostly an open issue.
Although the awareness of the new law was quite high among frequent drinkers, these high-risk group members did not change their drinking patterns noteworthy at all *(p. 516).*

10.8.1.3
Authors:
Voas, Tippetts, Fell (2000)
Location and time of the study:
All U. S. states including the District of Columbia
Analysed measure:
General deterrent impact of the implementation of 0.08 % BAC illegal per se law
Design and methods of research:
Interrupted time-series regression analysis
Comparison of the alcohol related fatality rates between 1982 and 1997

Involved drivers were separated into two groups: up to a BAC level of 0.09 % and at least 0.10 %
Drivers not older than 21 years were omitted, because they were targeted by special regulations (especially: minimum drinking age laws and zero tolerance laws)
Results:
The empirical and scientific evidence for the general deterrent effect of lower legal per se BAC levels is rather strong (e. g.: Rogers, 1997; Johnson & Fell, 1995). But the positive results of the cited studies were in some cases at least partly due to the simultaneous implementation of administrative licence revocation laws, which are well-known to produce commonly significant general deterrent impact (e. g.: NHTSA, 1991; Hingson et al., 1994) *(p. 486)*.
The computed regression coefficient for the implementation of 0.08 % BAC per se law was -0.08224, what corresponded to a significant reduction of 7.89 %, among drivers with a BAC level ranging between 0.01 % and 0.09 % *(p. 489)*. The value among drivers with a detected minimum BAC level of 0.10 % was almost the same with -0.08340, what corresponded to a highly significant reduction of 8.00 % *(p. 490)*.
A common downward trend of alcohol related fatalities was observed which already begun in the 1980´s. But despite this fact, the analysed countermeasure can be considered as an effective general deterrent to curb DUI in a measurable magnitude *(p. 491)*.
Moreover, the positive development of alcohol related fatalities was not attributable to one single measure, but to a bundle of different legislative interventions, which have the potential to cause long-term effects. But this objective is only achievable with strong enforcement behind the respective measure *(p. 492)*.

10.8.1.4
Authors:
Hingson, Heeren, Winter (1996)
Location and time of the study:
Utah, Oregon, Maine, California and Vermont; 1995
Analysed measure:
General deterrent impact of lowering the legal per se threshold from 0.10 % to 0.08 %
Design and methods of research:
Time-series analysis
Comparison of the alcohol related fatality rates of the lower limit states with the ones of those states which sustained their per se limit at 0.10 %
Only fatally injured drivers with BAC level of at least 0.08 % and of at least 0.15 % were included
The crash rates of the examination states were compared with the ones of a respective neighbouring state:

Utah - Idaho	(1976-1991; enactment new law: 1983)
Oregon - Washington	(1976-1991; enactment new law: 1983)
Maine - Massachusetts	(1984-1993; enactment new law: 1988)
California - Texas	(1986-1993; enactment new law: 1990)
Vermont - New Hampshire	(1990-1993; enactment new law: 1991)

Results:
In the following, the changes in the number of alcohol related fatalities are presented *(pp. 1298, 1299)*:

BAC level	0.08 % or above	0.15 % or above
Utah - Idaho	-15 % / +5 %	-17 % / +5 %
Oregon - Washington	+11 % / +43 %	+20 % / +33 %
Maine - Massachusetts	-14 % / -7 %	-21 % / +2 %
California - Texas	-12 % / +8 %	-9 % / +10 %
Vermont - New Hampshire	+1 % / -31 %	-3 % / -21 %

The results were very promising, because three states observed high reductions of the fatally injured drivers with BAC levels of at least 0.08 %. The increase in Oregon was much lower than the increase in the comparison state Washington, so, the result was mainly due to a common upward trend.
The results for the fatally injured drivers with BAC levels of at least 0.15 % were even more spurring, because four states experienced measurable reductions of the rates, while three of the respective comparison states showed an increase. The only exception was Oregon again, but the explanation for this phenomenon may be the same as in case of the 0.08 % drivers above.
The results of the experimental states could have been influenced by the former or simultaneous adoption of criminal per se laws and administrative licence revocation laws, because these laws went into effect in all examined states, but only in few of the control states. In this context, the confounding influence of the criminal per se laws may be almost negligible *(p. 1299)*.
On a pooled data base, it was, additionally, computed that the implementation of the lower legal per se limit was connected with a lowering of the fatalities including drivers with a BAC level of at least 0.08 % by 16 % and with a BAC level of at least 0.15 % by 18 % *(p. 1298)*. These results confirmed the hypothesis that the lowering of the legal threshold is also connected with reductions of BAC levels among other drivers than the initial target group. Among the group of the high-risk drinkers, the lowering also showed measurable general deterrent impact.

10.8.1.5
Authors:
Hingson, Heeren, Winter (2000)
Location and time of the study:
Kansas, North Carolina, Florida, New Mexico, New Hampshire and Virginia; 1999-2000
Analysed measure:
General deterrent impact of lowering the legal per se BAC level from 0.10 % to 0.08 %
Design and methods of research:
Time-series analysis
Alcohol related fatality rates of the examination states were compared with the rates of six neighbouring states which did not lower their 0.10 % per se BAC level
The rates only depicted fatality rates, when the driver has had a BAC level of at least 0.10 %
The following states were compared for their fatality rates during the named period of time:

Kansas - Oklahoma	(1988-1998; enactment new law: 1993)
North Carolina - Tennessee	(1988-1998; enactment new law: 1993)
Florida - Georgia	(1989-1998; enactment new law: 1994)
New Mexico - Colorado	(1989-1998; enactment new law: 1994)
New Hampshire - Connecticut	(1989-1998; enactment new law: 1994)
Virginia - Maryland	(1990-1998; enactment new law: 1994)

Results:
The researchers tried to separate the general deterrent effects of the lower legal per se limit and of administrative licence revocation laws *(p. 111)*.
While the examination states showed a 26.1 % reduction of the alcohol related fatalities, the comparison states revealed a reduction of only 20.2 %. Each of the six examination states observed a greater reduction than its respective counterpart *(p. 112)*.
Moreover, the reduction was higher in these four states which adopted administrative licence revocation laws (27.5 % versus 21.3 % in the respective comparison states) *(p. 112)*.
This study uncovered the following changes of alcohol related fatalities including a driver with a BAC level of at least 0.10 % *(p. 112)*:

Kansas - Oklahoma	-22 % / -19 %
North Carolina - Tennessee	-23 % / -20 %
Florida - Georgia	-31 % / -26 %
New Mexico - Colorado	-24 % / -19 %
New Hampshire - Connecticut	-22 % / -16 %
Virginia - Maryland	-15 % / -9 %

The variation of the results among the examined six states was not statistically significant *(p. 112)*.
The differences of the reduction rates between the examination and the comparison states were significant in the total view, but not in each single case *(p. 113)*.
All six comparison states had implemented criminal per se laws before the study began and, therefore, the results were not confounded by this factor *(p. 113)*.
The final recommendation of the researchers was the simultaneous enactment of the lower limit in conjunction with administrative licence revocation laws *(p. 113)*.
Thus, the implementation of a lower limit is connected with an enhancement of the general deterrence level, although the level of significance was not reached in all single cases.

10.8.1.6
Authors:
Voas, Taylor, Baker, Tippetts (2000)
Location and time of the study:
Illinois; 1998
Analysed measure:
General deterrent impact of the reduction of the legal per se BAC threshold from 0.10 % to 0.08 %, which was enacted by law in July 1997
This law change was not accompanied by an elevation of the enforcement efforts, but with a high standard of media and public information campaigns
Design and methods of research:
Time-series analysis
Comparison of the alcohol related fatality rates from 1988 to 1998
The data of the neighbouring states Indiana, Iowa, Kentucky, Missouri and Wisconsin were used for comparison purposes
Results:
The study uncovered a slight reduction of drivers with moderate-BAC levels (0.01 %-0.09 %) from 1996 (6.4 %) to 1997 (6.3 %), but an almost significant ($p = 0.062$) reduction in 1998 (5.2 %). Among high-BAC drivers with at least 0.10 %, the law change showed an initial general deterrent impact resulting in a reduction from 1996 (20.8 %) to 1997 (19.8 %), but in 1998 a very slight increase was observed (20.0 %) *(p. 16)*. The anticipated general deterrent

impact among high-BAC drivers could be explained by their higher level of awareness regarding DUI legislation.
The researchers assumed that at least the reductions among the moderate-BAC drivers would have reached the level of significance if the follow-up period had been enlarged *(p. 16)*.
Moreover, the casualty rates of Illinois were compared with the ones of the five comparison states in the time period from July 1997 to December 1998. This analysis uncovered a significant 13.7 % decrease in the examination state, while the comparison states observed a non-significant increase of 2.5 % *(p. 17)*.
The reduction of 13.7 % was higher than in three other comparable studies, which found decreases around 8 %. This outcome was mainly due to the short follow-up period, because the initial effects are commonly somewhat higher than the incidental ones *(p. 18)*.
One major impediment of the study was the lack of strong empirical evidence for the general deterrent impact of the threshold lowering due to the short follow-up period of 18 months *(p. 31)*.

10.8.1.7
Authors:
Voas, Tippetts, Taylor (2002)
Location and time of the study:
Illinois; 2000
Analysed measure:
General deterrent impact of the reduction of the legal BAC per se threshold from 0.10 % to 0.08 %, which became effective by law in July 1997
Design and methods of research:
Time-series analysis
Comparison of the alcohol related crash rates of Illinois with five surrounding comparison states (Indiana, Iowa, Kentucky, Missouri and Wisconsin) for the period 1988-1999
Results:
This study is a continuation of the above mentioned study (see: 10.8.1.6) by using a longer follow-up period *(p. 74)*.
The researchers computed a significant 13.65 % reduction of the alcohol related fatalities between the pre- and the post-law period in Illinois, while in the neighbouring states the fatalities increased by non-significant 3.38 % *(p. 76)*.
The pooled analysis of the mentioned data led to a significant reduction of 15.33 % in Illinois due to the implementation of the lower legal per se threshold *(pp. 76, 77)*.
But the lower threshold implementation was connected with an immediate drop of the alcohol related fatalities, but not with a change of the common upward trend of drunk driving. This tendency was already observable in the years before the law changed *(p. 78)*.

10.8.1.8
Authors:
Villaveces, Cummings, Koepsell, Rivara, Lumley, Moffat (2003)
Location and time of the study:
All 50 U. S. states and the District of Columbia
Analysed measure:
General deterrent effect of lowering the legal per se BAC level from 0.10 % to 0.08 %
Size of the sample:
792,184 fatal accidents (26 % were related to the use of alcohol)
Design and methods of research:
Time-series regression analysis

Comparison of the alcohol related fatality rates among automobile and motorcycle users between 1980 and 1997

Results:

The implementation of lower legal per se BAC levels was connected with measurable lower alcohol related fatality rates (3.4 % versus 4.7 %). Unfortunately, the authors did not explain if this was a significant difference *(pp. 133, 134).*

10.8.1.9

Author:

Dee (2001)

Location and time of the study:

48 states of the U. S.

Analysed measure:

General deterrent effects of a lowering of the legal per se BAC threshold from 0.10 % to 0.08 % in comparison to the implementation of legal per se BAC thresholds of at least 0.10 %
The respective state laws became effective between August 1983 and July 1997

Design and methods of research:

Time-series analysis
Comparison of the annual alcohol related traffic fatality rates between 1982 and 1998
The 19 states which already had implemented lower per se thresholds were used as examination states, while the remaining 29 states served as comparison states

Results:

Many states adopted in conjunction with the lower per se limit administrative licence actions laws, which are proven to enhance the general deterrent effectiveness of lower BAC levels *(pp. 113, 114).*
This study revealed highly significant reductions of all traffic fatalities after the implementation of 0.08 % per se laws (-7.2 %), but also highly significant declines attributable to the implementation of 0.10 % or higher per se laws (-5.3 %). Moreover, zero-tolerance laws were connected with a very small and not significant reduction of 0.2 % among all ages of drivers *(p. 120).* Consequently, laws with special target groups mostly do not affect the incidence of DUI among other groups of drivers.
The regression values were significant when the reductions of the fatality rates at the weekends were examined (it is empirically proven that the incidence of drunken driver is significantly higher during the weekends than during the weekdays). The 0.08 % per se laws were connected with an 8.6 % reduction of the fatalities, while the value for the 0.10 % or higher per se laws was only 5.6 % *(p. 122).*
When the night time fatality rates were analysed, the reductions attributable to the 0.10 % or higher per se laws were significant (-5.4 %), while the reductions due to the 0.08 % per se laws were only significant at the 0.10 level (-6.5 %) *(p. 123).*
Finally, the regression rates among different age groups were computed, while the values in brackets contain the reached level of significance *(p. 124)*:

	18-20 years	21-24 years	at least 25 years
0.08 % per se BAC level	-14.0 % (0.01)	-9.7 % (0.10)	-6.7 % (0.05)
0.10 % + per se BAC level	-12.1 % (0.01)	-11.1 % (0.01)	-5.2 % (0.05)

The results in the age group 18 to 20 years and 25 plus years were almost the same, revealing a slightly better outcome for the 0.08 % per se BAC law - as far as the levels of significance were concerned -, but in the group of the drivers between 21 and 24 years the outcome of the 0.10 % or above per se BAC law was much better. This led to the conclusion that the general

deterrent effect of the higher threshold among the middle age group was much higher than the one of the lower threshold. This outcome may be due to the fact that this group of drivers has at least some experience with driving and with drinking. Thus, they accept the higher level as "more adequate" for them.
One major impediment of this study was the lack of clear separation of the effects of the implementation of the lower limit and of the - in several states - simultaneously enacted administrative licence revocation laws. Therefore, these two DUI countermeasures are together much more effective than the sole implementation of a lower legal threshold *(p. 126)*.

10.8.1.10
Author:
Eisenberg (2003)
Location and time of the study:
All 50 U. S. states plus the District of Columbia; 2001
Analysed measure:
General deterrent impact of the lowering of the legal per se BAC level from 0.10 % to 0.08 % in comparison to the implementation of a legal per se BAC threshold of 0.10 % for adult drivers and of zero-tolerance laws for adolescent drivers
Design and methods of research:
Weighted least squares regression design
Comparison of the fatal traffic crash rates from 1982 to 2000
Results:
The reduction of high-BAC drivers must be regarded as one of the most important elements in the combat against DUI *(p. 250)*.
With reference to ten published studies, which dealt with the lowering of the legal per se BAC threshold from 0.10 % to 0.08 %, these studies produced mixed results concerning the general deterrent effectiveness *(p. 251)*.
The general deterrent effects of 0.10 % per se BAC laws were often not higher than the ones in states without having an illegal per se limit and using the detected BAC levels in the concrete case as presumptive evidence of impairment. The latter type of legal regulation is in several cases regarded as stricter than a certain per se limit, especially if the first one is enforced on a high level. Consequently, the change from no per se limit to 0.10 % per se limit was often not regarded as a tougher regulation and, therefore, the general deterrent impact was only limited, too. But the lowering of the legal per se limit from 0.10 % to 0.08 % contained the right signal of no acceptance of DUI *(p. 259)*.
The following regression coefficients in relation to the fatality rates were computed due to the respective DUI countermeasure. The values in bracket contain the reached level of significance *(p. 259)*:

	0.10 % per se	0.08 % per se	zero-tolerance
High-BAC fatalities	-0.0482 (0.05)	-0.1061 (0.05)	-0.0223
All alcohol related fatalities	-0.0646 (0.05)	-0.1344 (0.05)	-0.0309
Weekend night time single vehicle fatalities	-0.0116	-0.0292 (0.05)	-0.0057
Fatalities of drivers under 21 years	-0.0288	+0.0539	+0.0053

The differences between the regression values of 0.08 % and 0.10 % per se laws were significant only for the group of high-BAC fatalities and for all alcohol related fatalities *(p. 259)*. But both laws were able to cause significant general deterrent impact, even among high-BAC drivers.

So, the implementation of both 0.08 % per se laws and zero-tolerance laws was not connected with a reduction, but an increase of the fatality rates among the high-risk group of young drivers, while the implementation of 0.10 % per se laws was at least connected with reductions of the fatalities, although not significant. This outcome could be due to the circumstance that these higher thresholds were no longer valid if the respective state adopted a zero-tolerance approach. A further explanation could be that all adolescents up to 21 years already commit a law violation by consuming any alcoholic beverages and, thus, the deterrent effect of the additional traffic law violation loosed some of its general deterrent impact among this age group *(p. 267)*.
In all other fatality groups, the results of the 0.08 % per se laws were significant - especially the results among the high-BAC drivers were very spurring - and, so, connected with a higher level of general deterrence than the 0.10 % per se laws and especially the zero-tolerance laws. The latter ones achieved the worst results, what may be due to a lower level of social acceptance.
Moreover, the fatality rates for all drivers in all four above mentioned groups already dropped significantly up to two years before the implementation of the lower limit. This phenomenon may be due to the enhancement of public awareness caused by general discussions about the lowering and comprehensive media campaigns *(p. 262)*.
A little bit surprising was the observed outcome that within the first two years after the implementation of the 0.08 % per se laws only a significant drop of all fatalities was observed among high-BAC fatalities and all alcohol related fatalities. In contrast, the weekend night time and weekend night time single vehicle fatalities only showed reductions which did not reach the significance level. Unfortunately, this phenomenon was not explained by the author *(p. 262)*.
The outcome for the post-intervention-period was better, because the regression coefficients in the first year after adoption were significant for high-BAC fatalities and all alcohol related fatalities, while in the second year all four values were significant. This was possibly at least partly due to a common change of the adolescents´ attitude towards drinking and driving caused by education campaigns *(pp. 266, 267)*.
As it was shown above, the results of zero-tolerance laws for adolescent drivers were not very spurring. But the general deterrent effects improved when administrative licence revocation laws were enacted simultaneously *(p. 267)*.

10.8.1.11 Studies review
Authors:
Hingson, Heeren, Winter (1999)
Analysed measure:
General deterrent impact of lowering the legal per se BAC limit from 0.10 % to 0.08 %
Results:
All states which adopted the lower per se limit also had administrative licence revocation laws in effect *(p. 33)*.
With reference to two studies, which were conducted in California in the 1990´s (NHTSA, 1991; Rogers, 1995), the lower legal per se limit did not produce significant reductions of the alcohol related fatality rate until the administrative licence revocation law was implemented *(p. 33)*.
The results of a study of Hingson, Heeren & Winter (1996) (see: 10.8.1.4) were also confirmed by studies from the 1970´s and 1980´s, which were conducted in Great Britain and France. These two studies also confirmed that significant reductions of the alcohol related fatalities were observed when administrative licence action laws went into effect *(p. 33)*.
A study of Rogers (1995) revealed that the implementation of lower per se limits alone

reduced alcohol related fatalities, but the effects were much higher if administrative licence revocation laws were enacted simultaneously *(p. 34)*.
With reference to a study of Blomberg (1992), public awareness caused by comprehensive media campaigns was one of the key factors to receive significant general deterrent effects *(p. 35)*.

10.8.1.12 Studies review
Authors:
Shults, Elder, Sleet, Nichols, Alao, Carande-Kulis, Zaza, Sosin, Thompson, Task Force on Community Preventive Services (2001)
Analysed measure:
General deterrent impact of lowering the per se BAC level to 0.08 %
The changes in the night time single vehicle fatalities were used as an outcome measure
Results:
In the sum, nine studies were reviewed which analysed the effectiveness of the implementation of 0.08 % per se laws *(p. 70)*.
These studies uncovered a reduction of alcohol related fatalities ranging between 4 % and 15 %, leading to an average reduction of 7 % *(p. 70)*.
The following studies, which are not presented elsewhere in this document, were reviewed:

- The Research and Evaluation Associates (1991) examined the general deterrent impact of a BAC threshold reduction, which went into effect in California in January 1990, by using a time-series analysis and comparing the alcohol related fatality rates between 1986 and 1990. This new law was accompanied by a highly significant reduction of 12 %.

- Rogers (1995) analysed the same measure in California, but he used a longer follow-up period and evaluated the fatality rates between 1985 and 1993. Additionally, he only looked at single vehicle night time fatalities. In the end, he observed only a non-significant reduction of 7 %.

- Apsler, Char, Klein, Harding (1999) examined the general deterrent effects of the implementation of 0.08 % per se laws in eleven states of the U. S. (California, Florida, Kansas, Maine, New Hampshire, New Mexico, North Carolina, Oregon, Utah, Vermont and Virginia) by using a multiple time-series design with concurrent comparisons. The respective laws were enacted between 1983 and 1994. In seven states, the new law was connected with a significant reduction of the alcohol related fatality rates. While in five of these states, the reduction was exclusively attributable to the lower limit, in the other two states the results could have been confounded by the simultaneous enactment of administrative licence revocation laws. In three other states, a not significant increase and in one state a not significant decrease was observed.

- Scopatz (1998) analysed the general deterrent impact of this legal intervention in five U. S. states between 1983 and 1990 by using a pre-post design with concurrent comparisons. He only looked at the development of the fatality rates with drivers who exceeded the legal limit. In three states, he uncovered reductions ranging between 29 % and 38 % and in two states increases of 15 % and 25 %, respectively. This led to an average reduction of 5 %, but the magnitude of the decrease depended considerably on the selected comparison states.

- Johnson (1995) analysed the same measure like Scopatz in the same five countries by using the same design, but he only looked at high-BAC drivers with a BAC of at least 0.10 %. He revealed reductions in three states, ranging between 4 % and 31 %, and an increase of 1 %, while in one state no change was observable.

Additionally, this review did not support the hypothesis that the implementation of lower legal per se limits only has a deterrent impact among social drinkers, but not on the high-risk group of hardcore drinkers, because five of the reviewed studies showed a measurable reduction of the fatality rates even among drivers with a BAC of 0.10 g/dl or above *(p. 71)*.
As a conclusion, there is strong empirical evidence for the general deterrent effectiveness of this DUI countermeasure *(p. 71)*.

10.8.1.13 Studies review
Authors:
Chamberlain, Solomon (2002)
Analysed measure:
General deterrent effects of lowering the criminal code per se BAC level from 0.10 % to 0.08 %
Results:
At first, the implementation of lower criminal per se BAC levels in most federal states of the U. S. was connected with beneficial effects for traffic safety *(p. 5)*.
The researchers assumed that the implementation of a 0.05 % criminal code per se BAC threshold will mainly affect drivers with BAC levels between 0.07 % and 0.10 % *(p. 5)*.
An examination (NHTSA, 1994) of five U. S. states, which implemented the 0.08 % criminal per se BAC level, showed that four of these states observed significant reductions of their alcohol related fatality rates. A main disadvantage of this analysis was the absence of a control for confounding variables *(pp. 5, 6)*.
These confounding variables were omitted in another study (Apsler et al., 1999), which also confirmed the positive trend of the above mentioned analysis. In this study, the authors examined eleven states and seven of them showed statistically significant reductions of alcohol related fatality rates. Four of these seven states showed also significant reductions among high-risk drivers with a BAC level of at least 0.10 % *(p. 6)*.
Another study (GAO, 1999) revealed only very small general deterrent effects due to the threshold reduction, but this was mainly attributable to a low level of public awareness concerning the new law. So, the reduction of the legal limit will only be effective in combination with public information campaigns and an elevation of the enforcement efforts *(p. 6)*.
Moreover, the general deterrent effect of lower criminal per se BAC levels will elevate when they are combined with administrative licence revocation laws *(p. 7)*.
Recent research found strong evidence for the general deterrent effects of lower criminal per se BAC thresholds leading to significant reductions of the alcohol related fatality rates. This effect was also observable among the high-risk drivers with BAC levels of at least 0.10 % *(p. 7)*.

10.8.1.14 Studies review
Authors:
Fell, Voas (2006)
Analysed measure:
General deterrent effects of lowering the legal per se BAC threshold from 0.10 % to 0.08 %

Results:
Another review of empirical studies (GAO, 1999) found out that the lowering of the legal per se BAC threshold from 0.10 % to 0.08 % showed only measurable general deterrent impact if it was combined with administrative licence suspension/revocation laws. This was also one major impediment of some reviewed studies, because they did not separate between the general deterrent effects of these two different countermeasures when they were enacted more or less simultaneously *(p. 234)*.
The authors referred in each case to two studies which reported significant reductions of the alcohol related fatalities (Apsler et al., 1999; Rogers, 1995) and which did not find any significant decreases (Foss, Steward & Reinfurt, 1999; REA, 1991) *(p. 234)*.
A comprehensive meta-analysis (Tippetts et al., 2005) uncovered a 14.8 % reduction of the alcohol related fatality rate due to the lowering of the legal threshold from 0.10 % to 0.08 % *(pp. 234, 235)*.
In the United States, the former presumptive laws were replaced by per se laws, starting in Oregon and Utah in 1983 *(p. 235)*.
Another study (Voas & Tippetts, 1999), which examined the changes of the alcohol related fatality rates in all 50 U. S. states, revealed a significant 8 % reduction of the incidence of high- and low-BAC driving, but no significance in the field of moderate-BAC driving was observed. A further study (Foss et al., 1999) was not able to find any significant general deterrent impact of the limit lowering in North Carolina. Almost all studies observed the phenomenon that the drop of the alcohol related fatalities already began before the respective law became effective *(p. 236)*.
Almost all reviewed studies found out reductions of the alcohol related fatalities (mostly ranging between 3 % and 20 %), while only three studies showed increases of these rates. But two of the latter studies uncovered only a slight increase of 2 % and 3 %, respectively. Finally, one study failed to find any change at all *(p. 236)*.
As a conclusion, any reduction of the legal threshold is mostly connected with a measurable general deterrent effect, leading to a drop of alcohol related fatalities *(p. 241)*.
In this context, the adoption of a 0.05 % per se limit is connected with a high level of public support, which is one of the major elements to achieve high levels of law-abiding behaviour *(p. 241)*.

10.8.1.15 Studies review
Authors:
Mann, Macdonald, Stoduto, Bondy, Jonah, Shaikh (2001)
Analysed measure:
General deterrent effects of lowering the legal per se BAC level from 0.10 % to 0.08 %
Results:
Johnson & Fell (1995) examined the per se threshold lowering from 0.10 % to 0.08 % in five U. S. states (California, Maine, Oregon, Utah and Vermont) between 1982 and 1990 by using a pre-post comparison design with a follow-up period of two years. While the authors observed significant reductions of different indicators for alcohol related fatalities in four of the five states, only Maine did not show any significant reductions *(p. 574)*.
Most of the reviewed studies revealed reductions in the rate of alcohol related fatalities and serious injuries due to the lowering of the legal per se BAC level. But the results were not so clear as far as the long-term effects of these traffic safety benefits were concerned. Several studies also showed a measurable impact within a longer follow-up period. Finally, the results of American states were quite similar to the results from European countries *(p. 578)*.
The high-risk group of frequent drinkers must be the main target group when new DUI countermeasures are created *(p. 579)*.

Most reviewed studies observed that the reduction of the legal per se limit did also affect drivers with other BAC levels than the drivers who were originally aimed by the law amendment. Therefore, the reduction of the legal threshold had mostly a general deterrent impact on each BAC level, also the high-BAC´s *(p. 579)*.

10.8.1.16 Meta-analysis

Authors:

Tippetts, Voas, Fell, Nichols (2005)

Location and time of the study:

18 U. S. states and the District of Columbia

Analysed measure:

General deterrent impact of the lowering of the legal per se BAC threshold from 0.10 % to 0.08 %

The respective laws became effective between 1983 and 1999

Design and methods of research:

Two different types of time-series analysis (ratio and covariate design)

Comparison of the alcohol related fatality rates from 1982 to 2000

Results:

Referring to another review (U. S. General Accounting Office, 1999), the sole implementation of lower thresholds were not surely connected with general deterrent effects. But these effects were observed from a combination of lower limits with other legal interventions (especially: administrative licence suspension/revocation laws) and accompanying publicity campaigns and enforcement efforts *(p. 150)*.

Moreover, two further studies (Foss et al., 1998; Rogers, 1995) found no significant reductions of the alcohol related fatalities due to the implementation of the lower per se limit, while two other studies (Apsler et al., 1999; Research and Evaluation Associates, 1991) uncovered significant decreases of this outcome variable *(p. 150)*.

The ratio design showed a reduction of the fatality rates in 16 of the 19 examined U. S. states after the lower per se limit was introduced. Nine of these states showed significant declines and two further states observed slightly significant reductions at the 0.10 level. The remaining three states showed increases of their fatality rates, but these values did not reach the level of significance *(pp. 154, 156)*.

The covariate design revealed very similar results, because also 16 U. S. states had reductions of their fatality rates, while eight reached the significance level and three others the 0.10 significance level. None of the increased rates were significant *(pp. 155, 156, 157)*.

Two of the states observing non-significant reductions and the one state observing significant reductions had implemented the lower per se limit and administrative licence suspension/revocation laws simultaneously. Therefore, the general deterrent effects cannot be distinguished exactly *(p. 157)*.

The data of the two models were pooled for all 19 jurisdictions and resulted in significant reduction of 14.8 % of alcohol related fatalities *(p. 157)*.

Moreover, the reductions of the fatality rates were strongly associated to the frequency of the conduction of sobriety checkpoints *(p. 158)*. Thus, the implementation of enforcement measures is an important factor for measurable general deterrent effects *(p. 159)*.

Finally, the general deterrent effect of a limit reduction is mainly not based on the public knowledge of a certain threshold, but on the public perception that the state will no longer accept drunk driving and will combat it *(p. 160)*. This public perception is in most cases combined with a reduction of the social acceptance of DUI.

10.8.2 Reduction from 0.08 % to 0.05 %

10.8.2.1

Authors:

Bernhoft, Behrensdorff (2003)

Location and time of the study:

Denmark

Analysed measure:

Lowering of the legal per se BAC level from 0.08 % to 0.05 %

The corresponding law was implemented in March 1998

Size of the sample:

Interviewees: 2,873 (1997); 1,409 (1998)

Injured or fatally injured drivers: not specified

Design and methods of research:

Comparison of the alcohol related accidents with at least one injured or killed person and drivers having a BAC of at least 0.05 %, DUI violations and the drivers´ drinking patterns prior and after the legal intervention

The habits of the drivers concerning alcohol consumption and their knowledge of the correct legal per se BAC threshold was determined through the use of telephone interviews among a randomly selected sample of driving licence holders

The accident data were collected for the time period 1993 to 1998 and the data of DUI offences from 1993 to 1999

Results:

The number of requested blood samples due to the suspicion of impaired driving lifted from 15 % to 18 % (accidents with injuries) and from 46 % to 52 % (fatal accidents), respectively, although the practice of the police to detect impaired drivers had not changed noteworthy within the examination period *(p. 517)*.

The knowledge of the correct per se BAC threshold among the interviewed population rose significantly from about 40 % before the law change to 70 % among drivers aged from 25 years onward and even to 80 % among drivers between 18 and 24 years *(p. 518)*.

Furthermore, the change in drinking patterns before driving was also significant. Before the new law became effective, 71 % answered that they would not drink more than 12 g alcohol - one standard beer or a glass of wine - before driving. After the law changed, this rate elevated to 80 %. The vast majority of the interviewees attributed the change in their personal habits to the change of the legal per se BAC limit. The percentage of self-reported sober drivers increased from 37 % to 41 %. Consequently, the limit lowering led to a decrease of the social acceptance of drunken driving *(p. 518)*.

The data of accidents with injuries did not support the statement that the law change had a beneficial effect on traffic safety, because there was a reduction from 12.2 % (1997) to 11.4 % (1998) observed. But in the period from 1993 to 1994, the rate also dropped from 12.9 % to 11.5 %, so, the reduction in the post-law period cannot reliably attributed to the lower per se BAC limit *(p. 520)*.

The number of the fatal accidents showed a significant increase within the period from 1997 to 1998 (16.7 % to 21.9 %), while in the year before a significant decrease was observed (20.2 % to 16.7 %). Moreover, the number of fatalities reached the peak within the prior five years *(p. 521)*.

The total number of charged drivers with a BAC of at least 0.08 lifted modestly from 10,840 in 1997 to 11,011 in 1998 and 11,141 in 1999, but there was only a significant decline of the number of drivers with a BAC of more than 0.12 % (8.335: 1997; 8.179: 1998; 8.275: 1999). But the hazard existed that this decline was only a short-term effect, which can be proofed through the lift in 1999 *(p. 523)*.

One impediment of this study was the relatively short follow-up period.

10.8.2.2
Authors:
Deshapriya, Iwase (1996)
Location and time of the study:
Japan; 1993-1995
Analysed measure:
General deterrent effects of lowering the legal per se BAC level from 80 mg% to 50 mg%, which became effective by law in 1970
This law was accompanied by the implementation of random breath tests and an increase of the sentence severity (the maximum jail sentence was doubled and the maximal height of fines was lifted threefold)
Design and methods of research:
Time-series analysis of the accident rates between 1945 and 1992
Results:
The breath test was obligatory due to public safety reasons, but if it was refused anyway, a high fine was imposed on the driver *(p. 724)*.
The law change in 1970 led to a steady increase of DUI convictions from about 50,000 in 1970 to about 300,000 in 1977. In 1977, a downward trend was observed, which remained constant after the second law change in 1978 (containing the implementation of mandatory licence actions and administrative licence suspension laws), but it stopped in 1980 at about 210,000 convictions for DUI. Since 1980, another upward trend became visible, which reached its peak in 1988 with about 350,000 convictions. After this point in time, the rate remained more or less stable *(p. 725)*.
The implementation of the lower per se limit was connected with a high rate of enforcement, which was mainly attributable to random stopping by the police and night time checking. These measures led to long-term benefits for traffic safety.
A high level of enforcement through the police can be regarded as one of the most effective general deterrents, because the obvious level of punishment certainty - through a high perceived apprehension risk - can solve as a factor to get a high number of law-abiding drivers.
Based on scientific knowledge, the maximum for a legal BAC limit must be 50 mg%, but in their personal opinion, the best limit would be 20 mg% *(p. 725)*.
The main objective of the second law change was to increase the celerity of the sanctioning procedure. But the observed effect cannot mainly be attributed to the lowering of the per se BAC limit, but to a change of the public attitude towards drinking and driving.
Finally, the attitude concerning drinking and driving is rather different between Japanese and Americans, because the first ones support the implementation of legal DUI countermeasures in a high magnitude *(p. 728)*. This statement shows the great relevance of the moral obligingness of an alcohol prohibition in traffic to reach a high level of acceptance within in the society, what is even much more important than a high level of general deterrence.
The combination of administrative licence action laws and other traditional sanctions are supposed to have the highest beneficial impacts on traffic safety *(p. 729)*.

10.8.2.3
Authors:
Homel (1994)
Location and time of the study:
New South Wales (Australia); 1993

Analysed measure:
General deterrent effects of lowering the legal per se BAC level from 0.08 g% to 0.05 g%
The corresponding law became effective in December 1980 and was accompanied by the implementation of random breath testing, which was introduced by law two years later and was additionally accompanied by a lift of the sanction severity for DUI
Design and methods of research:
Time-series analysis of the fatal crash rates between July 1975 and December 1986
Results:
Most empirical studies came to the conclusion that the greatest decreases in fatality rates were attributable to the introduction of random breath testing laws *(p. 147)*.
The implementation of the lower legal threshold was not coincided with an official publicity campaign, and also the level of enforcement was not lifted measurable *(p. 149)*.
The introduction of random breath testing was connected with a high level of publicity and also an elevation of the enforcement efforts by the police, whereas the lift of the sanctions was hardly made public, so only few drivers were aware of the increased penalties *(p. 149)*.
A former study (Smith, 1987), using a pre-post comparison design, which examined the general deterrent effects of a per se BAC lowering from 0.08 g% to 0.05 g% in two Australian states found out that the introduction of the new law was connected with a small, but not significant decline in fatalities of 4 % *(p. 149)*.
The introduction of the lower per se BAC limit was not connected with any changes in daily fatal crashes and also the fatalities on Saturdays remained more or less stable. But the introduction of the random breath testing law was connected in both cases with an immediate highly significant downward trend (decline of 13.0 % after the implementation, whereas the reduction on Saturdays was highest with 20.3 %). This outcome also showed a long-term impact *(p. 150)*.
During the examination period, the fatal accidents declined through the implementation of random breath testing by 30.3 % during holiday periods and by 18.8 % during non-holiday periods. Similar results were found in another study which revealed a 36 % reduction of fatalities involving drivers with a BAC level of 0.05 g% or above *(p. 153)*.
The result of this study was the following: modest general deterrent effects were only measureable as far as the fatalities on Saturdays were concerned.
Moreover, the law change in fact did hardly change the drinking and driving patterns of the frequent drinkers as one of the high-risk groups *(p. 153)*.
The implementation of a 0.05 g% BAC level, which is accompanied by a high level of publicity, could create measureable traffic safety impact. But this effect will be several times higher if random breath testing is used as a measure of enforcement *(p. 153)*.

10.8.2.4
Authors:
Brooks, Zaal (1992)
Location and time of the study:
Australia; 1991-1992
Analysed measure:
General deterrent effect of reducing the legal per se BAC limit from 0.08 % to 0.05 %
The corresponding law became effective in January 1991 and it was not connected with an increase of the penalties for DUI
Design and methods of research:
Time-series regression analysis
Comparison of the incidence rates of drink driving in relation to different BAC levels of the drivers by using the police data from random breath testing for the years 1990 and 1991

Results:
The threshold reduction showed great impact among the target group of drivers with BAC levels between 0.05 % and 0.08 %. Their number decreased by highly significant 90 %. The lower threshold was also connected with a significant reduction of about 34 % among high-risk drivers with BAC´s above 0.15 % and even of 58 % among drivers with BAC´s above 0.20 %. Surprisingly, the medium-range drinkers between 0.08 % and 0.10 % or 0.10 % and 0.15 %, respectively, only showed a small and not significant reduction of their prevalence rates (9 % and 11 %, respectively) *(p. 1277)*.
One major impediment of this study was the relatively short follow-up period of one year *(p. 1286)*.
The authors referred to several empirical studies from the late 1980´s and early 1990´s which examined the reduction of the legal per se BAC level from 0.08 % to 0.05 %. They revealed all together a higher reduction among high-risk drinkers with BAC´s of at least 0.15 % than among the initial target driver population *(p. 1278)*.
The reduction of the prevalence rates was even more surprising, because the enforcement level through the measure of random breath testing in the period 1990/1991 decreased by about 10 % *(p. 1280)*.
Moreover, the above mentioned reduction of the prevalence rates appeared immediately after the lower legal per se limit became effective *(p. 1281)*.
The reduction of impaired driving occurred among both young drivers up to 25 years and older drivers *(p. 1283)*.
So, the general reduction of the BAC level can also affect high-risk drinkers, even if they were not the main target of the respective law change *(p. 1285)*.

10.8.2.5 Studies review
Authors:
Deshapriya, Iwase (1998)
Analysed measure:
General deterrent effect of lowering the legal per se BAC threshold from 0.08 % to 0.05 %
Results:
With reference to other empirical research, the implementation of administrative licence action laws is connected with a 5 % reduction of alcohol related fatalities, therefore, the rest of the respective reductions can be attributed to the lowering of the legal per se limit *(p. 2775)*.
Referring to Wilson (1993), the reduction of the legal per se threshold can be regarded as a general deterrent and preventive measure *(p. 2775)*.
With reference to Howat et al. (1991), a higher limit (in the study: 0.08 %) was connected with measurable higher rates of alcohol related fatalities than the 0.05 % limit. Therefore, the researcher recommended a general implementation of the 0.05 % value *(p. 2777)*.
A study of Smith (1987) came to the conclusion that the reduction from 0.08 % to 0.05 % in Queensland (Australia) in 1982 was connected with a significant 4 % reduction of the alcohol related fatalities. This effect also seemed to be longer-lived *(p. 2777)*.
The researchers strongly recommended a legal BAC threshold of maximum 0.05 % *(p. 2778)*.
Furthermore, higher levels of public support - leading to an increase of social acceptance - and of police enforcement are required to combat DUI effectively *(p. 2780)*.

10.8.2.6 Studies review
Authors:
Mann, Macdonald, Stoduto, Bondy, Jonah, Shaikh (2001)

Analysed measure:
General deterrent effects of lowering the legal per se BAC level from 0.08 % to 0.05 %
Results:
The authors named legal and political circumstances as most important factors which must be considered when enacting certain per se limits, while the knowledge of the natural sciences was named lastly *(p. 570)*.
The following studies were reviewed *(pp. 574, 575)*:

- Kloeden/Mc Lean (1994) conducted a pre-post-comparison of impaired drivers in South Australia. All together they reported a decline of 14.1 %, but the reductions among high-BAC drivers with at least 80 mg% were highest with 38.2 %. The results were biased due to the simultaneous implementation of random breath testing.

- Mc Lean et al. (1995) conducted a pre-post-comparison in South Australia by comparing the night time fatality rates. They observed only short-termed reductions among drivers with BAC levels of at least 80 mg%.

- Mercier-Guyon (1998) examined the general deterrent impact of the lower per se limit, which was enacted in France in 1996, by using a pre-post-comparison on alcohol related accidents. In 1996, an increase of the fatality rate of 11 % was observed, but in 1997, a drop of 47 % was revealed. The delay in the effectiveness was not explained by the authors.

- Bartl/Esberger (2000) conducted a pre-post-study in Austria and observed a small, but significant decline of alcohol related fatalities from 6.35 % to 5.75 %. The reductions were measured among drivers with BAC levels of at least 50 mg% and of at least 80 mg%.

Most of the reviewed studies revealed reductions of alcohol related fatality and serious injury rates due to the lowering of the legal per se BAC level. But the results were not so clear as far as the long-term effects of these traffic safety benefits were concerned. Several studies showed an impact within a longer follow-up period, while other examinations did not. Furthermore, the results of American states were quite similar to results from European countries, consequently, the results are regularly transferable *(p. 578)*.
In most cases, the sole lowering of the per se BAC threshold was not connected with high traffic safety benefits. To achieve this desirable high level of general deterrence, it would be necessary to connect the lower limit with the implementation of other legal measures (especially: administrative licence actions laws), publicity campaigns to lift the public awareness and strong highly visible enforcement efforts. All these measures are necessary to maintain the initial general deterrent effect of increased apprehension risk through the well-publicized law change, because this positive effect will decline after a relatively short period of time if the perceived risk of detection is in fact lower than the subjective one *(p. 578)*.
Additionally, the high-risk group of frequent drinkers must be the main target group when creating new DUI countermeasures *(p. 579)*.
Most of the reviewed studies observed that the reduction of the legal per se limit did also affect drivers having other BAC levels than the originally targeted levels. Thus, the reduction of the legal per se threshold had a general deterrent impact on drivers with each BAC level, also the high-BAC´s *(p. 579)*.
One reason for the higher level of effectiveness of law changes in Scandinavia was seen in their law-abiding culture *(p. 580)*.

10.8.2.7 Studies review

Authors:

Chamberlain, Solomon (2002)

Analysed measure:

General deterrent effects of lowering the legal per se BAC level from 0.08 % to 0.05 %

Results:

A common trend among international countries is the implementation of per se BAC levels around 0.05 % *(p. 1)*. This statement is not limited to criminal code offences, because most countries, which were named in this context, did not use the 0.05 % BAC level for criminal, but for administrative offences.

In 1999, the Canadian House of Commons refused to lower the criminal code per se BAC level from 0.08 % to 0.05 % due to the following reasons:

- loss of public support and, consequently, a lack of social acceptance
- no deterrent impact among hard-core drink drivers
- additional enforcement burdens

Especially the last point was seen critically, because like most other countries Canada suffers from a lack of police and judicial resources *(p. 1)*.

The exceeding of the 0.05 % level will be realized mostly by frequent or even problem, but not by social drinkers *(p. 11)*.

Moreover, a national opinion poll, which was conducted in 2001 in Canada, uncovered that 66 % of all respondents support or even strongly support the lowering of the criminal code per se BAC level from 0.08 % to 0.05 %, while only 30 % oppose or strongly oppose. The rest of the interviewees was unsure. Similar results were observed in the United States *(p. 12)*. Consequently, the social support for a lower legal per se limit is quite high and, therefore, such a law will lead to a reduction of the incidence of drinking and driving.

The argument of the lack of deterrence of hard-core drinkers is also flawed, because empirical studies showed that the lowering of the legal per se limit was mostly connected with high reductions of the incidence of drink drivers, especially high-BAC drivers. The general deterrent effect among the group of high-BAC offenders is often limited to a reduction of their BAC level while driving, but in most cases they do not render their behavior completely and become sober drivers. Moreover, the considerable higher number of occasional drinkers posted a much higher traffic safety risk than the relatively small number of hard-core drinkers *(p. 13)*.

The authors rebutted the argument of the court capacity overload with reference to the experiences in other Australian and U. S. countries, where mostly no significant changes of the procedures or the work loads were reported *(p. 13)*.

The problem of the enforcement lack through limited police capacities can be solved by an enhancement of the technical equipment and by education measures, which enable the officers to detect signs of impairment at lower alcohol levels more safely. Moreover, the police also enforces zero-tolerance laws - especially for young drivers - very successfully *(p. 14)*.

Due to the broad variety of legal conditions, the results of international studies are not exactly comparable. As a consequence, the amount of traffic safety benefits based on the general and specific deterrent effects also cannot be predicted precisely *(p. 2)*.

The implementation of a 0.05 % criminal code per se BAC threshold will mainly affect drivers with BAC levels between 0.07 % and 0.10 % *(p. 5)*.

Reviewed studies which examined the general deterrent effects of 0.05 % BAC administrative licence suspension laws, which allow the police officers to suspend the licence for twelve or

24 hours if the drivers refuses the breath test or exceeds the legal per se limit:

- One study, conducted in Ontario (1992), examined the general deterrent effects of this type of law. It had a measureable impact among drunken drivers, because their crash involvement rate declined steadily by 58 % after its implementation *(p. 8)*.

- Other studies, which were conducted in Prince Edward Island (1993), Newfoundland and Labrador (each 1994), also showed high decreases of the fatally injured drunken drivers *(p. 8)*.

International experiences with the enactment of a legal per se BAC threshold of 0.05 % or below, which is in most cases not regarded as a criminal, but a regulatory offence:

- All jurisdictions which have reduced their legal per se BAC thresholds observed measureable reductions of the incidence of drunk driving. So, the lowering is, at least in most cases, connected with general deterrent effects.

- A study, which was conducted in Belgium and examined the general deterrent impact of the lowering of the legal per se BAC level from 0.08 % to 0.05 % in 1994, revealed that the alcohol related fatality rate declined in both years after the implementation by about 10 % *(p. 9)*.

- It was also referred to a French study, which was conducted in Haute-Savoie and examined the reduction of the legal per se limit from 0.08 % to 0.05 % in 1996. This study showed great reductions of 36 % of the alcohol related fatalities in the first year after the enactment *(p. 9)*.

- A further time-series analysis of Henstridge et al. (1997) in Australia showed traffic safety benefits when the legal limit was lowered from 0.08 % to 0.05 %. This DUI countermeasure led to measurable reductions of the alcohol related fatality rates, ranging between 8 % and 18 % (depending on the examined province) *(p. 9)*.

- Two studies examined the lowering of the legal threshold from 0.08 % to 0.05 % in South Australia in 1991. While the first study observed a 14 % reduction of the incidence of drunken driving among night time drivers, the second one did not reveal any significant change of the fatality rates, but at least it uncovered a small reduction of the high-risk drivers with BAC levels of at least 0.15 % (from 60 % in 1991 to 56 % in 1993).

- The phenomenon of the last study was also shown in another examination of the Australian threshold lowering, which revealed a reduction of 34 % among drivers with BAC levels between 0.15 % and 0.199 % and of even 58 % among drivers with BAC levels of at least 0.20 % when the drivers were randomly breath tested. A very similar pattern was observed when the BAC level was detected in conjunction with an accident (reductions of 31 % and 46 %, respectively) *(p. 9)*.

In several cases, the threshold lowering was also connected with anticipated general deterrent impact. A roadside survey in Germany showed that the incidence of drunken driving already declined before the new 0.05 % BAC law became effective. This phenomenon was mainly due to the high level of media coverage and an elevation of the police enforcement *(p. 9)*.

Moreover, the international trend is the lowering and not the escalation of the legal BAC levels. This trend is also supported by a number of different international organizations *(p. 10)*.
A large number of different international studies was found which confirmed the traffic safety benefits of the lowering the per se BAC level to 0.05 %. The same statement is also valid for the reduction of the criminal per se BAC level from 0.10 % to 0.08 % in most U. S. states *(p. 11)*.

10.8.2.8 Studies review
Authors:
Fell, Voas (2006)
Analysed measure:
General deterrent effects of lowering the legal per se BAC threshold from 0.08 % to 0.05 %
Results:
Smith (1988) conducted an empirical study in Queensland (Australia) and uncovered that the lowering of the per se limit from 0.08 % to 0.05 % was connected with an 8.2 % reduction of serious injuries occurred at night. But the reduction was at least partly attributable to an elevation of the enforcement efforts *(p. 238)*.
The study of Smith is the only empirical evaluation which was not already examined in this analysis, therefore, its results are presented in detail. The following statements were based on all reviewed studies, because it is not possible to disentangle them precisely.
As a conclusion, any reduction of the legal threshold is mostly connected with a measurable general deterrent effect, leading to a drop of the alcohol related fatality rates *(p. 241)*.
In this context, the adoption of the 0.05 % per se limit is connected with considerable level of public support, which is one of the major elements to achieve high numbers of law-abiding drivers *(p. 241)*.

10.8.3 Reduction from 0.05 % to 0.03 %

Authors:
Desapriya, Shimizu, Pike, Subzwari, Scime (2007)
Location and time of the study:
Japan; 2006
Analysed measure:
General deterrent impact of the reduction of the legal per se BAC threshold from 0.05 mg/ml to 0.03 mg/ml
The corresponding law was enacted in June 2002 and accompanied by a high level of enforcement and media coverage
Design and methods of research:
Regression analysis
Comparison of the alcohol related injuries and fatalities among adult males, adult females and 16 to 19 years old adolescents in the pre-period 1998-2001 and in the post-period 2002-2005
Total motor crash rates were used as a covariate
Results:
With reference to other empirical studies (e. g.: Ross, 1982; Desapriya & Iwase, 2002; Desapriya et al., 2003), the general deterrent effect of the apprehension risk as one main element of the sanctioning certainty is much higher than the one of the severity or the celerity of the sanctioning *(p. 182)*.
One impediment of this study was the fact that the lower limit was accompanied by an elevation of the penalty severity for DUI, but the deterrent effects were not disentangled precisely *(p. 183)*.

This study showed a significant decrease of the alcohol related casualty rates per 100,000 licence holders among all three examined driver groups. The rates among the adolescent drivers dropped from 419.83 in the pre-period to 255.50 in the post-period, while the rates among the male drivers declined from 187.00 to 125.00. Among the females the rates decreased from 83.74 to 55.21. In comparison to these numbers, the rates of total motor vehicle accidents increased from 4,759.08 to 4,849.64 *(p. 184)*.
One factor which may have contributed to the good outcome could be the very low level of social acceptance of drunk driving among the Japanese society. Therefore, this lower per se limit is connected with a high level of public support *(p. 185)*.

10.8.4 General deterrence of the reduction of the legal per se limit from 0.05 % to 0.02 %

10.8.4.1
Author:
Aberg (1993)
Location and time of the study:
Sweden; 1987-1992
Analysed measure:
Compliance rates and self-reported drink driving behaviour pertaining to the lowering of the legal per se BAC threshold from 0.05 % to 0.02 % in July 1990
Size of the sample:
1987: 2,173
1991: 1,131
Design and methods of research:
Two waves of questionnaire surveys were conducted (1987; 1991)
The questionnaire of the second survey was only slightly extended to several additional questions
Results:
The first wave of the survey uncovered a rate of 69 % (1991: 65 %) among the interviewees who reported that they had not driven with any amount of alcohol within the last three years. In contrast, 23 % (27 %) reported drunk driving, but they did not believe that they had reached the legal per se BAC level, while 8 % (8 %) reported drunk driving with an assumed exceeding of the legal threshold *(pp. 1266, 1267)*.
These results do not show any significant change in the self-reported drinking patterns of the interviewees. Thus, the new law did not affect the incidence of drinking and driving *(p. 1268)*.
Furthermore, a highly significant increase of the self-reported likelihood of future DUI offences from 7.8 % to 11.7 % and of future driving with a BAC level below the legal per se threshold from 20.0 % to 32.7 % was revealed *(p. 1268)*. This outcome may be mainly due to the higher likelihood of offending when not changing the drinking and driving habits.
The threshold lowering was not connected with additional general deterrent effects. This may be due to the circumstance that the new lower level is so low that it already affects the social habits of drinking. Therefore, it is connected with low levels of societal acceptance.
Finally, a highly significant reduction of the dismissive attitudes towards drunk driving was connected with the new threshold, but higher reductions were observed among experienced drunken drivers *(p. 1268)*.
The new law was also not very successful from the general deterrent point of view. The lower threshold was connected with a highly significant reduction of the perceived apprehension risk, while the lowest values were uncovered among experienced drunken drivers *(p. 1269)*. This phenomenon can be mainly attributed to the lack of a simultaneous increase of the enforcement efforts.

10.8.4.2
Author:
Norström (1998)
Location and time of the study:
Sweden; 1997
Analysed measure:
General deterrent impact of the reduction of the legal per se BAC limit from 0.05 % to 0.02 %, which became effective in July 1990
Design and methods of research:
Interrupted time-series analysis
Comparison of the single vehicle night time injury accidents between July 1987 and June 1993
The rates of alcohol consumption and of driven mileage were used as determinants for control purposes
Results:
With reference to other empirical research (e. g.: Brooks & Zaal, 1993; Hingson et al., 1996), the reduction of per se BAC levels affects in most cases not only the target BAC drivers, but also other ranges of low- and high-BAC drivers *(p. 246)*. The main reason for this development is the creation of greater social pressure on the offender, who wants to drive while impaired *(p. 255)*. This phenomenon is also empirically proven through several studies (e. g.: Brooks & Zaal, 1993; Hingson et al., 1996).
With reference to Vingilis & Genova (1984), legal changes like the reduction of the BAC level has only impact on the drivers´ behaviour if the change is in line with the political and legal traditions of the respective country *(p. 246)*. Therefore, the Scandinavian states always are in a special role, because they have a long tradition of strict DUI penalties, so the results cannot be generalized easily.
This study revealed that the number of single vehicle night time injuries increased slightly after the implementation of the new law for about two months. After that a significant downward trend began, which only lasted about three months. It was followed by a change between increase and decrease of the injury rates, but in general on a lower level than before the legal intervention *(p. 248)*. The mean of the alcohol related injuries decreased from 366.83 in the pre-intervention period to 312.61 in the post-intervention period *(p. 250)*.
The reduction of the legal per se limit was connected with a decrease of the alcohol related injuries of about 11 %, what was a statistical significant value *(p. 254)*.
Moreover, the lowering of the per se BAC level was connected with a significant increase of drivers with a BAC up to 0.15 % and a significant decrease of high-risk drivers with a BAC of more than 0.15 % *(p. 256)*. This outcome revealed that the impact of a BAC lowering can be observed sometimes among drivers beyond the initial target group.
The results of this study were confirmed by another study (Borschos, 2000), which revealed a decrease of 10 % of the alcohol related fatalities due to the implementation of the 0.02 % per se BAC level *(p. 256)*.

10.8.4.3
Author:
Assum (2010)
Location and time of the study:
Norway; 2008
Analysed measure:
General deterrent effects of lowering the legal per se BAC level from 0.05 % to 0.02 %, which became effective by law in January 2001

Size of the sample:
Total: 6,002 licence holders (1998: 3,001; 2001: 3,001)
Design and methods of research:
Telephone interviews before and after the law amendment regarding the incidence of self-reported drink driving (first wave: June 1998; second wave: June 2001)
Single vehicle nighttime accident and weekend fatal crash rates from 1995 to 2007 were analysed
Results:
The public knowledge regarding the correct legal per se BAC level did not change measurable, because in the first and in the second wave 86 % of all interviewees were able to name the right threshold *(p. 1525)*.
The perceived risk of apprehension decreased from 1998 to 2001 from 41 % to 35 % *(p. 1526)*.
The social attitude pertaining to driving after drinking were a little bit confusing, because the dismissive reactions after having drunk one bottle of beer increased measurable from 63 % to 71 %, while the disapproval after having drunk four bottles declined slightly from 97 % to 96 %. This phenomenon was explained by the fact that driving after one bottle of beer was in the main focus of the law amendment, while driving after four bottles was already prohibited in the past. Consequently, the social acceptance of drink driving decreased *(p. 1526)*.
While in 1998 at least 1 % of the interviewees confirmed that they would drink more alcohol than allowed, in 2001 0 % did confirm this. Much more promising was the result that the percentage of sober drivers increased significantly from 82 % to 91 %. This outcome showed the great general deterrent impact of the threshold reduction *(p. 1527)*.
The average of drink driving offences in the six-year period before and after the law amendment decreased in a significant manner from 2.5 % to 2.2 % *(p. 1527)*.
The average rate of single vehicle night time accidents increased in a significant manner from 19.7 % to 21.2 %, while the single vehicle accidents at the weekend decreased in a non-significant manner from 42.7 % to 42.3 % *(pp. 1527, 1528)*.
If only fatal accidents within the six-year periods before and after the law amendment were analysed, it was shown that the reduction of the legal per se limit did not affect the average fatality rates in a significant manner (single vehicle: 33 % versus 33 %; night time: 15 % versus 16 %; weekend: 35 % versus 37 %). This outcome was also explained by the low validity of the surrogate measures for drink driving *(pp. 1528, 1529)*.
The absence of a control group was one major disadvantage of this study.
The lowering of the legal threshold was not connected with long-termed effects, because it was not able to reduce the drunk driving above the limit of 0.05 % *(p. 1529)*.

10.8.4.4 Studies review
Authors:
Chamberlain, Solomon (2002)
Analysed measure:
General deterrent effects of lowering the legal per se BAC level from 0.05 % to 0.02 %
Results:
Only one study was reported which analysed the lowering within this range:

- A study of Norström & Laurell (1997) dealt with the lowering of the legal per se BAC threshold from 0.05 % to 0.02 % in Sweden in 1990. The researchers observed measurable reductions among the proxies for the incidence of alcohol related driving (9.7 % in fatal accidents and 11 % in single vehicle night time accidents). Additionally, the reductions among the high-BAC drivers with at least 0.15 % were

highest (from 57.1 % in 1987 to 47.4 % in 1991). These results were also confirmed by a study of 2000, which uncovered a 10 % reduction of alcohol related fatalities due to the lower limit *(p. 9)*.

10.8.5 Implementation of zero-tolerance laws

10.8.5.1 Only for adolescent drivers

10.8.5.1.1
Authors:
Hingson, Heeren, Howland, Winter (1991)
Location and time of the study:
Maine, North Carolina, Wisconsin; 1989
Analysed measure:
General deterrent effects of zero-tolerance laws (the respective thresholds range between 0.00 % and 0.02 %) for young drivers
Design and methods of research:
Pre-post comparison
Analysis of night time fatal crash rates of adolescents and of older drivers
Comparison of the fatality rates of three states, which have not lowered the legal per se BAC level for adolescent drivers (Massachusetts, Virginia, Minnesota)
Comparison years:
Maine - Massachusetts: 1977 - 1989 (implementation of the lower legal limit: 1983)
North Carolina - Virginia: 1977 - 1989 (implementation of the lower legal limit: 1983)
Wisconsin - Minnesota: 1979 - 1989 (implementation of the lower legal limit: 1984)
Results:
This study revealed a statistically significant reduction of the night time fatalities among young drivers in comparison to the involvement of older drivers *(p. 120)*.
Moreover, the reductions of teen fatalities were significantly greater in states having implemented the lower per se BAC level in comparison to those having not *(p. 120)*.
In states which have introduced the lower per se limit, the adolescent fatalities declined about 35.0 % on average (comparison states: 26.3 %), while the adult fatalities declined in the examination states by 6.0 % (comparison states: 25.5 %; in Maine, the adult fatalities even increased 6 %) *(pp. 121, 126; self calculated)*. These findings support the hypothesis that the lowering of the teen BAC did not affect adult drivers, who are not the initial target group. This is one of the main differences between the lowering of the BAC level only for teens compared with a general threshold reduction for all drivers.
One detected reason for the bad outcome in Maine was the lack of accompanying enforcement, especially as far as the penalization was concerned *(p. 126)*.

10.8.5.1.2
Authors:
Whetten-Goldstein, Sloan, Stout, Liang (2000)
Location and time of the study:
All 50 states of the U. S. including the District of Columbia
Analysed measure:
General deterrent effects of zero-tolerance laws for adolescent drivers
Design and methods of research:
Quasi time-series analysis (so called fixed effects design)
Cross-sectional comparison of the alcohol related fatality rates between 1984 and 1995, distinguishing between drivers aged from 15 to 20 years and drivers aged from 21 to 64 years

Results:
Referring to a study of Manning et al. (1991), the implementation of zero-tolerance laws for adolescent drivers led to a 20 % reduction of single vehicle night time fatalities *(p. 726)*.
This study revealed a non-significant increase of the single vehicle night time fatalities among adolescent drivers (regression coefficient: +0.034), while the value for alcohol related fatalities was at least connected with a negative prefix (-0.0083), although the level of significance was not reached *(p. 730)*.

10.8.5.1.3
Author:
Carpenter (2004)
Location and time of the study:
All 50 states of the U. S. and the District of Columbia
Analysed measure:
General deterrent effects of zero-tolerance laws for adolescent drivers
Size of the sample:
49,076
Design and methods of research:
Self-reported drunk driving behaviour of youths between 18 and 20 years by using the data of the Behavioural Risk Factor Surveillance System - this institution conducts every year representative telephone surveys all over the United States - for the time period 1984 to 2001
The results of adolescents between 22 and 24 years were used as covariates
Results:
The vast majority of the empirical studies, which dealt with zero-tolerance laws, came to the conclusion that they can be considered as an effective general deterrent due to a measurable reduction of alcohol related fatality rates among the target group of adolescent drivers *(p. 67)*.
Zero-tolerance laws were connected with stable and significant reductions of unconditional and conditional binge drinking (17 % and 15 %, respectively) *(p. 69)*.
Moreover, zero-tolerance laws led in each case to a reduction of the incidence of self-reported drunk driving. When only the rates without any control variable or only the control variable of month and year fixed effects were included, the reductions were even highly significant (the respective regression coefficients were -0.028 and -0.026) *(p. 70)*.
When the regression coefficients for males and females were computed, while also state trends were took into consideration, the coefficient for males (-0.034) was at least in the right direction, but not significant. The coefficient for females (+0.024) was even positive and significant at the 0.10 level *(p. 71)*.
The last findings were in line with other empirical results, because Dee & Evans (2001) uncovered that the fatality rates among young males were reduced on a higher level than among young women *(p. 78)*. This phenomenon may be explained by the higher value of the driving privileges for young men than for young women, but it could also be due to the fact that women are “easier and swifter” even above the higher adult limit and, therefore, the zero-tolerance approach was often not regarded as an aggravation of the law *(p. 79)*. Especially the second statement is quite problematic, because an interpretation the other way round is also possible without any problems, but this would have lead to an increase of the general deterrent effects among young women.

10.8.5.1.4
Authors:
Ferguson, Williams (2002)

Location and time of the study:
California, New Mexico and New York; 2000
Analysed measure:
General deterrent effects of zero-tolerance laws for youth drivers
Size of the sample:
Total: 1,201 (California: 400; New York: 400; New Mexico: 401)
Design and methods of research:
Telephone surveys
The rates of public awareness pertaining to zero-tolerance laws among 17 to 20 years old drivers and their perception of the respective enforcement level were gathered
Results:
Some former studies revealed that partly modest general deterrent effects of zero-tolerance laws were due to a lack of accompanying publicity campaigns to cause higher levels of public awareness among the initial target group. A study of Hingson, Heeren, Howland & Winter (1991) came to the conclusion that about 33 % of the respondents were unaware of Maine´s zero-tolerance law, which was enacted in 1983. A further study (Voas, Lange & Tippetts, 1998), which was conducted in California, revealed that several months before the zero-tolerance law became effective only 50 % had heard about it. This percentage remained constant after two years of law implementation *(pp. 294, 295)*.
With reference to several empirical studies (e. g.: Hingson, Heeren & Winter, 1994; Streff & Hopp, 1997; Voas, Tippetts & Fell, 1999), zero-tolerance laws were an effective general deterrent, because they were connected with reductions of the alcohol related fatalities ranging between 10 % and 25 % *(p. 295)*.
The awareness rates pertaining to special legal regulation for adolescent drivers in the field of drunken driving differed considerably. The rates in New York (56 %) were significantly higher than in California (48 %) and New Mexico (31 %) *(p. 296)*.
These results were in line with the findings of a study from Yu & Rizzo (2001), which revealed that the awareness rate among adolescents between 15 and 18 years was only about 25 % *(p. 298)*.
A question closely connected with the last one was the perception of enforcing the law through the police. When the respondents did not knew that there was a zero-tolerance law in effect, they also could not perceive special enforcement efforts of the police. Therefore, the unaware interviewees were omitted for this section. The study uncovered differences in the perception that the police enforces the law "often" (California: 63 %; New Mexico: 56 %; New York: 53 %; but only California versus New York was significant) *(p. 297)*.
Finally, only 32 % (California and New York) and 25 % (New Mexico), respectively, thought that the zero-tolerance law was very tough *(p. 297)*. This result can be interpreted in two different ways. On the hand, it is possible that this perception is connected with a higher social acceptance of the "softer" law, but on the other hand, it is also possible that the general deterrent effectiveness is also low due to the fact that the sentence severity is one of the elements of general deterrence. The last explanation suffers from certain weakness, because the perceived enforcement level is a much more important element of general deterrence than the sentence severity and the results from the enforcement section are not as bad. So, the first explanation is the more convincing one.
As a conclusion, zero-tolerance laws will not unfold their complete general deterrent impact if they were not accompanied by high levels of media coverage and enforcement activity, because especially the relatively low levels of awareness among this target group was seen as a major impediment in the combat against adolescent drunken driving *(p. 298)*.

10.8.5.1.5
Authors:
Voas, Tippetts, Fell (2003)
Location and time of the study:
All 50 U. S. states and the District of Columbia
Analysed measure:
General deterrent impact of zero-tolerance laws for young drivers up to 21 years
Design and methods of research:
Pooled cross-sectional time-series analysis
Comparison of alcohol related fatality data of drivers younger than 21 years for the time period from 1982 to 1997
Results:
The computed odds ratio for zero-tolerance laws was -0.20959 *(p. 584)*.
Zero-tolerance laws were connected with a reduction of the odds of alcohol-positive drivers in fatal accidents of 24.4 %, which was a significant value *(p. 585)*.
The study also examined the deterrent effects of general laws which were valid for all ages of drivers. In this context, it was observed that the odds ratio for per se 0.08 laws (-0.06632) was lower than the one for per se 0.10 laws (-0.19633), when only the effect among adolescent drivers was analysed *(p. 584)*.
This observation led to a significant 17.8 % reduction of the alcohol related fatality odds among youth drivers due to 0.10 per se laws, while the 6 % reduction in conjunction with the implementation of 0.08 per se laws was not significant *(p. 585)*.
The researchers explained the better outcome of the 0.10 per se laws with the fact that these laws were in force long before the zero-tolerance laws were enacted (until 1992 only five states of the U. S. had implemented zero-tolerance laws) *(p. 586)*. But this statement is also valid for the 0.08 per se laws, which were mainly enacted at the end of the 1980´s and the beginning of the 1990´s.
With reference to an empirical studies review of Mc Arthur & Kraus (1999), zero-tolerance laws can be considered as an effective general deterrent for youth drunk drivers *(p. 585)*.
One impediment of this study was the lack of a check for the intensity of accompanying media coverage *(pp. 585, 586)*, although this is one major element of general deterrence. This failure in the design of research can be regarded as a further explanation for the bad outcome of 0.08 per se laws, which was mentioned above.
Finally, law changes are only connected with measurable general deterrent effects when the respective laws are enforced strictly *(p. 586)*.

10.8.5.1.6
Authors:
Hingson, Heeren , Morelock (1989)
Location and time of the study:
Maine (USA)
Analysed measure:
General deterrent impact of the implementation of a zero-tolerance law for drivers younger than 20 years
The respective law became effective in June 1983 and was connected with mandatory licence suspension for one year in case of limit exceeding
Size of the sample:
500 adolescents in each state after the passing of the law
1,000 adolescents in each state after the implementation of the law by using a three year follow-up period

200 police officers
Design and methods of research:
Quasi-experimental design
Randomized telephone surveys in Maine and - as a comparison state - Massachusetts were conducted, while the law was passed (1983) and annually for three years after its implementation (1984-1986)
Police officers were interviewed for their perceptions regarding the level of enforcement
Comparison of the night time fatality rates of younger and adult drivers for a four years baseline and a follow-up period of three years
Examination of the licence suspension rates among adolescent drivers
Results:
Regarding the levels of awareness pertaining to the new law it was revealed that both the self-reported "permitted" amount of alcohol - mostly one drink - and the self-estimated sanctions for driving with a BAC level of more than 0.02 % increased in a highly significant manner (from 38 % (1983) to 54 % (1984) to 59 % (1985) to 65 % (1986) and from 34 % to 49 % to 53 % to 58 %, respectively) *(p. 27)*. The rate of unaware adolescents was quite high, although an official education campaign was started before the conduction of the last survey *(p. 34)*.
Moreover, the percentages of youth drivers reporting drunk driving declined highly significant after the new law was implemented (from 31 % to 17 % to 16 % to 13 %). Furthermore, the value of high-risk drinkers, who drive after the consumption of at least five drinks at one sitting, decreased in a highly significant manner (from 17 % to 5 % and remained at this low level) *(pp. 27, 28)*. Regarding these results, the drop of drunk driving incidence appeared immediately after the legal regulation was implemented, but in the second and third year after the law implementation hardly any further improvement of the general deterrent impact was observed.
This study also uncovered a highly significant reduction of the drunk driving frequency in relation to the one of adult drivers after the consumption of any amount of alcohol (from 31 % to 17 % to 16 % to 13 %; adults: 27 %; 27 %; 23 %; 24 %) and also after the consumption of at least 5 drinks (from 17 % to 5 %; adults: 5 %; 6 %; 6 %; 7 %). The values reached the level of significance *(pp. 27, 31)*. Consequently, the new law had almost no general deterrent impact among drivers who were not part of the initial target group of adolescent drivers.
The survey among the police officers revealed that there was sometimes a lack of enforcing the new law. This was mainly due to limitations of detecting any signs of impairment caused by such low amounts of alcohol or the subjective perception of an exaggerated severity of the zero-tolerance legislation *(pp. 29, 34)*. The mentioned statements confirm the high general deterrent effectiveness of the lower limit for youth drivers, especially if the law is enforced unconditionally.
The reductions of the night time fatalities were not significant in relation to the comparison state (adolescents: examination state: -20 %; comparison state: -16 %; adults: examination state: +2 %; comparison state: -29 %) *(pp. 29, 34)*. Moreover, the reductions of the fatality rates were also part of a nationwide downward trend and not particularly due to the lower limit *(p. 35)*.

10.8.5.1.7
Authors:
Villaveces, Cummings, Koepsell, Rivara, Lumley, Moffat (2003)
Location and time of the study:
All 50 U. S. states and the District of Columbia

Analysed measure:
General deterrent impact of the implementation of zero-tolerance laws for drivers younger than 21 years
Size of the sample:
792,184, but only 26 % were related to the use of alcohol
Design and methods of research:
Time-series regression analysis
Comparison of the alcohol related fatality rates among automobile and motorcycle users between 1980 and 1997
Results:
The enactment of zero-tolerance laws for young drivers was connected with much lower alcohol related fatality rates (3.1 % versus 4.9 %). Although nowhere was explained if this value reached the level of significance, it became obvious that this type of law has a very high general deterrent potential *(pp. 133, 134).*

10.8.5.1.8 Studies review
Authors:
Shults, Elder, Sleet, Nichols, Alao, Carande-Kulis, Zaza, Sosin, Thompson, Task Force on Community Preventive Services (2001)
Analysed measure:
General deterrent impact of zero-tolerance laws for adolescent drivers
Design and methods of research:
Systematic studies review, which used the changes in the night time single vehicle fatality rates as an outcome measure
Results:
The reviewed studies treated laws which implemented a legal per se BAC level of at most 0.02 g/dl for drivers up to 21 years also as zero-tolerance laws. This type of law was enacted in all American states by 1998 *(p. 71).*
All six reviewed studies were conducted in the United States or Australia and reported a decline of the alcohol related fatalities in the post-intervention period ranging between 9 % and 24 % *(p. 72).*
One major impediment of zero-tolerance laws uncovered by the researchers is their problematic enforcement, because most of the adolescents do not show any signs of impairment at such low BAC´s. Therefore, a significant general deterrent impact will be reached only in combination with random breath testing laws. But apart from this not negligible problem, zero-tolerance laws are an effective general deterrent *(p. 72).*

10.8.5.1.9 Studies review
Authors:
Fell, Voas (2006)
Analysed measure:
General deterrent effects of zero-tolerance laws for young drivers
Results:
Lacey, Jones & Wiliszowski (2000) conducted a study to evaluate the general deterrent impact of zero-tolerance laws in four U. S. states. They found out that Maine and Oregon yielded among the target group of adolescent drivers a reduction of single vehicle night time fatalities of 36 % and 40 %, respectively. In contrast, Florida showed only a reduction of 5 %, while in Texas no measurable change of the rates was observable. The very spurring outcomes in Maine and Oregon were mainly due to the high level of accompanying media coverage and enforcement *(p. 239).*

Any reduction of the legal threshold is mostly connected with a measurable general deterrent effect, leading to a drop of alcohol related fatalities *(p. 241)*.

10.8.5.1.10 Studies review

Authors:

Hingson, Heeren, Winter (1999)

Analysed measure:

General deterrent impact of zero-tolerance laws for young drivers up to 21 years

Results:

States which have adopted lower per se limits for younger drivers than for adult drivers (ranging from 0.04 % to 0.06 %), regularly observed only modest reductions of their fatality rates between 6 % and 7 %. Hence, these lower per se limits did not send the right message to adolescents, because in case of a certain per se limit, they will mostly test to reach it step by step *(p. 35)*.

With reference to a study of Martin et al. (1996), the often observed unawareness among young drivers pertaining to zero-tolerance laws was mainly due to a lack of official public media campaigns. In this context, a before-after comparison designed study of Blomberg (1992) showed a 33 % higher decline of alcohol related accidents among young drivers in Maryland than in the comparison state (only 11 %) due to a high level of media coverage *(p. 35)*. Additionally, this public awareness could also be caused by educational sessions during school time.

10.8.5.1.11 Studies review

Authors:

De Jong, Hingson (1998)

Analysed measure:

General deterrent impact of the implementation of zero-tolerance laws with a maximum per se BAC level of 0.02 % for drivers up to 21 years

Results:

This review revealed that the implementation of zero-tolerance laws was connected with a decline of alcohol related fatalities among young drivers of about 20 % *(pp. 363, 367)*.

Moreover, the implementation of lower per se levels for young drivers ranging between 0.04 % and 0.06 % was not connected with significant declines of alcohol related fatalities. The youth did not get the “right” signal that driving after any alcohol consumption is illegal under every circumstance *(p. 367)*.

Finally, the success of zero-tolerance laws in was in several cases also due to the high level of publicity accompanying the law implementation *(p. 367)*.

10.8.5.2 Only for novice drivers

Authors:

Haque, Cameron (1989)

Location and time of the study:

Victoria (Australia); 1987

Analysed measure:

General deterrent impact of zero-tolerance legislation for novice drivers (learners and first-year probationers)

The law became effective in May 1984

Size of the sample:

Pre-law period: not specified

Post-law period: 866

Design and methods of research:
Time-series analysis in combination with pre-post comparisons of the rates of serious casualty accidents in times when alcohol involvement is statistically higher than average (especially: Thursday and Saturday nights)
The pre-law period was chosen from January 1978 to June 1984 and the follow-up period was chosen for 18 months (from July 1984 to December 1985)
The accident rates of standard licence owners were selected as a control group
Results:
At first, it was observed by the pre-post comparison that the rates of serious casualty accidents among novice drivers showed almost the same pattern for alcohol times and non-alcohol times. The implementation of zero-tolerance laws was connected with slight reductions within the first month, but after that the rates remained almost stable for about one year. Afterwards, the rates increased measureable and were higher than before the law implementation. While the rates during non-alcohol times were highest within the whole pre-law period, the pattern for alcohol times was little different, because the law implementation stopped a long-term downward trend, which already begun in January 1979 *(pp. 131, 132)*.
The time-series analysis revealed at least a non-significant 3.1 % (after adjustment: 3.8 %) net reduction of serious casualty accidents among the target group of youth drivers during alcohol times, while the comparison group showed a non-significant 0.7 % net increase *(pp. 132, 133)*.

The crude rates for the follow-up period were the following *(p. 134)*:

	Experimental group	Control group
Alcohol times	+7.8 %	+11.3 %
Non-alcohol times	+7.4 %	+6.6 %

So, the above mentioned net rates did not represent stable evidence for the general deterrent effects of zero-tolerance legislation *(p. 134)*.
Finally, two 18-months pre- and post-law periods were examined with a simple pre-post comparison design. It revealed the following outcomes, but none of them were statistically significant *(pp. 134, 135)*:

The net differences were -7.4 % for novice drivers (after adjustment: -6.0 %) and -1.5 % for standard licence holders:

	Experimental group	Control group
Alcohol times	+3.6 %	+6.3 %
Non-alcohol times	+11.9 %	+7.9 %

Both analyses revealed at least a lower increase among the novice than among the standard drivers, so, the zero-tolerance law showed some general deterrent impact, although it was not significant. Additionally, the strength of the statistical power was quite poor *(p. 135)*.
These weak results were mainly explained by two well-known factors: the lack of additional enforcement measures and the absence of high levels of media coverage *(pp. 135, 136)*.

10.8.6 Lower legal per se BAC thresholds for special groups of drivers

10.8.6.1 For convicted DUI offenders

10.8.6.1.1
Authors:
Hingson, Heeren, Winter (1998)
Location and time of the study:
Maine (USA); 1995-1997
Analysed measure:
General deterrent effects of lowering the legal per se BAC threshold for convicted DUI offenders from 0.10 % to 0.05 %
Design and methods of research:
Pre-post design
Comparison of the alcohol related fatality rates for a six years baseline (beginning: August 1982) and a follow-up period of six years (ending: July 1994)
Data of other New England states served as comparison data
Results:
The proportion of fatally injured convicted DUI offenders in Maine declined by 25 % (odds ratio: from +0.089 to +0.067), while the rate in the rest of New England increased by 46 % (from +0.036 to +0.052). In the consequence, an adjusted highly significant decline of 48 % due to the implementation of the lower legal per se threshold was observed *(p. 443)*.
Moreover, the lower limit led to a reduction of 31 % (from +0.054 to +0.037) when fatally injured convicted drunk drivers with a BAC of at least 0.05 % were examined. In the other New England states, a 40 % elevation of these rates (from +0.015 to +0.022) was detected *(p. 443)*.
The highest reductions were found among drivers with a BAC level of at least 0.15 %. These rates declined by 35 % (from +0.043 to +0.028), while in the other states of New England their proportion increased by 45 % (from +0.011 to +0.016). This was equal to an adjusted, almost highly significant reduction of 55 % *(p. 443)*.
There was certain bias against the outcome due to the simultaneous enactment of lower legal per se thresholds for all drivers in Maine and also in several comparison states. Additionally, some states in New England adopted zero-tolerance laws for adolescent drivers *(p. 444)*.
Due to some weakness in the empirical design, it was warned to overestimate the results of this study, although at least the positive trend connected with this type of law can be regarded as confirmed by this study *(p. 445)*.
The drop of the fatality rates already began in the year before the lower limit became effective. This anticipation in effect was mainly due to a high level of media coverage causing public awareness *(p. 446)*.

10.8.6.1.2
Authors:
Jones, Rodriguez-Iglesias (2004)
Location and time of the study:
Maine (USA); 2001-2003
Analysed measure:
General deterrent impact of a zero-tolerance law (per se threshold 0.00 %) for convicted DUI offenders (general legal per se limit for other drivers: 0.08 %)
The law was enacted in 1995 and preceded by a law enacted in 1988, which administered a prohibition for convicted drunk drivers to drive with a BAC of more than 0.05 % (general legal per se limit for other drivers: 0.10 %)

Design and methods of research:
Time-series analysis
Comparison of the fatality rates with inclusion of convicted drunk drivers
Vermont and New Hampshire were used as comparison states
Three different time sections were compared:
1982-1987: no lower limit for convicted DUI offenders (period B)
1988-1995: 0.05 % limit for convicted DUI offenders (period A1)
1996-2000: 0.00 % limit for convicted DUI offenders (period A2)
Results:
This study was the continuation of the study which was analysed before under 10.8.6.1.1.
With reference to a study of Jones & Lacey (2000), the convicted DUI offenders are a further high-risk group, because they are responsible for about one fourth of all alcohol related fatalities *(p. 1)*.
The level of enforcement did not change significantly after the new law was implemented *(pp. 11, 27)*.
The percentage of convicted drunk drivers in all fatal crashes dropped almost significantly ($p = 0.059$) from 12.9 % to 7.1 % after the implementation of the lower per se limit in 1988. A further significant 10 % reduction was observed after the enactment of the 0.00 % limit. At the second intervention point, the two comparison states showed slight elevations of their rates. Moreover, this positive trend will very likely continue over the year 2000 *(p. 21)*.
The rates of convicted drunk drivers with BAC levels between 0.01 % and 0.09 % involved in alcohol related fatalities were also analysed. In period B about 7 % of the fatalities were related to convicted drunk drivers, while this percentage increased in period A1 to 9 % and dropped in period A2 to 7 %. The comparison states showed within this examination period an upward trend from 10 % to 12 % *(p. 21)*.
But the results for the fatally injured convicted drunk driver with BAC levels of at least 0.10 % were even more promising. They showed a measurable reduction from 18 % to 13 % from period A1 to A2, while in the periods B to A1 no change was observed. In the same time, the comparison states showed an upward trend of 15 % to 16 % from B to A1 and to 17 % in A2 *(p. 21)*.

10.8.6.2 For adolescent drivers

10.8.6.2.1
Authors:
Wagenaar, O´Malley, La Fond (2001)
Location and time of the study:
30 U. S. states; 1999-2000
Analysed measure:
General deterrent impact of lower legal per se BAC thresholds for drivers up to 21 years (ranging from 0.00 % to 0.05 %, but one state even had a 0.06 % and another a 0.07 % limit) than for adult drivers (0.08 % or 0.10 %)
These laws were enacted between 1984 and 1998
Size of the sample:
Over 5,000 high-school seniors in the pre- and the post-law period
Design and methods of research:
Regression analysis
Self-reported drinking and driving behaviour
The relevant data were gathered annually by nationwide surveys
The pre- and the post-law period in each examination state constituted three years

Results:
The results showed significant general deterrent effects of the lower per se BAC thresholds for young drivers. The study revealed that the magnitude of driving after consuming any amount of alcohol declined highly significant by 6.4 % and by significant 5.6 % after adjustment for long-term trends *(p. 803)*.
The results in the case of high-risk drinkers, who drive after the consumption of at least five drinks, were very promising. These rates decreased significantly by 5.7 % and by highly significant 5.9 % after adjustment for secular trends *(p. 803)*.
The drinking behaviour in general was not significantly affected by the lower per se limits. Thus, the effect of the laws was only limited to driving after drinking *(p. 803)*.
When the results were not expressed as percentages of baseline standard deviations like above, but as crude percentages, the lower per se limits were connected with a 19 % reduction of the incidence of driving after drinking any amount of alcohol and of 23 % after the consumption of at least five drinks. These findings were in line with the results of prior studies (e. g.: Zwerling & Jones, 1999) *(p. 803)*.
Finally, no significant trends were observed among the states with legal per se BAC levels of 0.00 % or 0.02 % and those with per se levels from 0.04 % upward *(p. 803)*. These findings confirmed the hypothesis that the value of the threshold is less important, but it is much more important for significant general deterrent impacts to show tough official reactions against DUI. Consequently, the implementation of lower per se limits for young drivers sets the right signal.
The most promising outcome was the substantial reduction of the incidence of high-risk driving after drinking. The results could improve if the level of public awareness increases *(p. 803)*.

10.8.6.2.2 Studies review
Authors:
Zwerling, Jones (1999)
Analysed measure:
General deterrent impact of lower legal per se BAC thresholds for young than for adult drivers
Results:
Only those studies were presented precisely which were not already included in this studies analysis:

- Maisey (1984) conducted a study in Western Australia to examine the general deterrent effect of a 0.02 % level for first-year drivers by using a pre-post comparison design. In this study, a non-significant 17 % reduction of the night time injuries was uncovered *(p. 78)*.

- Blomberg (1992) used an interrupted time-series analysis to examine the general deterrent effect of a 0.02 % BAC level for drivers up to 21 years in Maryland. He used crashes with drivers considered to have been drinking as an outcome measure and observed statistically significant reductions of 11 % and 33 %, depending on the chosen model *(p. 78)*. Blomberg also examined the general deterrent effects of an intense information and education campaign. For that purpose, he chose six evaluation and two comparison states. He observed a 21 % reduction of "had been drinking" accidents when the law was implemented without public media and a further 30 % reduction if the law implementation was accompanied by a high level of media coverage *(p. 79)*.

The following remark takes all reviewed studies into consideration, because it is not possible to disentangle the authors´ statements for each study: All reviewed studies showed reductions of their respective outcome measures, but only in the half of all cases these reductions were statistically significant. Most studies revealed a reduction of about 20 % *(p. 79)*.

10.8.6.2.3 Comparison of general deterrent impact of different lower per se BAC thresholds

Authors:

Hingson, Heeren, Winter (1994)

Location and time of the study:

Arizona, North Carolina, Oregon and Wisconsin (0.00 %)
Maryland, Maine, Ohio and Vermont (0.02 %)
California, Georgia, New Mexico and Rhode Island (0.04 % - 0.06 %)
1992-1993

Analysed measure:

General deterrent impact of zero-tolerance laws (per se limit: 0.00 % and 0.02 %) compared with lower per se BAC thresholds (ranging from 0.04 % to 0.06 %) for drivers younger than 21 years

Design and methods of research:

Time-series analysis
Comparison of the night time single vehicle fatality rates
The respective fatality rates among drivers older than 21 years were used as a reference size
Each examination state was compared to a neighbouring state:
0.00 %: Arizona - Utah; North Carolina - Virginia; Oregon - Washington; Wisconsin - Minnesota
0.02 %: Maryland - Pennsylvania; Maine - Massachusetts; Ohio - Indiana; Vermont - New Hampshire
0.04 % to 0.06 %: California - Texas; Georgia - Alabama; New Mexico - Colorado; Rhode Island - Connecticut

Results:

The results of all examined twelve U. S. states observed that all states with lower per se BAC levels for adolescent drivers showed a 16 % reduction of night time single vehicle fatalities (odds ratio: drop from +0.289 to +0.242), while the comparison states observed a slight increase of 1 % (from +0.299 to +0.303). This was a highly significant value, but only if drivers younger than 21 years - who were the main target group - were analysed. Among older drivers the examination states had a 6 % decline (from +0.290 to +0.272), while the comparison states had a reduction of 5 % (from +0.325 to +0.310). These differences were not significant.
At least eight of all examined states showed reductions of their fatality rates in comparison to their counterparts, although the declines were not significant in each case.
Moreover, the highest reductions and, therefore, the greatest general deterrent effects were observed in states which have implemented a 0.00 % or 0.02 % per se BAC threshold, while the effects of the 0.04 % to 0.06 % laws was not overwhelming.
The 0.00 % states showed a reduction of 22 % (from +0.313 to +0.244) among the targeted adolescents, while the comparison states only showed a decline of 2 %. This was a significant value approaching the level of high significance. The differences for adult drivers were not significant (examination states: 8 %; from +0.298 to +0.273; comparison states: 4 %; from +0.309 to +0.296).
States which implemented the 0.02 % per se threshold observed a night time single vehicle fatality reduction of 17 % (from +0.324 to +0.268) among adolescents. This value was significant in relation to the 4 % increase in the comparison states. Among older drivers the

lower per se limit surprisingly led to lower reductions of the fatality rates than in the comparison states (examination states: -1 %; from +0.299 to +0.296; comparison states: -7 %; from +0.330 to +0.307), although the value did not reach the level of significance.
The decrease of the fatality rates among adolescents in states having per se limits ranging between 0.04 % and 0.06 % detected only a not significant reduction of 7 % (from +0.245 to +0.229), while the rates in the comparison states increased by 3 % (from +0.268 to +0.275).
The rates for adults were not significant, because the examination states showed a reduction of 6 % and the comparison states of 3 %.
So, the declines of the fatality rates in zero-tolerance states were highest. This outcome may be mainly due to the clear message of this type of law which is therefore connected with higher levels of general deterrence than lower per se limits.
The states with lower limits for adolescent drivers also observed measurable reductions of adult fatalities.
This pattern did not change significantly when the researchers checked for potential confounding factors like administrative licence revocation laws or lower legal per se thresholds for adult drivers.
So, the results for zero-tolerance laws were in fact very promising. But the enactment of per se limits above the zero-tolerance approach for youth drivers is connected with some general deterrence.

10.9 Special problem: General deterrent effects of raising the legal per se BAC threshold

Authors:
Krüger, Schöch (1998)
Location and time of the study:
Thüringen (former East Germany), Unterfranken (West Germany); 1992-1994
Analysed measure:
General deterrent impact of raising the legal per se BAC threshold for all drivers from 0.00% to 0.08 %, which became effective by law in January 1993
Before the law enactment the legal per se limit in East Germany was 0.00 % and in West Germany 0.08 %
Size of the sample:
Roadside survey: Total: 20,357 (1992: 5,702; 1993: 6,879; 1994: 7,776)
Additional telephone survey: Total: 2,283 (1992: 661; 1993: 717; 1994: 905)
Design and methods of research:
Roadside surveys were conducted in three waves (one before the new per se limit went into effect: November and December 1992; two after the new limit was implemented: April to June 1993 and April to June 1994)
During the survey sessions, the drivers were asked to answer several questions and additionally a breath sample was required
While Thüringen was used as examination state, Unterfranken was chosen as control state
A subsample was constituted from a number of drivers who were checked during the roadside survey; these drivers were asked to answer a comprehensive questionnaire during a telephone survey
Results:
The survey was conducted around a quite unique situation, because it was the time after the reunification of East and West Germany and in Thüringen an absolute zero-tolerance limit for all drivers was in effect until 1.1.1993.
The clear trend among international states for the last decades was the lowering of the legal per se BAC threshold and not its elevation. So, the results are very interesting from the scientific point of view, but they can hardly be generalized.

Until the reunification of East and West Germany in 1989, the alcohol related injuries were rather similar in both states (East Germany: 9.7 %; West Germany: 10.0 %), although the legal per se limit in East Germany was 0.00 % and in West Germany 0.08 % *(pp. 174, 175)*.
The rates of the alcohol related injuries in East Germany increased in the first years after the reunification (1990: 11.6 %; 1991: 14.7 %; 1992: 15.2 %; 1993: 16.3 %), although the zero-tolerance law was still in force. In West Germany, the rates remained rather constant (1990: 9.6 %; 1991: 10.0 %; 1992: 9.3 %; 1993: 9.3 %). In the following years, a constant decline of the rates in East Germany was observed, while the rates in West Germany decreased only modestly *(pp. 174, 176)*.
The percentages of drivers with a BAC level of at least 0.03 % in Thüringen were the following ones: 1992: 1.29 %; 1993: 1.75 %; 1994: 1.58 % (Unterfranken: 1.99 %; 1.95 %; 2.06 %). The rates of sober drivers were the following ones: 1992: 95.76 %; 1993: 95.48 %; 1994: 96.30 % (Unterfranken: 94.88 %; 94.83 %; 93.89 %) *(p. 177)*.
The increase of the alcohol related injuries was not attributable to the raising of the legal per se limit, because the 0.00 % level was in force until 1993, and it was connected with high levels of social acceptance among the drivers in Thüringen. The respective mean values of estimated abjection of DUI remained more or less constant and were higher than in Unterfranken (1992: 9.47 % versus 8.98 %; 1993: 9.46 % versus 9.03 %; 1994: 9.41 % versus 8.89 %) *(pp. 178, 179)*.
The increase of the incidence of DUI was mainly due to the lack of enforcement in East Germany, because the levels of drivers who reported that they were never checked by the police were much higher than in West Germany (1992: 51.9 % versus 35.2 %; 1993: 51.1 % versus 30.6 %; 1994: 40.6 % versus 32.3 %). This lack of enforcement was connected with a decrease of the objective control density and led in the consequence to a reduction of the perceived detection risk *(p. 179)*.
The increase of the alcohol related injuries was not attributable to a common increase of the incidence of drunk driving, but it was due to an increase of the frequency of drunk driving among the high-risk groups of young drivers and frequent drinkers *(pp. 179, 180)*. This led to an increase of the BAC levels of impaired drivers, but the number of these drivers or of DUI trips did not enhance measurable. This phenomenon was especially observed among adolescent drivers, especially males (see also: Vollrath, Krüger & Löbmann, 2005). Consequently, the consumed amount of alcoholic beverages increased among the high-risk driver groups, indicating that the enhancement of the legal per se threshold led to a decline of the social disapproval for DUI.
The lowering of the legal per se threshold (especially below the level of 0.05 %) can - of course this is not obligatory - lead to a reduction of the social acceptance *(p. 182)*. Whether the respective legal threshold is accepted or not, depends mainly on the prevailing social attitudes and the enforcement activity of the police.

10.10 General deterrent effects of implementation of per se laws

10.10.1
Authors:
Legge, Park (1994)
Location and time of the study:
48 U. S. states
Analysed measure:
General deterrent impact of per se laws
Design and methods of research:
Pooled cross-sectional time-series regression analysis
Comparison of the single vehicle night time fatal accidents

Data were pooled across three years (1980, 1984, 1987)

Results:

Former research indicated that the implementation of per se laws was connected with a high level of sanctioning certainty and, therefore, of general deterrence *(p. 595)*. But several studies (e. g.: Ross, 1984) observed that the impact on drunk drivers was only short-termed *(p. 596)*.

The standardized regression coefficient for the implementation of per se laws was significant -0.21. This was the highest value among all examined variables for sanction certainty, severity and celerity *(p. 600)*.

As a conclusion, the implementation of per se laws - at best in connection with preliminary breath test laws on the enforcement level and with administrative licence measure laws on the sanctioning level - can be considered as an effective general deterrent *(p. 602)*.

10.10.2

Authors:

Zador, Lund, Fields, Weinberg (1989)

Location and time of the study:

41 U. S. states

Analysed measure:

General deterrence of the implementation of per se BAC laws, which became effective in the respective states between January 1975 and October 1985

Design and methods of research:

Cross sectional time-series analysis

Comparison of the alcohol related fatalities in the years 1978-1985

Drivers younger than 21 years were excluded from the analysis due to special legal regulations

This study distinguished between the weekday (Monday including Thursday), weekend (Friday including Sunday) and daytime according to the incidence of drivers with high BAC levels (0.10 % or above):

Low incidence (prevalence rates between 10 % and 29 %): weekday: 6:00 a.m.-3:59 p.m.; weekend: 7:00 a.m.-2:59 p.m.

Moderate incidence (prevalence rates between 30 % and 49 %): weekday: 4:00 a.m.-5:59 a.m.; 4:00 p.m.-6:59 p.m.; weekend: 6:00 a.m.-6:59 a.m.; 3:00 p.m.-5:59 p.m.

High incidence (prevalence rates between 50 % and 69 %): weekday: 3:00 a.m.-3:59 a.m.; 7:00 p.m.-11:59 p.m.; weekend: 4:00 a.m.-5:59 a.m.; 6:00 p.m.-10:59 p.m.

Very high incidence (prevalence rates between 70 % and 89 %): weekday: Midnight-2:59 a.m.; weekend: Midnight-3:59 a.m.; 11:00 p.m.-11:59 p.m.

Results:

The researchers computed the percent reductions of alcohol related fatalities due to the implementation of the per se BAC laws and distinguished between four incidence levels of high-BAC drivers *(p. 477)*:

Low:	+1.0 %	(not significant)
Moderate:	+2.2 %	(not significant)
High:	-11.4 %	(significant at the 5 % level)
Very high:	-5.3 %	(not significant)
All:	-4.6 %	(significant at the 5 % level)

Moreover, the implementation of the per se BAC laws was connected with a significant reduction of the fatal injured males of 5.4 % during the low- and moderate-incidence times,

but also with a non-significant increase of 3.4 % during the high- and very high-incidence times *(p. 478)*.

Additionally, the regression estimations were attributed to different age groups *(p. 478)*:

21-24: -4.8 % (significant at the 10 % level)
25-34: +2.5 % (non-significant)
35-54: -5.8 % (significant at the 5 % level)
55-65: -4.9 % (non-significant)

The results revealed that the implementation of per se BAC laws was connected among three of the four age groups with a decline of alcohol related fatalities. At least in two cases, the reductions were also significant. This positive traffic safety outcome is not destroyed by the slight increase of the fatalities among drivers aged between 25 and 34 years, especially because this value was not significant and, therefore, can be attributed also to other factors than the per se laws.
Much more people were covered by the per se laws than by the administrative licence action laws. Therefore, the higher proportion of the decline of the alcohol related fatalities was due to this countermeasure *(p. 481)*. But the decline was much greater during day times than night times. This phenomenon was mainly due to the lack of enforcement during night times *(p. 482)*.

10.10.3 Studies review

Authors:
Mann, Macdonald, Stoduto, Bondy, Jonah, Shaikh (2001)

Location and time of the study:
International studies review

Analysed measure:
General deterrent effects of introducing legal per se limits, while in the time before impairment approaches were used

Results:
The per se approach is accepted all over the world as one of the most important countermeasures in the combat against DUI *(p. 570)*.
A study of Voas et al. (2000), which examined the general deterrent effects of the introduction of 0.10 % per se laws in all 50 U. S. states and the District of Columbia between 1982 and 1997 by using a weighted least squares regression design, revealed that the rates of fatally injured drivers with both low-BAC (0.01 % to 0.09 %) and high-BAC (at least 0.10 %) were reduced significantly (13.17 % and 8.69 %, respectively) due to the implementation of the per se laws *(pp. 571, 572)*.
In The Netherlands, a 50 mg% per se law was introduced in 1974. Noordzij evaluated this countermeasure two times, at first in 1977 and again in 1994 by using pre-post-comparisons of the alcohol related data gathered by roadside surveys. The study from 1994, which evaluated the long-term effects of the per se threshold lowering, came to the conclusion that the proportion of night time drivers with BAC levels of at least 50 mg% dropped significantly after the law was implemented in 1974 from 15 % to 5 %. Furthermore, the rates increased in the following years. Nevertheless, the lower limit started a common decline of DUI in the Netherlands *(pp. 571, 572)*.
The other reviewed studies were conducted in the late 1960´s and early 1970´s and examined mostly the enactment of per se laws in the 1960´s. Therefore, these empirical evaluations were omitted from the presentation, because the societal change within this period of time is

so considerable that the results are at best partly valid for the current problem of DUI.
The researchers came to the conclusion that the implementation of per se laws is in general connected with measurable general deterrent effects, but these effects decay over the time, what may be mainly due to a drop of the perceived apprehension risk *(p. 572)*. This observation must lead to the result that the implementation of per se laws has the potential to cause long-term general deterrent effects if the enforcement level is enhanced simultaneously.

10.10.4 Comparison between administrative and judicial per se laws

Authors:
Evans, Neville, Graham (1991)
Location and time of the study:
50 U. S. states; 1987
Analysed measure:
General deterrent impact of administrative and judicial per se laws
The judicial per se threshold was in each case 0.10 %
Design and methods of research:
Time-series regression analysis
Comparison of the alcohol related single vehicle night time fatality data from 1975 to 1986
Results:
With reference to a study of Zador et al. (1991; using a state-pair comparison design and examining the alcohol related fatality rates of 48 U. S. states from 1978-1985), both administrative and illegal per se laws were connected with reductions of alcohol related fatalities ranging between 6 % and 9 %. But the results of administrative per se laws provided the strongest empirical evidence for general deterrent effectiveness *(p. 282)*.
The regression coefficient of administrative per se laws was negative (-0.014), but not significant, while the regression coefficient of illegal (criminal/judicial) per se laws was positive (+0.017), but also not significant. Therefore, the second law type was connected with an increase of the single vehicle night time fatalities *(p. 285)*. The combination of per se laws - which increase the punishment certainty - with criminal sanctions is rather problematic due to the special situation of DUI as an “everybody offence”.
This result confirmed the hypothesis that swift legal DUI countermeasures have a much greater deterrent impact on the target population than delayed ones, what is, unfortunately, the fact in most of the judicial sanctioning procedures, because of the duration of the court sessions. Consequently, the implementation of further criminal per se laws cannot be considered as an effective general deterrent *(p. 288)*.

10.11 Special deterrent effects of implementation of lower per se BAC limits for convicted DUI offenders

Authors:
Jones, Rodriguez-Iglesias (2004)
Location and time of the study:
Maine
Analysed measure:
Special deterrent impact of a zero-tolerance law (per se value: 0.00 %) for convicted DUI offenders (general legal per se limit for other drivers: 0.08 %)
The law was enacted in 1995 and preceded by a law which was enacted in 1988 and administered a prohibition for convicted drunk drivers to drive with a BAC of more than 0.05 % (general legal per se limit: 0.10 %)
Size of the sample:
35,433

Design and methods of research:
Before-after-comparison cohort study
Comparison of the driver record files
Five cohorts were chosen depending on the date of the conviction (1993-1997)
Results:
The level of enforcement did not change significantly after the new law was implemented *(pp. 11, 27)*.
This study uncovered a prolongation of the recidivism time of 12 % between the pre- and the post-law sample *(p. 24)*.
Moreover, the recidivism likelihood during the whole examination period of 96 months was lower among the post-law sample than among the pre-law sample *(p. 25)*.
The total rates of recidivists in the post-law sample were about 7 % lower than in the pre-law sample *(p. 25)*.
As a conclusion, the new law had only little special deterrent impact *(p. 28)*.

10.12 Special deterrent effects of zero-tolerance legislation in case of drug consumption

Authors:
Holmgren, Holmgren, Kugelberg, Jones, Ahlner (2008)
Location and time of the study:
Sweden; 2006
Analysed measure:
Special deterrent effects of zero-tolerance legislation for DUID, which was enacted in July 1999
This law administered sanctions if the concentration of illegal psychoactive substances exceeds the analytical threshold, which is several times higher than the threshold of detection *(p. 536)*.
The general BAC limit in Sweden is 0.02 %
Size of the sample:
36,799 DUI and DUID offenders, which also contained a subsample of 165 users of medicines
Design and methods of research:
Regression analysis
A period of four years was used to analyse the re-arrest rates of convicted alcohol and drug drivers
Results:
The higher level of prosecuting led to an increase of the arrests made by the police, because they were spurred on through the higher level of convictions. But the question if the zero-tolerance legislations had lead to some traffic safety benefits, is still open *(p. 534)*.
Some of the cited studies (e. g.: Voas & Fischer, 1999) came to the conclusion that the current level of the detection risk and the sentence severity is not able to deter the high-risk group of hardcore offenders *(p. 535)*.
If the charge for DUID depends on analytical thresholds, which are multiple higher than the limit of detection, it is assured that analytical uncertainties are omitted *(p. 536)*.
This study revealed that most of the DUI offences are committed by high-BAC drivers having values between 0.15 % and 0.16 % *(p. 537)*. So, even a very low legal BAC level is not able to deter problem drinkers, what is mainly dependent on the underlying consumption problem.
In comparison to DUI offenders, DUID offenders are in the average somewhat younger (35 years versus 40 years) *(p. 537)*.
The blood-amphetamine concentration lifted if the offender was a multiple-offender. The median value increased from 0.77 mg/l among first-offenders to 1.22 mg/l among offenders

who were at least twelve times convicted for DUID within the examined four year period. Among alcohol offenders the same pattern was observed, but the increase trend line regarding the substance concentration was much softer. *(pp. 536, 537).*
56 % of all offenders remained first-offenders throughout the four years, while 44 % re-offended one or more times *(p. 538).*
The recidivism rate among users of medicines was quite low (17 %) *(p. 538).*
While alcohol offenders were mainly first-offenders (among 17,038 alcohol offenders, only 14 % were multiple-offenders), the situation concerning illicit drugs showed the contrarily results (among 17,677 illicit drug offenders, 68 % were multiple-offenders). In this context, the rate of multiple-offenders among users of amphetamines was much higher than among users of pharmaceuticals (73 % versus 52 %) *(p. 538).* This may be explained by the lower level of deterrence among users of amphetamines, who in general belong to the high-risk group of youth drivers.
With reference to Butters et al. (2005), Gjerde et al. (1988), Holmgren et al. (2007) and Lapham et al. (2004), repeat-offenders in general suffer from a substance abuse problem *(p. 539).*
The only possibility to solve the traffic safety hazard caused by this offender group is to treat the underlying abuse problem (with reference to Marowitz, 1998; Voas & Tippetts, 1990) with the aim of changing their whole life-style, because the awareness of the imposed penalties was among these offenders very high. Consequently, they will not be deterred by a further elevation of the sanction severity for DUID *(p. 539).*
Studies conducted in Norway (e. g.: Gjerde et al., 1988; Christophersen et al., 1996) also came to the conclusion that the recidivism risk among DUID offenders is much higher than among DUI offenders (57 % versus 28 %) *(p. 539).*
The researchers summed up that the traditional sanctions (i. e. fines and jail penalties) had not been successful in deterring frequent consumers *(p. 539).* Therefore, the question if the zero-tolerance approach can be considered as an effective special deterrent depends mainly on the imposed sanctions and not on the imposed threshold approach.

10.13 Measures of enforcement

10.13.1 Increase of the control density

10.13.1.1 General deterrence of sobriety checkpoints

10.13.1.1.1 Meta-analysis

Authors:
Erke, Goldenbeld, Vaa (2009)
Analysed measure:
General deterrent effects of sobriety checkpoints
Design and methods of research:
Meta-analysis which was conducted within the EU-project PEPPER
Results:
The advantage of sobriety checkpoints in comparison to random breath testing sessions is the less severe intervention into the personal (constitutional) rights of the controlled drivers. Therefore, the implementation of random breath testing laws may be constitutionally problematic in some countries *(p. 914).*
In fact, there are three possible solutions to furnish the testing session for the pulled out drivers: random, compulsory or selective. But it must be noted that the effectiveness of the first possibility seemed to be superior *(p. 915).*

Additionally, the general deterrent success of sobriety checkpoints is mainly influenced the level of enforcement and of public awareness caused by accompanying publicity campaigns *(p. 915)*.
Moreover, the deterrent effect of publicity campaigns disappeared if it was not accompanied by a high level of enforcement *(p. 916)*. This hypothesis was proofed by a look at the superior general deterrent effectiveness of sobriety checkpoints in Australia, where the intensity of enforcement and also the visibility for all other drivers is in comparison to other countries very high *(p. 921)*.
This meta-analysis came to the result that alcohol related crashes were reduced by 17 % at a minimum through the implementation of sobriety checkpoints *(p. 919)*.
One main factor for the high effectiveness of sobriety checkpoints uncovered by the authors was their duration, because the reduction of the alcohol related crash rates declined steadily (from -29 % within the first three months after the implementation to -13 % in the first and second year). This outcome may be due to an increase of the public awareness of the not-changing location of the checkpoints, what is in general one major impediment compared with random breath testing/stopping sessions *(p. 919)*. But some studies were examined, which revealed constant alcohol related accident reductions within the whole examined follow-up period *(p. 921)*.
Only little superior effects were achieved when not all drivers were tested at the checkpoint (i. e. random and selective testing, while the first one seemed to be slightly more effective, because of omitting the possibility of behaving "normally") in comparison to testing all pulled out drivers (i. e. compulsory testing), which led to a reduction of alcohol related crashes of 18 % and 15 %, respectively *(p. 919)*.
The deterrent effects increased if the implementation of the checkpoints was accompanied by paid media (reduction of crash rates of 20 % compared with only 6 % in the case of no accompanying media) *(p. 919)*.
Finally, the design of research used in the respective study affected the outcome on a measurable level. So, for example, evaluation studies without a comparison design reported a reduction of the alcohol related accident rates of 24 %, while studies with a comparison design revealed only a decline of 13 % *(p. 919)*.

10.13.1.1.2
Authors:
Levy, Shea, Asch (1989)
Location and time of the study:
New Jersey; 1986
Analysed measure:
General deterrent impact of random roadside sobriety checkpoints, which were conducted within the Strike Force Program
Only drivers who appeared to be intoxicated had to undergo further examination procedures (consequently it must be argued that the use of the term "random roadside testing" was in fact not correct, because the checkpoints were designed as selective testing checkpoints)
The implementation of these checkpoints was connected with a high level of publicity and the testing sessions were always also visible for other, not stopped drivers
Design and methods of research:
Covariance analysis
Examination of the alcohol related single vehicle night time fatality data for the time period between 1980 and 1985

Results:
At first, the single vehicle night time fatalities declined from 1980 to 1985 by 27.9 %, while the rate overall the United States fell only by 24.5 % *(p. 292)*.
Moreover, the researchers conducted two equations to calculate the effect of the Strike Force Program. These calculations came to the result that this DUI countermeasure led to a reduction of the alcohol related fatalities by 10 % (regression coefficient without the lagged dependent variable: -0.095) and 15 % (regression coefficient with the lagged dependent variable: -0.143), respectively. The accidents occurring during daytimes did not show measurable changes. It must be emphasized that both values were highly significant and, therefore, able to confirm the high potential of general deterrence connected with the implementation of sobriety checkpoints *(p. 293)*. But the results were biased due to the simultaneous implementation of more severe sanctions for DUI and an enhancement of the minimum legal drinking age.

10.13.1.1.3
Authors:
Villaveces, Cummings, Koepsell, Rivara, Lumley, Moffat (2003)
Location and time of the study:
All 50 U. S. states and the District of Columbia
Analysed measure:
General deterrent impact of sobriety checkpoints
Size of the sample:
792,184 fatal accidents (26 % were related to the use of alcohol)
Design and methods of research:
Time-series regression analysis
Comparison of the alcohol related fatality rates among automobile and motorcycle users between 1980 and 1997
Results:
The implementation of laws which contain the permission to conduct sobriety checkpoints was connected with measurable general deterrent impact, because it led to a reduction of the alcohol related fatality rates from 5.2 % to 3.8 % *(pp. 133, 134)*.
Although it remained unclear, if this value reached the level of significance, sobriety checkpoints have a great potential to reduce the incidence of drink driving among the targeted population.

10.13.1.1.4
Authors:
Wells, Preusser, Williams (1992)
Location and time of the study:
Binghamton (New York); 1988-1990
Analysed measure:
General deterrent effects of a total of 72 sobriety checkpoints, which were conducted in six sets
Each set lasted between two and four months and was highly publicized
Passive alcohol sensors were used for the detection of alcohol impairment
The drivers were pulled out randomly and then had to undergo an alcohol check mandatorily, so this type of checkpoints was a mixture of random and compulsory testing
Size of the sample:
About 5,500 drivers checked for their BAC levels
About 760 of the checked drivers were interviewed in the telephone surveys

Design and methods of research:
Weighted least square regression design
Relevant data were collected at the 54 checkpoints which were conducted on Thursday, Friday and Saturday nights, because the daytime checkpoints served at first to enforce the seatbelt use *(pp. 64, 65)*
Telephone surveys were conducted to gather information concerning the perceptions of the public pertaining to the enforcement level and its changes *(p. 66)*
Results:
Referring to former empirical studies (Voas et al., 1985; Lacey et al., 1985), the implementation of highly publicized sobriety checkpoints had been connected with a significant reduction of alcohol related accidents in comparison with states not having enacted such sobriety checkpoint laws *(p. 63)*.
The study revealed a highly significant drop of the percentages of impaired drivers having a BAC level of at least 0.01 % from 23 % at the baseline period to 14 % during the first checkpoint session. This outcome serves as a confirmation for the sometimes mentioned short-lived impact of this enforcement measure. After the first testing session a change between increase and decrease of impaired drivers ranging from 19 % to 14 % was observed *(p. 66)*.
Moreover, the rate of low-BAC drivers (between 0.01 % and 0.049 %) decreased from 13 % to 9 % and then it remained more or less stable on this lower level. The percentage of moderate-BAC drivers (between 0.05 % and 0.099 %) dropped from 7 % to 3 % within the first set, but then the percentage increased up to 6 % and remained afterwards at this higher level. The high-BAC drivers (from 0.10 % upward) seemed to be unaffected by the implementation of the checkpoints, because their percentage remained rather stable at around 2 % *(p. 66)*.
Thus, this enforcement measure had primarily impact on low- and moderate-BAC drivers. But it must be noted that also among these driver groups the impact seemed to be short-lived only *(p. 67)*.
Very similar results were found for another general deterrent factor, because the level of public awareness concerning changes of enforcement measures elevated from 49 % to 74 % during the first set and after then dropped to 59 % *(pp. 68, 69)*.
Finally, the checkpoints must be conducted constantly and highly visible to achieve longer-lived general deterrent effects *(p. 71)*.

10.13.1.1.5
Authors:
Lacey, Kelley-Baker, Brainard, Tippetts, Lyakhovich (2008)
Location and time of the study:
Delaware, District of Columbia, Maryland, Pennsylvania, Virginia, West Virginia; 2002-2004
Analysed measure:
General deterrent impact of frequently (almost weekly) conducted, well publicized sobriety checkpoints
The first checkpoints were implemented in 2002
Size of the sample:
3,475 breath tested drivers at the roadside surveys
7,314 surveyed persons
Design and methods of research:
Interrupted time-series analysis
Comparison of the alcohol related fatality data of the years 1991 to 2002

Analysis of the public awareness levels pertaining to the checkpoint programme which were gathered through telephone or personal surveys
In total seven survey waves in Delaware and Maryland were conducted
Results:
With reference to Shults et al. (2001), highly visible checkpoints can be considered as a significant general deterrent *(p. 6)*.
In 2002/2003/2004 more than 700/more than 800/932 checkpoints were conducted. During the operation period more than 400,000/500,000/560,000 car drivers were checked, resulting in 1,929/2,514/3,187 DUI arrests *(pp. 21, 22)*.
The self-reported likelihood of apprehension caused by the implemented checkpoints was quite stable in Maryland, the percentages of being caught "almost certain" ranged between 22.7 % and 29.3 % *(p. 31)*.
In contrast to these findings, the results in Delaware were less homogeneous, because the second wave in 2002 revealed significant 30.8 % of "almost likely" answers. In the following wave, only 10.2 % shared this opinion, but apart from this outlier both states showed a steady increase of the perceived apprehension risk after the checkpoints were established *(p. 31)*.
The results of the surveys concerning the level of public awareness of the sobriety checkpoints were more or less stable in both states, but the last wave in Maryland and the last two waves in Delaware uncovered a significantly lower level of awareness. The reasons for this phenomenon were not known *(p. 33)*.
The comparison of the alcohol related fatality data showed an almost significant 7.05 % reduction among all involved countries. But only the 16.72 % reduction in West Virginia was highly significant, while a pooled analysis of the alcohol related fatalities in the rest of the United States led to a slight increase of 1.68 % *(p. 58)*.
Although the level of significance was not reached in total, a highly publicized and continuously conducted sobriety checkpoint program, accompanied by a high level of publicity, can be considered as an effective general deterrent measure.

10.13.1.1.6
Author:
Kenkel (1993)
Location and time of the study:
Pennsylvania; 1990
Analysed measure:
General deterrent impact of sobriety checkpoints
Size of the sample:
About 28,000 (about 12,000 males and 16,000 females)
Design and methods of research:
Regression analysis
Self-reported data were derived from an interview survey conducted in 1985
Two evaluation groups were disentangled: young adults up to 21 years and all ages of respondents matched
Results:
As far as the whole group of respondents was concerned, the computed regression coefficients were negative for both males and females (-21.329 and -3.417, respectively). In this context, the author did not mention if the level of significance was reached or not *(pp. 889, 890)*.
The implementation of sobriety checkpoints among young drivers was also connected with negative regression coefficients of -26.399 and -13.936, respectively *(pp. 893, 894)*.

10.13.1.1.7
Authors:
Evans, Neville, Graham (1991)
Location and time of the study:
50 U. S. states; 1987
Analysed measure:
General deterrent impact of sobriety checkpoint laws
Design and methods of research:
Time-series regression analysis
Comparison of the alcohol related single vehicle night time fatality data from 1975 to 1986
Results:
The implementation of sobriety checkpoint laws was connected with a negative regression coefficient of -0.080 *(p. 285)*. Although nowhere was noted if the level of significance was reached, this law type is able to produce measurable general deterrent impact among the main target group. Therefore, it can be regarded as rather effective.
10.13.1.1.8 Literature and studies review
Author:
Ross (1994)
Analysed measure:
General deterrence of sobriety checkpoints
Results:
There are differences between sobriety checkpoints and random breath testing laws, because the latter were declared unconstitutional in some U. S. states *(p. 441)*.
Most of the older studies evaluating sobriety checkpoints (e. g.: Williams & Lund, 1984; Epperlein, 1985; Lacey et al., 1988) were not very well conducted or contained more or less severe methodological deficiencies. Thus, most of the existing results deliver only weak support for the general deterrent effectiveness of sobriety checkpoints. But these problems declined in newer studies. In this context, these studies in many cases only proved an increase of the perceived deterrent threat among the relevant target population *(p. 442)*. But the subjective detection risk is only one element of general deterrence. A much more reliable indicator for the general deterrent impact of a certain DUI countermeasure is the reduction of alcohol related fatalities, but this outcome was not examined in several of the cited studies. Therefore, their validity cannot be regarded as very high.
Only four studies (Voas, Rhodenizer & Lynn, 1985; Lacey et al., 1986; Levy, Ash & Shea, 1990; Wells, Preusser & Williams, 1991) were relatively flawless and also provided certain evidence for the general deterrent impact of sobriety checkpoints *(p. 443)*.

10.13.1.1.9 Studies review
Authors:
De Jong, Hingson (1998)
Analysed measure:
General deterrent impact of sobriety checkpoints
Results:
With reference to Lacey, Jones & Fell (1996), this review came to the conclusion that the implementation of highly publicized sobriety checkpoints was connected with a decline of alcohol related fatalities up to 17 % in comparison to states without having implemented such countermeasures *(p. 363)*.
The observed literature revealed that one major disadvantage in comparison to random breath testing is the short interview session, because within this period of time the police officer has to detect signs of impairment if further steps like breath or blood tests should be administered.

Therefore, about 50 % of actually impaired drivers avoid further measures by behaving "normally" and covering their impairment *(p. 365)*.
To increase the general deterrent impact of sobriety checkpoints it was proposed to use them on a frequent, but unpredictable schedule for several times a month and furthermore, in each case their carrying out has to be accompanied by a high level of publicity *(pp. 365, 366)*.

10.13.1.1.10 Studies review
Authors:
Shults, Elder, Sleet, Nichols, Alao, Carande-Kulis, Zaza, Sosin, Thompson, Task Force on Community Preventive Services (2001)
Analysed measure:
General deterrent impact of sobriety checkpoints
The changes in the rates of night time single vehicle fatalities was used as an outcome measure
Results:
A total of 76 studies were reviewed. 72 % of them were conducted in the United States, while among the European countries only France and The Netherlands conducted few studies, which were also reviewed in this analysis *(p. 67)*.
This review distinguished between random and selective breath testing checkpoints, because only the latter require a suspicion of impaired driving *(p. 75)*.
In both cases, public awareness and high visibility are necessary to cause significant general deterrent impact *(p. 75)*.
Eleven studies dealt with the general deterrent impact of selective breath testing checkpoints *(p. 75)*.
These studies found a reduction of alcohol related fatalities ranging between 5 % and 26 % *(p. 76)*.
Additionally, twelve studies evaluating random breath testing checkpoints were reviewed *(p. 75)*.
This drink driving countermeasure was connected with a reduction of alcohol related fatalities ranging between 11 % and 36 % *(p. 76)*.
Although the crude rates seemed to uncover a higher general deterrent impact of random breath testing checkpoints, the proven effectiveness of both approaches was more or less the same, only with little additional benefits for random breath testing checkpoints *(p. 76)*. Although there was no explanatory statement for this assumption, it refers to the number of studies which were able to deliver results reaching the level of significance.
Finally, the existing evaluation studies provide strong empirical evidence for the general deterrent effectiveness of sobriety checkpoints *(p. 78)*.

10.13.1.1.11 Studies review
Author:
Löbmann (2001)
Analysed measure:
General deterrent impact of sobriety checkpoints
Results:
In the following, only these studies are presented which are not already analysed within this document in detail:

- Beirness et al. (1997) conducted a pre-post comparison of the effectiveness of sobriety checkpoints, which were in effect during night times in British Columbia (Canada).

The percentage of DUI drivers declined by 45.7 %, while the single vehicle night time accidents of males declined by 10.3 % *(p. 61)*.

- Foss et al. (1997) conducted a pre-post comparison of the general deterrent effects caused by sobriety checkpoints in four provinces of North Carolina, which were accompanied by a high level of publicity. The percentages of drivers with BAC values of at least 0.08 % declined by 55 %, but the level of significance was only reached in the smaller provinces *(p. 61)*.

The implementation of sobriety checkpoints is not in each case connected with measurable general deterrence, because the found results were quite mixed *(p. 64)*.

10.13.1.1.12 Studies review

Authors:

Elder, Shults, Sleet, Nichols, Zaza, Thompson (2002)

Analysed measure:

General deterrent effects of two different types of sobriety checkpoints: random and selective breath testing checkpoints

In case of the latter ones, the police officer needs a certain degree of suspicion of drivers´ impairment to require a breath sample

Results:

The authors reviewed a total of twelve studies which examined the general deterrent effects of random breath testing checkpoints. As a result, these empirical studies reported a decrease of alcohol related fatalities, ranging between 14 % and 35 % *(p. 267)*.

- Henstridge et al. (1997):

The researchers analysed the implementation of a random breath testing law, which became effective in 1988 in Queensland (Australia), by using an interrupted time-series analysis and examining the alcohol related fatality data from 1980 to 1992.

During this period of time, a 35 % decrease of the fatalities was observed.

- Henstridge et al. (1997):

In another study in Western Australia, the authors analysed the fatality data between 1980 and 1992 to assess the general deterrent effect of the implementation of a random breath testing law in 1988.

During the examination period, a decrease of alcohol related fatalities of about 28 % was observed.

- Henstridge et al. (1997):

A further study of these researchers analysed the general deterrent impact of a random breath testing law, which was enacted in 1982 in New South Wales (Australia), by using an interrupted time-series design and comparing the data of alcohol related fatality rates from 1976 to 1992.

This study revealed a 15 % reduction of alcohol related fatalities.

Additionally, eleven studies were reviewed which dealt with the general deterrent effects of the implementation of selective breath testing checkpoints *(p. 270)*.

One observed impediment was the chosen outcome measure, because only two studies measured the results for traffic safety in the change of alcohol related fatalities, while most of the other studies only reported the change in the height of the property damage or any type of

personal injuries *(p. 270)*. This outcome measurement is, at best, only limited eligible for criminological purposes, because they do not allow valid statements pertaining to the general deterrent impact of the implemented DUI countermeasure. Therefore, the respective studies were excluded from the further analysis.
The two remaining studies showed a decrease of alcohol related fatalities of 20 % and 26 %, respectively *(p. 270)*.

- Castle et al. (1995):

This study examined the introduction of a selective breath testing law, with special target to younger drivers up to 34 years, in New Mexico implemented in December 1993 by using a time-series analysis and comparing the alcohol related fatality rates for the time period between 1983 and 1994.
There was a certain bias against the reported reduction of 26 %, because the follow-up period was relatively short and, furthermore, additional legal countermeasures were implemented in 1993.

- Lacey et al. (1999):

This study looked at the traffic safety benefits of a selective breath testing campaign in Tennessee, which was conducted between 1994 and 1995 and accompanied by a high level of publicity. Therefore, the researchers used an interrupted time-series analysis and compared the alcohol related fatality rates from 1988 to 1996.
In the end, a reduction of 20 % was observed.

The empirical results showed stronger support for the general deterrent effects of random than of selective breath testing checkpoints. This outcome is especially due to the fact that drivers have in the second type of checkpoints the occasion to avoid detection by behaving "normally" *(p. 270)*.
With reference to some authors, sobriety checkpoints could also have a general preventive effect *(p. 273)*.

10.13.1.2 General deterrence of different measures

10.13.1.2.1 Enforcement crackdowns

10.13.1.2.1.1
Authors:
Fell, Langston, Lacey, Tippetts, Cotton (2008)
Location and time of the study:
Sobriety checkpoints and saturation patrols: Georgia, Louisiana, Indiana, Michigan
Telephone surveys: Georgia, Louisiana
2000-2001: Georgia, Louisiana
2002-2003: Indiana, Michigan
Analysed measure:
General deterrent impact of sobriety checkpoints and saturation patrols, which were perennially accompanied by a high level of publicity
In Georgia only sobriety checkpoints were implemented *(pp. 19, 20)*
Louisiana at first only conducted saturation patrols, but after two months additionally sobriety checkpoints *(p. 20)*
Indiana implemented two major enforcement blitzes (mobilization periods), containing sobriety checkpoints accompanied by saturation patrols *(pp. 23, 24)*
Michigan only conducted saturation patrols *(pp. 24, 25)*

Size of the sample:
Concerning sobriety checkpoints: not specified
Concerning telephone surveys: about 1,000 per state
Design and methods of research:
Time-series analysis
Comparison of the alcohol related fatality data from 1987 to 2001 in Georgia and Louisiana and from 1987 to 2003 in Indiana and Michigan
Additionally telephone surveys were conducted before, while and after the respective enforcement measure was in effect to gather information about the changes in levels of public awareness concerning these enforcement efforts and the perceived risk of apprehension
Results:
An overview of the respective publicity efforts is contained on pp. 27, 28.

Georgia conducted with 2,837 the highest number of checkpoints among all countries. During the whole project period, 280,082 drivers were checked for psychoactive substances and 2,322 drivers were arrested for DUI *(p. 29)*.
Louisiana checked 20,000 drivers through the checkpoints and arrested 120 DUI offenders. Additionally, 217 saturation patrols were conducted *(p. 31)*.
Indiana had in total 45,054 saturation patrol hours, stopped totally 70,624 drivers and arrested of 11,703 of them for DUI *(p. 36)*.
Michigan conducted 1,122 saturation patrols and stooped within the whole project period 59,906 drivers and made a total of 3,117 DUI arrestees *(p. 37)*.
The telephone survey in Georgia revealed a significant increase of the level of public awareness concerning the enforcement efforts between the second and the third wave *(p. 53)*.
The same result was observed in Louisiana, where the percentage of aware drivers rose from 36 % to 55 % *(p. 53)*.
The time-series analysis in Georgia revealed only a slight and non-significant reduction of 4.6 % of alcohol related fatalities due to the implemented enforcement measures *(p. 58)*.
Surprisingly, in Louisiana a significant increase of 14.8 % of alcohol related fatalities in comparison to the control states was observed during the project period *(p. 59)*.
The enforcement measures in Indiana showed an almost highly significant decrease of 20 % (at the two percent level) of alcohol related fatalities *(pp. 61, 62)*.
Finally, the measures in Michigan were also successful, what led to a significant 18 % reduction of the alcohol related fatalities (at the three percent level) *(p. 62)*.
The only outlier was Louisiana with its significant increase, but in all other states the respective enforcement measures showed general deterrent impact, in two states even reductions which approached the level of high significance.
The main limitations of this study were on the one hand the relatively short follow-up periods and on the other hand the wide variety of analysed enforcement measures and media campaigns, because this led to a lack of comparability of the results *(p. 65)*.
The results of Georgia concerning the level of public awareness were very spurring and supported the hypothesis that enforcement measures with accompanying publicity campaigns lead to a significant increase of the general deterrent impact. But a further important element besides the media coverage is a high visibility of the enforcement efforts, because the latter often cause even more general deterrence than media efforts *(p. 67)*.

10.13.1.2.1.2
Authors:
Zwicker, Chaudhary, Solomon, Siegler, Meadows (2007)

Location and time of the study:
West Virginia; 2003-2005
Analysed measure:
General deterrence of high visibility enforcement crackdown programmes (sobriety checkpoint and saturation patrols), which were conducted at night times from 2003 to 2005 and accompanied by a high level of paid media
Design and methods of research:
Time-series analysis on alcohol related fatality data from 2000 until 2004
Survey campaigns at the checkpoints and additionally telephone surveys (2003, 2004, 2005) were conducted to get information about changes in the level of public awareness pertaining to enforcement efforts
Roadside surveys were conducted in 2004 and 2005 to gather information about BAC levels of drivers through the use of breathalysers
Results:
With reference to a study of Lacey et al. (2005), high visibility sobriety checkpoints are able to reduce the incidence of drivers with BAC levels of 0.05 % or above in a significant manner.
This study revealed a steady increase during the project duration of the perceived likelihood of being "always" arrested for DUI. A peak was observed in the post-phase of the first wave, what uncovered a great initial general deterrent effect of these efforts *(p. 14)*.
There was also a highly significant increase from 7.3 % to 19.3 % of drivers who reported a control at a checkpoint, but here again the peak was reached in the post-phase of the first wave. This may be the explanation for the last result reported on p. 14 *(p. 16)*.
Moreover, a significant 2.8 % reduction of drivers with any positive BAC from 2004 to 2005 was found out *(pp. 16, 17)*.
An interesting result was that the percentages of impaired drivers of 16 to 24 and of 25 to 34 years were in both cases lowest in the middle-phase of the project and reached, after an increase, the bottom to the end of the campaign *(p. 19)*. These results supported the hypothesis of sustained general deterrence through continuously conducted enforcement measures also among the high-risk group of young drivers.
A significant reduction of the alcohol related fatalities was observed due to the conduction of the enforcement crackdowns *(p. 21)*. Also among the younger drivers up to 34 years a reduction was measured, but it was not statistically significant *(p. 22)*.
The number of drivers who had heard about or had seen checkpoints increased in every year after the crackdown phase started (2003: from 48 % to 60 %, significant; 2004: from 46 % to 61 %, highly significant; 2005: 54 % to 56 %, not significant). More or less the same pattern was observed among the younger drivers *(pp. 26, 27)*.
The perceived likelihood of being stopped by the police increased among younger drivers in all three waves and among all drivers in at least two waves, but the results were not significant at all *(p. 33)*.

10.13.1.2.1.3
Authors:
Solomon, Hedlund, Haire, Chaffe, Cosgrove (2008)
Location and time of the study:
All 50 states of the U. S. and the District of Columbia; 2006
More detailed case studies containing descriptive material without scientific evaluations were only available for eight states: Colorado, Connecticut, Georgia, Minnesota, Nevada, New Jersey, Tennessee, West Virginia

Analysed measure:
General deterrent effects of highly visible enforcement crackdown efforts which were accompanied by a vast media campaign
The measures in each state were often designed very differently
Size of the sample:
Pre-intervention telephone interviewees: 1,214 (269 were aged between 18 and 34 years)
Post-intervention telephone interviewees: 1,222 (228 were aged between 18 and 34 years)
Design and methods of research:
Time-series analysis
Comparison of the alcohol related fatality rates between 2001 and 2006
Pre- and post-intervention telephone surveys were conducted to achieve information concerning the level of public awareness and the perceived likelihood of being stopped
Results:
Referring to different empirical studies (e. g.: Wells et al., 1991; Lacey et al., 1999; Solomon, Ulmer & Preusser, 2002) subjected to highly visible and publicized enforcement efforts, mainly sobriety checkpoints, these countermeasures are the key factor to achieve a significant general deterrent outcome. But in multi-state projects the results differed from state to state and not every state was able to achieve the goal of increased traffic safety *(pp. 1, 2)*.
Among all interviewees, a significant increase of public awareness from 80 % to 84 % was observed. The percentage of the aware younger drivers also increased, but not in a significant manner *(p. 16)*.
The perceived likelihood of being stopped for DUI increased slightly among all interviewed persons from 25 % to 27 %. Among drivers between 18 and 34 years even a small decrease from 29 % to 28 % was observed, but in both cases the level of significance was not reached *(p. 22)*.
Moreover, the perceived enforcement efforts - measured in the likelihood of being stopped by the police - increased among both all drivers (from 27 % to 32 %) and younger drivers (from 30 % to 36 %), but only the first value was highly significant *(p. 23)*.
In most cases, the conduction of media campaigns was connected with an increase of the general deterrent level.
The number of alcohol related fatalities remained with 17,602 in 2006 compared to 17,590 in 2005 rather stable, because 25 U. S. states and the District of Columbia reported a decrease, while the other 25 U. S. states showed an increase. But there was a measurable decrease in the same period from 5,782 to 5,654 among the high-risk group of drivers between 18 and 34 years. Additionally, the number of fatally injured drivers with BAC levels of at least 0.08 % declined measurable from 4,996 to 4,872. Consequently, the crackdown programme had a general deterrent impact on these two high-risk groups *(p. 26)*.

10.13.1.2.1.4
Author:
Mercer (1985)
Location and time of the study:
British Columbia (Canada); 1984
Analysed measure:
General deterrent effects of police roadcheck blitzes, which were conducted in April and May 1984
Size of the sample:
One week before the blitz: 249
One week after the blitz: 252

Design and methods of research:
Correlational examination of the alcohol related casualty data for the period December 1977 to June 1984
Furthermore, the number of articles publicized in the print media was gathered to put them in relation to the accident data
Additionally two telephone surveys (one week before and one week after the blitz) were conducted to gather information pertaining to the perceived apprehension risk for DUI
Results:
First of all, the media coverage accompanied by the blitz was rather low *(p. 469)*.
A significant relation between the level of media coverage and the reduction of alcohol related casualties was observed. This effect lasted in general more than one month *(p. 470)*.
It was surprising that no significant correlation between the number of checked cars, what is tantamount to the level of enforcement, and the change in the alcohol related casualties was found out *(pp. 470, 472)*.
Therefore, the level of media coverage was the only significant predictor for the reduction of alcohol related injuries or fatalities *(p. 472)*.
Consequently, the conduction of the blitz hardly led to a general deterrent effect *(p. 473)*, because the level of public awareness was quite low *(p. 472)*.
The result was confirmed through the conducted interviews concerning the perceived likelihood of apprehension, because there were no measurable differences in the perception of the public opinion. This discovery was really surprising, because the percentages of people who reported that they had seen the blitz activity or had been stopped at a checkpoint increased significantly from 17 % to 38 % and from 6 % to 12 %, respectively *(p. 472)*.
So, that police activity and media coverage go hand in hand. As a result, general deterrent effects only can be observed, if both factors are in balance. It is the job of the media to inform the population that special police efforts are working to combat drunk driving, because otherwise this elevation of enforcement will not be perceived by the individuals *(p. 473)*.

10.13.1.2.2 Saturation patrols

Authors:
Voas, Hause (1987)
Location and time of the study:
Stockton (California); 1984
Analysed measure:
General deterrence of special drunk driving enforcement patrols (ten additional patrol cars, but sobriety checkpoints were not used), which were at work between January 1976 and June 1979 on Friday and Saturday nights
Design and methods of research:
Interrupted time-series analysis
Comparison of the enforcement night time and other night time accident data for the time period 1973-1981
Conduction of roadside breath test surveys to gather information about the distribution of the BAC levels
Results:
The researchers observed a highly significant 15 % reduction of the enforcement time accidents during the whole project period. This downward trend begun immediately after the implementation of the patrols *(p. 84)*.
Also the other night time accidents were reduced by at least highly significant 10 %, but this trend begun about six months after the launching of the enforcement time downward trend. The explanation for this phenomenon remained unclear *(p. 84)*.

The percentages of drivers with a BAC of more than 0.10 % declined during from 8.8 % in 1975, to 6.3 % in 1976, to 5.9 % in 1977 and, finally, to 5.0 % in 1978. All of these reductions reached the level of high significance *(p. 85)*.
Finally, this countermeasure can be considered as an effective general deterrent, which may, at least partly, be due to the high level of accompanying publicity *(p. 89)*.

10.13.2 Increase of the control efficiency through random breath testing laws

10.13.2.1
Authors:
Homel, Carseldine, Kearns (1988)
Analysed measure:
General deterrence of random breath testing
Design and methods of research:
Studies review and data collection
Results:
Studies review:
One Australian study (n = 195,000) reported a significant decline of the number of fatalities with drivers having BAC´s above 0.05 % (32.9 %) and also the fatality rate of drivers with BAC´s below 0.05 % decreased in a significant manner (from 45.6 % to 39.8 %) due to the implementation of a random stopping law. The highest rates of decline were observed within a short period of time after the implementation of the law *(p. 125)*.
A further study, which examined the general deterrent effects of highly published random breath tests, conducted in New South Wales (Australia), by comparing the alcohol related accidents of a six year pre-intervention- with a three year post-intervention-period, came to the result that the number of fatalities declined by 42 % *(p. 126)*.
In South Wales, the introduction of random breath testing laws was accompanied by a high level of publicity and a high rate of checked drivers, what is equivalent to a high rate of enforcement. These levels were kept up for several years. Official evaluations of the government, using a three year follow-up period, showed a significant decline of 21 % concerning alcohol related fatalities. The observed outcome was mainly attributable to the level of highly visible police enforcement *(p. 128)*.
Data analysis:
Further analyses of the authors, using a before-after-comparison-design on the official accident data, confirmed the measurable general deterrent effect of random breath testing laws in New South Wales, which were introduced in December 1982.
The rates of alcohol related fatalities and serious injuries, involving single vehicles at night times, remained five years prior to the introduction more or less stable, with a peak of the cumulative sum graph of +100. But immediately after the law implementation, a steady downward trend began, which was expressed in the reduction of the cumulative sum graph from 0 in the year of the implementation to -1,000 in the fourth year after the implementation. This corresponded to a drop of 35 % *(p. 130)*. The same results were observed among the fatality rates including drivers with a BAC of more than 0.05 %. In this case, the cumulative sum graph peaked in the three years prior to the implementation up to +25 and declined in the fourth year after the introduction to -330, what corresponded to a drop of 36 % *(p. 131)*.

Conduction of surveys:
To examine the general deterrent effects, which were connected with the implementation of random breath testing laws, a longitudinal series of a total of four questionnaire surveys was conducted in South Wales. The first wave was conducted only several weeks before the introduction of the random breath testing law in November 1982 and the subsequent ones in

May 1983, July-August 1984 and February 1987. The design of the used questionnaires had not changed noteworthy within the different surveys. The interviews were conducted at the telephone or face-to-face at home. The randomized sample contained in each survey about 1,000 persons, expect in the last survey, which only covered about 600 persons *(p. 133)*.
The percentages of the drivers who reported to drink before the ride for at least once per month remained during the first three surveys rather stable at 45 % to 47 %. In the fourth survey, the rates declined to 41 %, but this was not a significant reduction *(p. 133)*.
Moreover, the percentages of drivers who drank at least once per month more than their self-assessed safe BAC limit declined from 16 % in 1982 to 6 % in 1984. This outcome was mainly attributed to the implementation of random breath testing *(p. 134)*.
The rates of drivers who reported that they had been already breath tested increased from 25 % in 1982 to 53 % in 1987. Additionally, the rates of drivers who had seen a breath testing station in action increased from 63 % in 1983 to 83 % in 1984 *(p. 134)*.
The perceptions of the apprehension risk increased measurable. The rates of interviewees who estimated the apprehension risk as "much higher" increased from 26 % (1983) to 40 % (1984) and to 44 % (1987) *(p. 135)*.
Finally, the interviewees were asked if they suppose that their accident risk increases at a BAC level of at least 0.05 %. While the rate remained quite constant at about 60 % during the first three surveys, the rate elevated in the last survey to 78 % *(p. 135)*.
The rate of supporters for a continuation of random breath tests lifted from 64 % in 1982 to 85 % in 1983/1984 and to 97 % in 1987 *(p. 138)*. These values confirm a high social acceptance of random breath testing laws.
One result of this study was - besides the overwhelming general deterrent effects of random breath testing laws - the hypothesis that random stopping laws, which are accompanied by a high level of publicity, could lead to the same or at least similar positive impacts for traffic safety *(p. 139)*.
Moreover, these effects were only achieved through the high level of publicity and visible enforcement. Thus, the sole enactment of a random breath testing law may have only very little general deterrent impact *(p. 139)*.

10.13.2.2
Authors:
Moore, Barker, Ryan, Mc Lean (1993)
Location and time of the study:
Adelaide (South Australia); 1987-1991
Analysed measure:
General deterrent effects of a random breath testing law, which was implemented in 1981 and conducted on a high enforcement level in all three waves at Eastern
In 1987 and in 1989 it was also accompanied by a high level of publicity
Size of the sample:
1987: 3,092
1989: 2,093
1991: 2,784
Design and methods of research:
Information of the perceived apprehension likelihood was gained through surveys of night time (10 p.m.-3 a.m.) drivers
Three waves were conducted (1987, 1989, 1991)
At the roadside, the drivers were asked to provide a breath sample for a breathalyser test and they were asked to fill in a questionnaire at home

Results:
The perception of being likely apprehended as a drink driver if he has a BAC of 0.8 % or above increased from 1987 to 1989 from 22.4 % to 25.3 %. This value remained stable until the next survey in 1991 with 25.0 % *(p. 253)*.
Moreover, in all waves the perception of being likely caught was measurable higher among drivers who had no prior DUI charge than among drivers with a DUI history (1987: 22.4 % versus 19.0 %; 1989: 25.6 % versus 16.4 %; 1991: 25.0 % versus 23.1 %) *(p. 254)*. This may be due to the higher rates of controls among the second ones, which allow them to assure themselves of the often bemoaned ineffectiveness of police alcohol checks. This impediment is also valid in case of random breath testing, because in most cases the police stops only drivers which show at least some slight signs of impairment.
The perception of the apprehension likelihood was higher among drivers who were already tested in a random breath testing session for at least three times, compared with drivers who were never tested (1987: 26.2 % versus 21.6 %; 1989: 28.1 % versus 25.3 %; 1991: 26.0 % versus 24.9 %; only in 1989 statistically significant) *(p. 254)*.
While drivers with an actual zero BAC at the time of the survey thought at a higher percentage that it is likely to be caught than it is unlikely (1987: 79.0 % versus 71.9 %; 1989: 77.5 % versus 73.1 %; 1991: 83.8 % versus 77.9 %; only significant in 1987 and 1991), the results among drivers with an actual BAC of at least 0.8 % were vice versa (1987: 2.7 % versus 3.2 %; 1989: 3.1 % versus 3.8 %; 1991: 1.5 % versus 2.3 %; only significant in 1987 and 1991) *(p. 255)*. So, the general deterrent effect of the implementation of random breath testing laws was much higher among non-drinkers than among drink drivers, but at least this countermeasure showed also measurable impact among drivers with higher BAC levels.
With reference to former empirical research on the perceived apprehension likelihood, random breath testing laws led to a measurable increase of the general deterrent level *(p. 255)*.
Moreover, the perception of apprehension likelihood increased if the level of factual enforcement efforts reaches approximately the same level like the perceived one *(p. 257)*.
Finally, the implementation of random breath testing laws also has a general preventive effect by leading to an increase of the social disapproval of drunk driving *(p. 257)*.

10.13.2.3
Author:
Tay (2005)
Location and time of the study:
Victoria (Australia); 2004
Analysed measure:
General deterrent effect of random breath testing
Design and methods of research:
Time-series analysis
Comparison of the rates of alcohol related serious accidents of male drivers up to 24 years for the time period between July 1989 and December 1992
During this period random breath testing was implemented, accompanied by a drink driving adstock (publicity measures)
Results:
The regression coefficient of random breath testing was statistically significant -0.0044. The number of serious accidents among adolescents dropped immediately about 20 % after the random breath testing implementation *(p. 926)*.
Moreover, the drink driving adstock was connected with a significant regression coefficient of -0.0637. This led to the statement that publicity is always an important deterrent element and

that enforcement measures like random breath testing only work successfully in connection with those publicity campaigns *(p. 926)*.
Furthermore, the researchers observed a common downward trend during the examination period with a significant regression coefficient of -0.0039. This outcome was not attributable to one concrete DUI countermeasure, but it had been stated that the enforcement efforts at least supported this downward trend in a significant manner *(p. 926)*.
Enforcement measures connected with high visibility led to significant general and special deterrent effects *(p. 927)*.
The examined enforcement campaigns were mainly targeted on young male drivers, who are commonly more likely impaired during their drives than other driver groups *(p. 927)*.
Targeted legal interventions cause higher general deterrent impact than untargeted measures.

10.13.2.4
Authors:
Dunbar, Pentilla, Pikkarainen (1987)
Location and time of the study:
Finland; 1986
Analysed measure:
General deterrent impact of random breath testing, which always was conducted at changing locations (no sobriety checkpoints)
Each testing session lasted only 30 minutes, but during this time every passing driver was tested
This measure was implemented in 1979
Size of the sample:
133,332 drivers
Design and methods of research:
Pre-post comparison of the number of drivers with measurable BAC levels, distinguishing between up to 50 mg/dl and above 50 mg/dl
The incidence rates of impaired drivers were gathered through annually conducted roadside surveys between 1979 and 1985
Results:
Random breath testing had a deterrent effect among social drinkers and that problem drinkers were at least detected, although not deterred *(p. 101)*. If problem drinkers are detected, they are able to undergo the urgent treatment therapy, which is necessary to solve their drinking problem. Thus, random breath testing is also connected with traffic safety benefits in the field of problem drinkers *(p. 103)*.
One major factor which contributed to the success of random breath testing was the high level of social acceptance pertaining to this countermeasure. So, for example one study (Arthurson, 1985) revealed that before the implementation of random breath testing laws, 60 % were in favour of this measure. After its introduction, the value increased up to 90 % *(p. 102)*.
This countermeasure showed significant impact among both low- and high-BAC drivers, because the percentages of drivers having a BAC level of above 50 mg/dl declined from 0.46 % in 1979 to 0.20 % in 1985. Also the incidence rates of drivers with BAC levels of less than 50 mg/dl decreased from 0.97 % in 1979 to 0.39 % in 1985. The rates declined continuously from year to year *(p. 102)*.
Moreover, the implementation of random breath testing checkpoints was not connected with a change in the level of other police enforcement measures *(p. 103)*.
One identified impediment for an increase of the general deterrent effects of random breath testing was the fact that the sessions often have been conducted during night times and at weekends. But also in the morning hours a high rate of impaired social drinkers is on the

roads. Consequently, the deterrent impact would increase if more testing sessions would be conducted in the early morning hours *(p. 103)*.

10.13.2.5 Studies review
Author:
Löbmann (2001)
Analysed measure:
General deterrent impact of random breath testing laws
Results:
After the review of a total of seven empirical studies, the general deterrent results for the implementation of random breath testing laws were very promising, because each of the evaluated studies observed reductions of the alcohol related variables *(p. 65)*.
The following six studies *(pp. 66, 67)* were not already presented within this document in detail:

- ALAC (1995) evaluated the general deterrent impact of the implementation of random breath tests in New Zealand in 1993 by using a pre-post comparison design. The evaluated data for 1990 to 1994 revealed that the fatalities with drivers having BAC levels of at least 0.08 % declined by 8 %. Additionally, a downward trend of these rates was shown. The number of had-been-drinking accidents declined in 1993 by 11 %, but in 1994 only by 5 %. So, the had-been-drinking crashes showed the contrarily trend than the higher BAC fatalities. This outcome may, at least partly, be due to the greater dark field in the first cases.

- Bailey (1995) evaluated the same measure in New Zealand. For the only alcohol related proxy of night time injuries, these rates declined between 1991 and 1994 by 11.8 %.

- Homel (1995) observed in his time-series analysis between 1976 and 1992 that the highly publicized implementation of a random breath testing law in New South Wales (Australia) in 1982 was connected with a decrease of the single vehicle night time fatal accidents of 48 % within the first 4.5 months after the implementation. But this decline minimized to 5 % in the aftermath. This was mainly due to the decrease of the enforcement efforts, because after an increase of these efforts in 1987, the fatalities declined again.

- The same measure was evaluated by Span and Stanislaw (1995) by using the same research design. The night time accidents decreased by 14 % among males and by 5 % among females.

- Henstridge et al. (1997) evaluated the general deterrent effects of random breath testing laws which were enacted in four Australian provinces by using a time-series design. The researchers observed immediate and stable effects in three provinces, while the last one only showed short-termed effects.

- Mc Caul and Mc Lean (1990) evaluated random breath testing sessions during night times, conducted in South Australia since 1987. The pre-post comparison used a baseline and a follow-up period of seven weeks in each case. The percentages of drunken drivers, which were gathered by roadside surveys, declined by 20 %, while the rates of drivers with BAC levels of at least 0.08 % even decreased by 34 %.

Thus, the empirical research provided a strong basis for the recommendation of the implementation of random breath testing laws.

10.13.3 Studies review of general deterrence of random breath testing and sobriety checkpoints

Author:
Peek-Asa (1999)
Analysed measure:
General deterrent impact of random screening laws, containing random breath testing and sobriety checkpoints laws
Results:
The reviewed studies revealed, in general, a greater reduction of alcohol related accidents than of non-alcohol related accidents. According to alcohol related fatalities, the studies showed a decline ranging between 17 % and 75 % *(p. 59)*.
Moreover, the reductions of alcohol related accidents were greater by using random breath testing (like in Australia) than by testing the drivers at sobriety checkpoints (like in the United States) *(p. 59)*.
In the following, only studies which were conducted since 1988 are presented, older studies were excluded.

- Stuster, Blowers (1995):

This study used an intervention-trial design and examined the reductions of alcohol related accidents in four Californian communities by analysing the accident data in a pre-post-comparison design.
The implementation of the checkpoints was accompanied by a high level of publicity and, consequently, of public awareness.
The number of alcohol related crashes decreased between 17 % and 38 %, compared with a reduction of 28 % in the control state and of 8 % in the whole USA.

- Lacey et al. (1996):

This study examined the change of alcohol related fatalities in Tennessee between 1994 and 1995, caused by the implementation of sobriety checkpoints.
This measure led to a significant reduction of 17.1 %, while during the same time period the rate of alcohol related fatalities increased in all five comparison states.

- Cameron et al. (1992):

By using a multivariate time-series approach, the alcohol related accident data of Melbourne were compared with the ones of Sydney after the introduction of a random breath testing law.
This study revealed a significant reduction of 17.9 % of alcohol related fatalities and of 24 % of serious injuries only in the first year. As the reduction in the second year did at least no longer reach the level of significance, this measure had no long-term effect. A decrease of the level of enforcement or public media coverage led to this poor outcome.

- Drummond et al. (1992):

The researchers examined the data of alcohol related fatalities in Melbourne and as a control location in Sydney after the implementation of a random breath testing law by using a quasi-experimental time-series analysis.
Alcohol related fatalities were significantly reduced by 19 %, but the non-fatal alcohol related accidents did not show a significant decline.

A further study revealed that an increase of the enforcement efforts was connected with a decrease of alcohol related fatalities *(p. 64)*.
Moreover, a high level of publicity is a main factor for significant general deterrent impact of random screening *(p. 64)*.
The higher success rates of the Australian programmes, compared with those from the United States, were also due to a higher visibility of the stopping and testing sessions. This procedure led to a higher perceived apprehension hazard, which serves as one of the major general deterrents *(p. 65)*.
Especially the "blitz" programs in some Australian communities were identified as very effective general deterrents *(p. 65)*.

10.13.4 General deterrence of preliminary breath testing laws

10.13.4.1
Authors:
Legge, Park (1994)
Location and time of the study:
48 U. S. states
Analysed measure:
General deterrent impact of preliminary breath testing laws
Design and methods of research:
Pooled cross-sectional time-series regression analysis
Comparison of the single vehicle night time fatal accidents
Data were pooled across three years (1980, 1984, 1987)
Results:
This analysis computed a standardized regression coefficient of -0.116 connected with the implementation of preliminary breath testing laws, compared with states having not such a law implemented. This value was not significant *(p. 600)*.
Although the results were not significant, this DUI countermeasure sets the "right signal". Moreover, it is likely that the impact will increase, although this optimistic opinion was not well-founded *(p. 602)*.

10.13.4.2
Authors:
Evans, Neville, Graham (1991)
Location and time of the study:
50 U. S. states; 1987
Analysed measure:
General deterrent impact of preliminary breath testing laws
Design and methods of research:
Time-series regression analysis
Comparison of the alcohol related single vehicle night time fatality data from 1975 to 1986
Results:
With reference to three studies reviews of Ross (1978, 1982, 1984), an increase of the sanction severity is an ineffective general deterrent, while the lift of the sanction certainty was at least connected with a temporary reduction of alcohol related fatalities *(p. 281)*.
Moreover, the implementation of preliminary breath tests would lead to a significant reduction of alcohol related fatalities *(p. 282)*.
The regression coefficient of the implementation of preliminary breath testing laws was negative, but not significant for single vehicle night time fatalities (-0.008). Consequently, this enforcement measure is connected with measureable general deterrent impact *(p. 285)*.

10.13.4.3
Authors:
Whetten-Goldstein, Sloan, Stout, Liang (2000)
Location and time of the study:
All 50 states of the U. S. including the District of Columbia
Analysed measure:
General deterrent effects of preliminary breath testing laws
Design and methods of research:
Quasi time-series analysis (so called fixed effects design)
Cross-sectional comparison of the alcohol related fatality rates between 1984 and 1995, distinguishing between drivers aged from 15 up to 20 years and drivers aged from 21 up to 64 years
Results:
Preliminary breath testing laws were connected with a significant increase of the night time single vehicle fatalities among minors (regression coefficient: +0.089; alcohol related fatal crashes: +0.057 (non-significant)), while the same measure had at least a measurable, but not significant general deterrent effect among adult drivers (regression coefficient: -0.009; alcohol related fatal accidents: -0.019 (non-significant)) *(pp. 730, 731)*. Unfortunately, the researchers did not comment these results, thus, it remained unclear why this measure was not connected with any general deterrent impact among adolescent drivers.

10.13.4.4
Author:
Ruhm (1996)
Location and time of the study:
48 states of the U. S.; 1990
Analysed measure:
General deterrent impact of preliminary breath testing laws
Design and methods of research:
Time-series analysis
Comparison of the single vehicle night time fatality rates between 1982 and 1988
Results:
The preliminary breath testing laws were not connected with a negative regression coefficient among both all drivers night time fatalities (value: +0.0117) and all fatalities of drivers aged between 18 and 20 years (value: +0.0538). Thus, the negative safety impact of this kind of law was higher among young drivers than among older drivers *(pp. 449, 450)*.

10.13.4.5
Authors:
Saffer, Chaloupka (1989)
Location and time of the study:
48 states of the U. S.; 1987
Analysed measure:
General deterrent effects of preliminary breath testing laws
Design and methods of research:
Time-series cross-sectional analysis
Comparison of the single vehicle night time fatality rates of all and of adolescent (15 to 24 years old) drivers for the time period from 1980 to 1985

Results:
The objective of this kind of law is the elevation of the apprehension risk and, so, of the punishment certainty, which is - besides the punishment celerity - one of the major general deterrents *(p. 901)*.
Moreover, most states had enacted also per se laws to increase the effectiveness of the preliminary breath testing laws *(p. 902)*.
Referring to two prior studies (Ross, 1984; Swan, 1984), the preliminary breath testing laws will have a significant general deterrent effect on DUI offenders *(p. 903)*.
After the use of the independent variable model, the implementation of preliminary breath testing laws was connected with a statistically significant reduction of all single vehicle night time fatalities among both all matched drivers (regression coefficient: -0.0922) and adolescents (regression coefficient: -0.0761) *(p. 908)*.
The absolute reduction of youth fatalities was greater than of all drivers due to the higher level of impaired drivers among the first ones *(p. 909)*.
Preliminary breath testing laws were commonly connected with a significant general deterrent effect *(p. 910)*.

10.13.4.6
Authors:
Chaloupka, Saffer, Grossmann (1993)
Location and time of the study:
48 U. S. states; 1990
Analysed measure:
General deterrent effect of preliminary breath testing laws
Design and methods of research:
Time-series analysis of the alcohol related fatality rates from 1982 to 1988
The results distinguish between all drivers and drivers aged 18 to 21 years
Results:
The computed regression coefficient for the group of matched drivers was -0.163. This was a highly significant value *(p. 173)*.
Among the young drivers, the regression coefficient was even a little bit better with -0.173, which was also a highly significant value *(p. 174)*.
Both results show the high potential of preliminary breath testing laws to cause general deterrence among drivers, even among adolescents.

10.13.4.7
Author:
Eisenberg (2003)
Location and time of the study:
All 50 U. S. states including the District of Columbia; 2002
Analysed measure:
General deterrent impact of preliminary breath testing laws
Design and methods of research:
Weighted least squares regression model
Comparison of the alcohol related fatality rates for the time period 1982 and 2000, distinguishing between involved drivers with BAC levels above 0.01 % and at least 0.10 %
Results:
The regression coefficients for both high-BAC and any alcohol related fatal accidents were not significant, but at least connected with a negative prefix (-0.0237 and -0.0358, respectively). Consequently, these results show their potential to reduce the incidence of DUI.

The quite reliable proxy single vehicle night time fatality rate was even connected with a positive regression coefficient of +0.0044. Among drivers under 21 years, the value was positive and also significant +0.1405 *(p. 260)*. The results indicated that the general population of drivers is measurable deterred by this type of law, but among the population of adolescent drivers this countermeasure was connected with a decrease of traffic safety. Unfortunately, no further explanations on this topic were given by the authors.

10.13.4.8
Authors:
Benson, Rasmussen, Mast (1999)
Location and time of the study:
48 U. S. states; 1994
Analysed measure:
General deterrent impact of preliminary breath testing laws
Design and methods of research:
Time-series analysis
Comparison of the alcohol related fatality rates from 1984 and 1992, distinguishing between drivers with low-BAC levels of at least 0.01 % and high-BAC levels of at least 0.10 %
Results:
The regression coefficient for drivers with low-BAC levels was at least negative, but non-significant (-0.00343). The value for high-BAC drivers was even positive, but also non-significant (+0.007012) *(p. 219)*. The observed outcome among high-BAC drivers indicated that this type of law is connected with an increase of the incidence of alcohol related driving, while among the vast majority of the social drinkers at least some general deterrent impact was observed.

10.13.4.9
Authors:
Young, Likens (2000)
Location and time of the study:
48 U. S. states; 1995
Analysed measure:
General deterrent impact of preliminary breath testing laws
Design and methods of research:
Time-series logistic regression analysis
Comparison of the alcohol related fatality rates between 1982 and 1990
Two evaluation groups were created: all ages of drivers and drivers between 18 and 20 years
Results:
The computed regression coefficient for the whole driver group was -0.019. This value did not reach the level of significance *(p. 116)*. The coefficient for young driver fatalities was connected with a positive, not significant prefix *(p. 118)*, indicating that this type of law is not able to deter adolescent drivers in general.

10.13.4.10
Author:
Kenkel (1993)
Location and time of the study:
Pennsylvania; 1990
Analysed measure:
General deterrent impact of preliminary breath testing laws

Size of the sample:
About 28,000 persons (about 12,000 males and 16,000 females)
Design and methods of research:
Regression analysis
Self-reported data were derived from an interview survey, conducted in 1985
Two evaluation groups were disentangled: young adults up to 21 years and all ages of respondents matched
Results:
The regression coefficients for males and females were negative, but, unfortunately, it was nowhere mentioned if these values reached the level of significance (-6.017 and -9.389, respectively) *(pp. 889, 890)*.
Among adolescent males and females, the following values were computed: -6.801 and -5.217, respectively. Although it remained unclear if the level of significance was reached or not, the coefficients were at least connected with a negative prefix *(pp. 893, 894)*.

10.13.5 General deterrence of implied consent laws

10.13.5.1
Authors:
Whetten-Goldstein, Sloan, Stout, Liang (2000)
Location and time of the study:
All 50 states of the U. S. including the District of Columbia
Analysed measure:
General deterrent effects of implied consent laws
Design and methods of research:
Quasi time-series analysis (so called fixed effects design)
Cross-sectional comparison of the alcohol related fatality rates from 1984 to 1995, distinguishing between drivers aged 15 to 20 years and drivers aged 21 to 64 years
Results:
Implied consent laws for breath tests were at least connected with a measureable, but not significant reduction of the single vehicle night time fatalities among youth drivers (regression coefficient: -0.021; alcohol related fatal accidents: +0.015 (non-significant)), but with a not significant increase among older drivers (regression coefficient: +0.046; alcohol related fatal accidents: +0.009 (non-significant)) *(pp. 730, 731)*. This may lead to the assumption that the swiftness of sanctioning has a much greater general deterrent impact among young drivers than among older drivers.

10.13.5.2
Author:
Ruhm (1996)
Location and time of the study:
48 states of the U. S.; 1990
Analysed measure:
General deterrent impact of implied consent laws, which lead to a licence suspension if the driver refuses to provide a breath sample
Design and methods of research:
Time-series analysis
Comparison of the single vehicle night time fatality rates from 1982 to 1988
Results:
The implementation of implied consent laws showed more or less the same general deterrent impact among older and younger drivers. This statement was derived from the computed

regression coefficients for all drivers night time fatalities (value: -0.0515) and for all fatalities of drivers aged 18 to 20 years (value: -0.0418). Although the results were quite promising, both results were not significant *(p. 449)*.

10.13.5.3
Authors:
Benson, Rasmussen, Mast (1999)
Location and time of the study:
48 U. S. states; 1994
Analysed measure:
General deterrent impact of implied consent laws
Design and methods of research:
Time-series analysis
Comparison of the alcohol related fatality rates for the time period from 1984 to 1992, distinguishing between drivers with low-BAC levels of at least 0.01 % and high-BAC levels of at least 0.10 %
Results:
Among the low-BAC drivers, the regression coefficient was connected with a negative prefix, but the level of significance was not reached (-0.000015). The same result was revealed among the group of high-BAC drivers (-8.320005) *(p. 219)*. So, this type of law is connected with similar general deterrent impact among both low- and high-BAC drivers.

10.13.5.4 Preliminary breath testing law in combination with implied consent law
Authors:
Rhee, Zhang (1993)
Location and time of the study:
Canada; 1990
Analysed measure:
General deterrent impact of preliminary breath testing laws, which also consider it as an offence to refuse a breath test (combination with so called implied consent law)
Design and methods of research:
Time-series cross sectional analysis
Comparison of the alcohol related fatality rates of 1952 to 1988
The results of Ontario presented the main focus of this study
Results:
The law change had a measurable, but non-significant effect on the fatal accident rates (computed regression coefficient: -0.68) *(p. 770)*.
It was rather surprising that the application of another simpler regression computing model led to a highly significant reduction of fatal accidents due to the implementation of the combined preliminary breath testing law *(p. 771)*.
The results of Ontario showed a negative regression coefficient of -0.16. As the value did not reach the level of significance, the implementation of this type of law was not connected with a strong deterrent effect *(p. 771)*.
The deterrent effect of this law was weak, but that it worked mainly by the detection of impaired drivers *(p. 773)*. But as it is scientifically known, an increase of the detection risk also leads to an elevation of the general deterrent element sanctioning certainty.

10.14 Media campaigns - Studies review

Authors:
Elder, Shults, Sleet, Nichols, Thompson, Rajab, Task Force on Community Preventive Services (2004)
Analysed measure:
General deterrent impact of media campaigns, related to enforcement activities or legal consequences for DUI
Results:
The following reviewed studies revealed the additional general deterrent benefits of comprehensive media campaigns, although the level of enforcement or the legal consequences remained the same *(p. 60)*:

- Mc Lean (1991) conducted a time-series analysis in Adelaide (South Australia) with a follow-up period of two months to evaluate the impact of a media campaign related to enforcement activities. The number of drivers having a BAC level above the legal limit decreased by 30 %.

- Epperlein (1987) evaluated the general deterrent impact of a media campaign targeted at enforcement efforts and legal consequences in Arizona. By using an interrupted time-series design for a follow-up period of 21 months with concurrent comparisons, the author revealed that all three outcome measures were reduced significantly (night time fatalities: -16 %; night time injuries : -7 %; had-been-drinking accidents: -13 %).

- Worden (1975) conducted a pre-post-comparison study with concurrent comparisons in Vermont to examine the general deterrent impact of media campaigns in relation to enforcement measures. Within the follow-up period of 24 months, the percentages of drivers with BAC levels above 0.05 g/dl were reduced by 158 %, but the rate of alcohol related fatalities were not affected at all. The results were based on very small sample sizes and therefore the statistical power of this outcome was rather poor.

Consequently, well-executed mass media campaigns have the potential to cause additional general deterrent benefits *(p. 63)*.
Additionally, media efforts which also focus on social and health norms are able to cause better outcomes due to the potential to change individual behaviour *(pp. 63, 64)*.
Finally, the long-term effectiveness of media campaigns is sometimes questionable *(p. 64)*.

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