Alcohol interlock

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Please note: The studies included in this synopsis were selected from those identified by a systematic literature search of specific databases (see supporting document). The main criterion for inclusion of studies in this synopsis and the DSS was that each study provides a *quantitative effect estimate*, preferably on the number or severity of crashes or otherwise on road user behaviour that is known to be related to the occurrence or severity of a crash. Therefore, key studies providing qualitative information might not be included in this synopsis.

1 Summary

Nieuwkamp, R., Martensen, H., Meesmann, U., July 2017

1.1 COLOUR CODE: GREEN

The results of the research on the effectiveness of the alcohol interlock are positive in terms of reducing recidivism. However, once the device is uninstalled, the recidivism rates become comparable to those in the control group. Therefore, the effect on road safety is positive, but only while the device is installed.

1.2 KEY WORDS

Alcohol interlock, recidivism, offender, DUI, DWI, alcohol, rehabilitation; driving under the influence; impaired driving; drink driving; alcohol ignition interlock; alcolock

1.3 ABSTRACT

For many years, drink-driving has posed a serious threat to road safety. That threat can be countered most efficiently by preventing drunk drivers from driving. An alcohol interlock can verify whether or not a driver's Blood Alcohol Concentration (BAC) is lower than the maximum threshold set by the legislator. If the driver's BAC exceeds that threshold, the vehicle will not start, and as a result prevents driving. In relevant studies, the recidivism rates are typically compared between offenders who had an alcohol interlock installed (experimental group) and those who did not (control group). Such a comparison can be carried out during the period while the device is installed and/or during a follow-up period after the device is removed. The results from a recent meta-analysis show that installing an alcohol interlock reduces recidivism risk by 75%. However, in a follow-up period after the alcohol interlock is removed, recidivism risk is only decreased by 7% compared to the control group. That difference is not statistically different from those who had not installed an alcohol interlock. A similar pattern of results also emerges from most recent studies. Alcohol interlocks do what they promise to do: while installed they reduce the risk on drink-driving. However, once removed the recidivism rates increase towards their initial level.

1.4 BACKGROUND

What is an alcohol interlock?

In short, an alcohol interlock is "a device installed in a vehicle that requires the driver to provide a breath sample every time an attempt is made to start" (Silverans et al., 2006, p. 10). The alcohol interlocks have four key elements: 1)"a breath alcohol sensor in the vehicle (and a control unit under the bonnet) that records the driver's blood alcohol concentration (BAC) and can be set to provide a warning if any alcohol is detected and [...] that recommends the vehicle not to start if the BAC exceeds a certain threshold"; 2) "a rolling retest system, which requires at least one retest after the vehicle is underway, but in most applications a retest is required every 20 to 30 minutes while driving (the purpose of the retests is to prevent a non-driver from starting the vehicle for a person who has been drinking and also to prevent drinking once the vehicle is underway); 3) a tamper-proof system for mounting the engine part of the unit, [...] along with a system to detect hotwiring or other means that bypass the interlock; and 4) a data-recording system that logs the BAC results, test compliance and engine operation, and creates a record to ensure that the offender is actually using

the vehicle as expected and not simply parking it while driving with another vehicle" (Marques & Voas, 2010, p.1).

Besides the device installed in the vehicles, the offenders are also participating in accompanying rehabilitation programs. These rehabilitation programs ideally combine therapy, education, sanctions and supervision measures (Houwing, 2016). The specific implementation of such measures depends on the legal framework of the concerned countries. Such rehabilitation programs are effective in reducing recidivism in drunk drivers[1] and can be combined with an alcohol interlock. However, when combining both measures the rehabilitation program should fit the offender's need very well in order to be effective (Boets, et al., 2008) as is explained in more detail below.

How does an alcohol interlock affect road safety?

About 25% of all lethal accidents in Europe are caused by drink driving (Houwing, 2016). It is clear that if these drivers were not allowed to take part in traffic, when their BAC exceeds a certain threshold, the roads would become safer. Indeed, in the Netherlands it is estimated that eight to ten road fatalities could be annually avoided if offenders with a BAC of 2.1‰ or more would participate in an alcohol interlock program which would prevent them from drink driving (SWOV, 2009). Four risk groups of drivers have been identified who have the highest risk of having an accident while driving under the influence of alcohol (Houwing, 2016). Of these groups, the group of re-offenders is of particular interest. Even when they have been caught drink driving and have been sentenced, they persist in that dangerous behaviour. The best way to protect other road users against this risk group of drivers is preventing them from driving while they are intoxicated. With the help of an alcohol interlock, these drivers could be excluded from traffic when attempting to drive while intoxicated (DWI). Rather than a withdrawal revocation of the driving licence, the offenders are allowed to drive when their BAC is below a certain threshold. By applying this method, the offenders are immediately punished for showing unacceptable behaviour (they will not be able to drive the car while intoxicated) and will be rewarded for showing positive behaviour (they will be able to drive the car when they are sober). An alcohol interlock program is not strictly limited to re-offenders, also first offenders can be included.

How is the effect of an alcohol interlock on road safety measured?

The most frequently used outcome measure to determine the effectivity of the alcohol interlock, is recidivism. Typically, two groups of DWI offenders are included: a (quasi) experimental group (i.e., drivers who had installed an alcohol interlock) and a control group (i.e., drivers without an alcohol interlock). The drivers in the control group are convicted to a classical sentence (e.g. paying a fine and/or revocation of the driving licence) in the same period. Recidivism can be measured during the time while the device is installed (e.g., Assailly & Cestac, 2014) or in a follow-up period after the alcohol interlock has been uninstalled (e.g., Voas et al., 2013). During the installation and/or during the follow-up period, the recidivism rates between both groups are compared.

1.5 OVERVIEW OF RESULTS

It is important to note that in earlier literature reviews, the effectiveness of the alcohol interlock has been demonstrated to reduce recidivism in drink driving, varying from 40 to 95%, while installed (e.g., Houwing, 2016; Silverans et al., 2006; Willis, Lybrand, & Bellamy, 2004).

The starting point for the present literature review is the most recent meta-analysis (Elder et al., 2011). Four more recent studies were included that were conducted after this meta-analysis. The results of the present review are in line with the findings described above: once the device is

[1] Slootmans, Martensen, Kluppels, Meesman (2017). Road Safety Decision Support System, developed by the H2020 project SafetyCube

installed, the risk on recidivism is drastically reduced compared to (matched) control groups but once the device is removed, the risk on recidivism is equally high in all groups.

2 Scientific details

2.1 GENERAL LITERATURE

As discussed above, there is consensus in the scientific literature that an alcohol interlock can improve road safety by reducing the risk of drink driving by 40 to 95% while installed. These conclusions are underlined in a recent meta-analysis (Elder et al., 2011); while the alcohol interlock is installed, there is lower recidivism risk compared to the control group. However, long-term effects are not evident.

Typically studies investigating the effect of alcohol interlocks refer to a certain point in time when a number of people are convicted for DWI. Some of them are sanctioned by an ordinary sanction (e.g., paying a fine, revocation of driving licence: control group), while others can install an alcohol interlock as alternative measure (experimental group). Due to ethical reasons, it is not possible to randomise the offenders to an experimental or control group. Therefore, a quasi-experimental design is typically chosen where the control group is matched to the experimental group to allow for comparison on number of factors (e.g., age, gender BAC level at arrest). The results should therefore be interpreted with caution: differences between the groups can be either due to pre-existing differences between the groups or by the effect of the installation of an alcohol interlock. Given the lack of random assignment to the two groups, matching techniques based on various criteria are the preferred statistical solution, to be able to measure effect of the alcohol interlock and to minimize pre-existing differences.

Modifying conditions

The following four remarks should be taken into account when interpreting the results. First, in general, in almost all studies the performance of the experimental group was compared to a matched control group. Almost no randomised experiments are conducted and therefore we need to carefully interpret the results in terms of transferability. The observed difference between the groups could be explained by pre-existing differences between the groups, however, as argued above such potential difference are thought to have a minimal effect on the observed difference between the groups.

Second In some studies, recidivism rates are compared between the groups while the alcohol interlock is installed (e.g., Assailly & Cestac, 2014) in other studies, however, the recidivism rates are compared after a follow-up period after the device was uninstalled (e.g., Voas et al., 2013).

Third, the educational component in every program also varies, but typically the BAC's while the alcohol interlock was installed are discussed with the offender. These conversations may help estimating whether or not the driver is eligible to have the alcohol interlock uninstalled. Given this diversity, it is difficult to compare the studies on a one-to-one basis. Last, the data in all the presented studies are based on official database records. Such databases only include the data of the people who actually were convicted and therefore do not represent the entire population of offenders (e.g., Nochajski & Stasiewicz, 2006). Despite that limitation, research based on the official data is faster, cheaper and contains more subjects compared to a survey among road users. Furthermore, the latter method is prone to socially desirable answers, especially when traffic re-offenders are questioned (Cavaiola, Strohmetz, & Abreo, 2007; Lajunen & Summala, 2003; Schell, Chan, & Morral, 2006). Applying such a method would probably result in underreporting of the actual behaviour.

2.2 METHODOLOGY

A systematic literature study was conducted. The search strategy is explained in section 3.2 of this document. The most recent meta-analysis (Elder et al., 2011) was taken as starting point for our literature search. Although the paper was published in 2011, only papers published until January 2008 were included. Only four additional papers met our prior set inclusion criteria (Assailly & Cestac, 2014; Ma, Byrne, Bhatti, & Elzohairy, 2016; Voas, Tippetts, Bergen, Grosz, & Marques, 2016; Voas et al., 2013). Table 1 provides an overview of the main characteristics of the coded studies. It should be noted that most of the (coded) studies on the effectiveness of the alcohol interlock were conducted in the United States of America.

Table 1
Selected papers and short description of the used study designs

Authors, Year, Country	Study type	Sample/Measurement	Analysis
Elder et al., 2011, (World)	Meta-analysis; systematic literature review	This paper provides a systematic review and meta-analysis of the literature on the effectiveness of the alcohol interlock in reducing alcohol-impaired driving. In short, their paper extends the systematic review of the literature that was conducted by the Cochrane Collaboration by adding more recent studies to that review and investigating the link between the installation of an alcohol interlock and (a reduction in) recidivism. A meta-analysis was conducted on nine prior studies in the Cochrane Collaboration review and four new studies were included. The included studies were mainly conducted in North America.	The decrease in recidivism is either expressed in a relative risk, a hazard rate (the time to recidivism based on survival analyses) or by displaying the percentage of recidivism for various groups of offenders.
Assaily & Cestac, 2014 (France)	Quasi-experimental design	Two groups of offenders were compared. Drivers were convicted between 2006 and 2011. Only 45 cases of recidivism observed.	Percentage recidivism reported in June 2012; 17 cases in the experimental group and 28 in the control group.
Ma et al., 2016 (Canada)	Quasi-experimental design	The paper presents a longitudinal study (2005 – 2014) of three groups of drivers and their recidivism rates between two experimental conditions and one control group. Eligible first offenders were included in the 'Reduced Suspension with ignition interlock Conduct Review' (RSCR) program and three streams were put together: Stream A (N = 4817) when they plead guilty within 90 days; Stream B (2244) when they plead guilty but after 90 days; the remaining offenders were included in Stream C (N = 2265), the control condition. Their recidivism rates were determined while the alcohol interlock was installed, during pre-trial (time between the offence and sentence) and during a follow-up period. The participants were matched on: age, gender, criminal code (of the law) and offence history.	No differences in recidivism were observed between streams a and b and the control group (stream c). Only 56 cases of recidivism were observed.
Voas et al., 2013, (USA)	Observational study	A longitudinal study was conducted evaluating the 'Administrative Reinstatement Interlock Program' (ARIP) in Florida that was implemented in 2002 until 2012 covering 120.000 drivers. No control group was included.	The recidivism rates during the time on the alcohol interlock were reviewed after six and 12 months. After the alcohol interlock was removed the recidivism rates were monitored.
Voas et al., 2016	Quasi-experimental	The paper discusses the	Survival analyses were conducted to

Authors, Year, Country	Study type	Sample/Measurement	Analysis
(USA)	design	effectiveness of the Florida alcohol interlock program (AUD) for the re-offenders who had been drink driving in the period between October 2010 and January 2013. The offenders in both groups had an alcohol interlock installed. The experimental group had three or more violations while the alcohol interlock was installed (i.e., lock-outs) and the comparison group had less than three violations. The comparison group was matched to the experimental group based on: demographics, prior DWI record and performance on the alcohol interlock.	compare both groups in terms of time to recidivism. Installation of an alcohol interlock led to 32% decrease in recidivism rates.

2.3 ANALYSIS AND RESULTS

Five studies were coded on the effects of the alcohol interlock with regard to (reducing) recidivism. Table 2 summarises the main results per paper.

In the 2004 SWOV factsheet[2] it is stated that: "Various international studies show 65-90% fewer re-offences for users of an alcohol interlock device than for drivers with a suspended or a revoked driving licence (Bax et al., 2001)". That finding is underlined by the literature review of the Cochrane Collaboration (Willis, Lybrand, & Bellamy, 2004) and the results of a 2006 literature review, financially supported by the European Commission[3]. The latter concluded that alcohol interlocks: "lead to 40-95% reductions in the rate of repeat driving under the influence (DUI) offences of convicted DUI offenders (ICADTS, International Council on Alcohol, Drugs and Traffic Safety, 2001). The recidivism rates of the offenders on the alcohol interlock programme are significantly smaller than in the control groups but only as long as the alcohol interlocks are installed" (Silverans et al., 2006, p. 10).
Elder and his colleagues (2011) conducted a meta-analysis on nine studies presented in the Cochrane Collaboration review. They concluded that the installation of an alcohol interlock decreased the risk on recidivism by 75% compared to the control group in the period that the device was installed. During the follow-up period (on average, 31 months; [21 months minimum, 48 months maximum], a non-significant decrease of 7% was observed between the experimental and group control group.

In addition to the conducted meta-analysis, Elder et al. (2011) included four more recent studies to the systematic literature review of the Cochrane Collaboration. They added three studies from the USA and one study from Sweden. In the USA studies it came to light that the installation of an alcohol interlock reduced the risk of drink driving by 65% among re-offenders (Roth, Voas, & Marques, 2007) and 61% for first offenders (Roth, Marques, & Voas, 2007). After the removal of the alcohol interlocks the risk on recidivism was only 9% and 18% lower than the control groups. In the other USA study no pre-and post-measures were administered but in general, the risk on recidivism decreased by 34% for all offenders and by 41% for re-offenders (DeYoung, Tashima, & Masten, 2005). These differences are statistically different from the control group. In the Swedish study none of the drivers in the experimental group recidivated during the follow-up period compared to 4.4% of the control group (Bjerre, 2005). The selection of drivers was, however, different from other studies. People were included who failed to comply with their alcohol treatment plan. That might explain why no difference between the groups is observed. It should be noted that rehabilitation courses are in general effective in preventing drink driving offences. [4] The alcohol interlock can be combined with such rehabilitation course (Silverans et al., 2006). That study revealed that the rehabilitation programs, combined with an alcohol interlock, should be fitted to the driver's needs in order to be successful (Boets, et al., 2008).

In the present synopsis we continued building on previous overview studies by adding four more recent studies to the overview of Elder and colleagues (2011). Two studies were conducted in Florida (Voas et al., 2016, 2013) and are in line with the previous findings. While the device was installed the recidivism rates varied between 0.55% and 1.20% (absolute percentage); those rates increased once the device was removed to 6.8% (Voas et al., 2013). In the most recent study, the risk on recidivism was reduced with 32% while the device was installed (Voas et al., 2016). The younger the drivers, the higher the risk on recidivism, for instance: drivers under the age of 25 were five times more likely to recidivate compared to drivers aged 55 or older. In the study by Ma and her colleagues (2016) only 56 cases of recidivism were observed in Canada that yielded no differences between the groups. The French study from Assailly and Cestac (2014) found no statistical difference between

[2] https://www.swov.nl/en/facts-figures/factsheet/alcohol-interlock-devices
[3] Alcoholock: Alcolock implementation in the European Union
[4] For a detailed overview, please refer to the synopsis by Slootmans, F.; Martensen, H.; Kluppels, L.; Meesmann, U. "Rehabilitation courses as alternative measure for drunk driving offenders".

both groups (10% vs. 12% recidivism for the experimental and control group). It should be noted that in the latter study 45 cases of recidivism were observed (17 cases in the experimental condition and 28 in the control condition). The small number of cases might explain why no statistical differences were observed between the groups.

It should be noted, that a new subfield of research is starting to emerge to better predict drink driving in the future by evaluating bio-markers that are indicative of heavy drinking (e.g., Bean et al., 2014; Kummer et al., 2016; Maenhout et al., 2014; Marques et al., 2014). Simply put, biomarkers are biological indicators that are visible in a subject's body and are caused by heavy drinking behaviour (i.e., four or more daily alcohol consumptions for males or three or more consumptions for females). One can distinguish direct and indirect markers (Bean et al., 2014). Direct markers can be found in the body after the alcohol has been metabolised (e.g., EtG: ethyl glucuronide). Indirect markers are residuals that can be found in the body and are caused by heavy drinking (e.g., gamma-glutamultransferase: GGT, a liver enzyme).[5] The research started in order to explain why the recidivism rates increased once the device was uninstalled (Marques et al., 2014). In the research on the effectiveness of an alcohol interlock on reducing recidivism, it was assumed that offenders in the experimental group would, in general, adapt their drinking behaviour resulting in drinking less alcohol than the control group (Marques et al., 2014). However, when indirect biomarkers are examined before the installation of the alcohol interlock and after eight months while the device was installed, no differences were observed in these indicators. It is therefore more likely to assume that an alcohol interlock does what it promised to do: it separates drinking and driving but does not lead to an overall decrease in drinking behaviour. These results might explain why a substantial number of offenders in the experimental group relapse after the device is removed: their drinking behaviour is not altered compared to when the offender was convicted. In other words, no learning effect is observed. As stated above an alcohol interlock can be combined with additional rehabilitation measures in order to increase its effectiveness for long term effects.[6] It might therefore be argued that bio-markers may be a better predictor in determining when it is 'safe' to remove the alcohol interlock. However, this research is still in its infancy and the researchers do not (yet) agree what indicators are most valid. Therefore this new subfield of research is included in this synopsis rather than in a separate synopsis because at this point there is much ambiguity in the equation.

[5] A helpful overview of various biomarkers is provided in Boets, et al. (2008, p.103-107).

[6] Slootmans, F.; Martensen, H.; Kluppels, L.; Meesmann, U. "Rehabilitation courses as alternative measure for drunk driving offenders".

Alcohol interlock

3 Supporting document

3.1 DESCRIPTION OF STUDIES

Meta-analysis

Based on a meta-analysis of nine international studies, Elder el al. (2011) found that an alcohol interlock can help to reduce recidivism by 75% for all offenders: first offenders and re-offenders during the installation period.

3.2 LITERATURE SEARCH

The search was conducted in Scopus and the TRID database. The search criteria are displayed in Table 3. After the search was completed, all duplicate papers from the two data sources were removed and the remaining papers were prioritised based on the title and the abstract. In general, we focused on the methods to determine the effectiveness of the alcohol interlock by which the implementation adds to improving road safety (i.e., in this case reducing recidivism). The following topics were excluded from our search:

- Way to measure/ detect/ assess alcohol/ drug consumption/ dependency/ sobriety;
- prevention of drink-driving in general (i.e., for primary prevention) [Only selected: Alcolock for offenders/recidivist, i.e., for secondary prevention];
- prevention programs (that are not focused on offenders/recidivists) / programs to reduce DUI;
- effects on the rehabilitation programs (e.g., on health-care (costs); on hospital care utilisation; and on sick leave);
- how to improve the effectiveness of rehabilitation programs;
- monitoring of identified offenders.

Table 2

Summary of the main effects of the (decreased) recidivism in the coded studies

Name authors and (country)	Type of offenders	Measure on the alcohol interlock	Relative decrease in risk on recidivism (%)	Effects on road safety
Elder et al., 2011, (World)	All offenders	During installation	75%	↗
	All offenders	After installation	7%	–
	Re-offenders	During installation	65%	↗
	First offenders	During installation	61%	↗
	All offenders	After installation	32%	↗
	Re-offenders	After installation	41%	↗
	All offenders	During installation	100%	↗
	Re-offenders	After installation	1.8% recidivism rates	?
Assaily & Cestac, 2014 (France)	All offenders	During installation	10% recidivism (alcohol interlock) vs. 12% (control group)	?
	All offenders	Before installation	13% recidivism (alcohol interlock) vs. 35% (control)	?
Ma et al., 2016 (Canada)	First offenders	After installation	/	– (only 56 cases of recidivism in a short period of follow-up which might explain why no effect was found
Voas et al., 2013, (USA)	All offenders	During installation (6 months)	0.6% recidivism	– (no control group)
	All offenders	During installation (12 months)	1.2% recidivism	– (no control group)
	All offenders	After installation	3.6% recidivism	– (no control group)
	All offenders	After installation	6.8% recidivism	– (no control group)
Voas et al., 2016 (USA)	Re-offenders	After installation	32%	↗

Note: ↗ is indicative for a significant positive effect on road safety
↘ is indicative for a significant negative effect on road safety
– is indicative for a non-significant negative effect on road safety
? is indicative for an unknown effect on road safety

Table 3

Search strategy for the systematic literature review

	SCOPUS		
	search no.	**search terms / operators / combined queries**	**hits**
Rehabilitation	#1	(TITLE-ABS-KEY ("Alcohol ignition interlock*" OR "Alcohol interlock*" OR "ignition interlock*" OR "Alcohol ignition") AND TITLE-ABS-KEY (training* OR course* OR program* OR rehabilitation OR "driver improvement" OR diagnostic OR "fitness to drive")) AND PUBYEAR > 1989	84
TRID database			
Rehabilitation	Not selected	(drunk* OR speed* OR drink* OR aggress* OR offender* OR offense* OR recidivis* OR alcohol OR drug* OR intoxicated OR "driving under the influence" OR "Alcohol ignition interlock*" OR "Alcohol interlock*" OR "ignition interlock*" OR "Alcohol ignition") AND (rehabilitation OR program*)	12,627
	#2	("Alcohol ignition interlock*" OR "Alcohol interlock*" OR "ignition interlock*" OR "Alcohol ignition") AND (training* OR course* OR program* OR rehabilitation OR "driver improvement" OR diagnostic OR "fitness to drive")	269
	Note: Limitations/ Exclusions: • Search field: TITLE-ABS-KEY or TITLE • Published: 1990 to current • Document Type: ALL		

The total selection contained 72 papers in which young drivers and/or young offenders were underrepresented. Therefore, the group of young offenders was merged with the general group of offenders. A recent meta-analysis (Elder et al., 2011) was taken as starting point for the inclusion of more recent papers. This analysis included studies which were published before January 2008. Therefore, the present literature research was limited to studies published after January 2008. The primary variable of interest in that review was recidivism during the installation of the alcohol interlock and/or after the alcohol interlock was removed from the vehicle. The hypothesis is that the installation of an alcohol interlock will prevent more intoxicated drivers from actually driving in traffic compared to the control group. The control group most often consists of a group of offenders who are also convicted for DWI, but in whose cars no alcohol interlock was installed. Based on the aforementioned criteria, a total of 17 more recent papers were selected. That selection was further narrowed down based on the following criteria (the number of *remaining* papers is displayed in brackets):

- the study needed to be published in a scientific journal (8);
- the full-text paper needed to be available (8);
- the study should (at least) have recidivism as (one of the) outcome measures (4); and
- needed to be relevant (4).

The study designs are displayed in Table 1 and the most important results are summarised in Table 2.

3.3 REFERENCES

Assailly, J. P., & Cestac, J. (2014). Alcohol interlocks and prevention of drunk-driving recidivism. *Revue Europeene de Psychologie Appliquee*, *64*, 141–149. https://doi.org/10.1016/j.erap.2014.03.002

Bean, P., Kay, B., Bean, J., Roska, C., Pearson, J., Garuz, C., & Hallinan, P. (2014). Recidivism risk of repeat intoxicated drivers monitored with alcohol biomarkers. *Alcoholism Treatment Quarterly*, *32*, 433–444. https://doi.org/http://dx.doi.org/10.1080/07347324.2014.950913

Bjerre, B. (2005). Primary and secondary prevention of drink driving by the use of alcolock device and program: Swedish experiences. *Accident Analysis & Prevention*. https://doi.org/10.1016/j.aap.2005.06.020

Boets, S., Meesmann, U., Klipp, S., Bukasa, B., Braun, E., Panosch, E., Wenninger, U., Roesner, S., Kraus, L. & Assailly, J-P. (2008). State of the Art on Driver Rehabilitation: Literature Analysis & Provider Survey. DRUID (Driving under the Influence of Drugs, Alcohol and Medicines). 6th Framework programme. Deliverable 5.1.1

Cavaiola, A. A., Strohmetz, D. B., & Abreo, S. D. (2007). Characteristics of DUI recidivists: A 12-year follow-up study of first time DUI offenders. *Addictive Behaviors*, *32*, 855–861. https://doi.org/10.1016/j.addbeh.2006.06.029

DeYoung, D. J., Tashima, H. N., & Masten, S. V. (2005). An evaluation of the effectiveness of ignition interlock in California. *Alcohol Ignition Interlock Devices—Volume II: Research, Policy, and Program Status 2005*, 42–52.

Elder, R. W., Voas, R. B., Beirness, D. J., Shults, R. A., Sleet, D. A., Nichols, J. L., … Task Force on Community Preventive Services. (2011). Effectiveness of ignition interlocks for preventing alcohol-impaired driving and alcohol-related crashes: a Community Guide systematic review. *American Journal of Preventive Medicine*, *40*, 362–376. https://doi.org/10.1016/j.amepre.2010.11.012

Houwing, S. (2016). *Alcohol interlock and drink driving rehabilitation in the European Union: Best practice and guidelines for Member Strates*. Brussels, European Transport Safety Council.

Kummer, N., Wille, S. M. R., Poll, A., Lambert, W. E. E., Samyn, N., & Stove, C. P. (2016). Quantification of EtG in hair, EtG and EtS in urine and PEth species in capillary dried blood spots to assess the alcohol consumption in driver's licence regranting cases. *Drug and Alcohol Dependence*, *165*, 191–197. https://doi.org/10.1016/j.drugalcdep.2016.06.012

Lajunen, T., & Summala, H. (2003). Can we trust self-reports of driving? Effects of impression management on driver behaviour questionnaire responses. *Transportation Research Part F: Traffic Psychology and Behaviour*, *6*, 97–107. https://doi.org/10.1016/S1369-8478(03)00008-1

Ma, T., Byrne, P. A., Bhatti, J. A., & Elzohairy, Y. (2016). Program design for incentivizing ignition interlock installation for alcohol-impaired drivers: The Ontario approach. *Accident Analysis & Prevention*, *95*, 27–32. https://doi.org/10.1016/j.aap.2016.06.011

Maenhout, T. M., Poll, A., Vermassen, T., De Buyzere, M. L., Delanghe, J. R., Maenhout, P., … Top, W. (2014). Usefulness of indirect alcohol biomarkers for predicting recidivism of drunk-driving among previously convicted drunk-driving offenders: Results from the Recidivism Of Alcohol-impaired Driving (ROAD) study. *Addiction*, *109*, 71–78. https://doi.org/10.1111/add.12372

Marques, P. R., Tippetts, a S., & Yegles, M. (2014). Ethylglucuronide in hair is a top predictor of impaired driving recidivism, alcohol dependence, and a key marker of the highest BAC interlock tests. *Traffic Injury Prevention*, *15*, 361–369. https://doi.org/10.1080/15389588.2013.824569

Marques, P. R., & Voas, R. B. (2010). *Key Features For Ignition Interlock Programs*. Washington DC.

Nochajski, T. H., & Stasiewicz, P. R. (2006). Relapse to driving under the influence (DUI): A review. *Clinical Psychology Review*, *26*, 179–195. https://doi.org/10.1016/j.cpr.2005.11.006

Roth, R., Marques, P., & Voas, R. B. (2007). New Mexico ignition interlock: laws, regulations, utilization, effectiveness, cost-effectiveness and fairness. In *Presentation to the 8th Annual Ignition Interlock Symposium, August 26-27*. Seatle, W.A.

Roth, R., Voas, R. B., & Marques, P. (2007). Mandatating interlocks for fully revoked offenders: the New Mexico experience. *Traffic Injury Prevention*, *8*, 20–25.

Schell, T. L., Chan, K. S., & Morral, A. R. (2006). Predicting DUI recidivism: Personality, attitudinal, and behavioral risk factors. *Drug and Alcohol Dependence*, *82*, 33–40. https://doi.org/10.1016/j.drugalcdep.2005.08.006

Silverans, P., Alvarez, J., Assum, T., Drevet, M., Evers, C., Hagman, R., & Mathijssen, R. (2006). *Deliverable D-2: Description , results and discussion of the alcolock field trial - Alcolock implementation in the European Union*. Brussels, Belgium.

SWOV. (2009). *Geschat effect op de verkeersveiligheid van een alcoholslotprogramma (ASP) en de kosten-batenverhouding ervan*. Leidschendam.

Voas, R. B., Tippetts, A. S., Bergen, G., Grosz, M., & Marques, P. (2016). Mandating Treatment Based on Interlock Performance: Evidence for Effectiveness. *Alcoholism: Clinical and Experimental Research*, *40*, 1953–1960. https://doi.org/10.1111/acer.13149

Voas, R. B., Tippetts, A. S., & Grosz, M. (2013). Administrative reinstatement interlock programs: Florida, a 10-year study. *Alcoholism: Clinical and Experimental Research*, *37*, 1243–1251. https://doi.org/10.1111/acer.12078

Willis, C., Lybrand, S., & Bellamy, N. (2004). Alcohol ignition interlock programmes for reducing drink driving recidivism. *Cochrane Database of Systematic Reviews*, (3). https://doi.org/10.1002/14651858.CD004168.pub2