Licence suspension

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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 <u>a *quantitative effect estimate,*</u> 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

Goldenbeld, Ch., July 2017

1.1   COLOUR CODE: GREEN

Studies indicate that licence suspension (or licence revocation) is an effective measure for reducing violations and crashes of (repeat) offenders.

1.2   KEY WORDS

Licence suspension, licence revocation, licence disqualification, licence withdrawal, recidivism.

1.3   ABSTRACT

In most countries, a licence suspension means a temporary withdrawal of the privilege to drive a motorised vehicle. Most often after a fixed period of time and after fulfilling certain conditions (e.g. paying a fee, and/or participating in a rehabilitation programme), the driving privileges will be restored. There are two basic ways in which licence suspension may improve road safety. First, the threat of licence suspension may motivate drivers to improve their traffic behaviour and to abstain from risky driving. Second, licence suspension temporarily removes risky drivers from traffic. Studies indicate that licence suspension (and also licence revocation) is effective in reducing crashes and violations of repeat offenders. A 2004 meta-analysis estimated that licence suspension or revocation measures reduce crashes and violations of suspended offenders by 17% and 21% respectively. A 2009 meta-analysis indicated that administrative licence suspension laws reduce all fatal accidents by 4%. It should be added that for specific groups of offenders, such as drink-drivers, other sanction measures, in particular the alcohol-interlock measure, is likely to produce larger road safety benefits than licence suspension. Also, the combination of licence suspension and other measures, such as rehabilitation programmes or vehicle impoundment, is likely to perform better than licence suspension as a single measure.

1.4   BACKGROUND

What is licence suspension?

In most countries, a licence suspension means a temporary withdrawal of the privilege to drive a motorised vehicle. Most often after a fixed period of time and after fulfilling certain conditions (e.g. paying a fee, and/ or participating in a rehabilitation program), the driving privileges will be restored. Licence suspension is distinct from licence revocation. Under licence revocation, the privilege to drive is factually ended. Revocation of the licence applies for a minimum period set by law, until the driver becomes eligible to apply for a new licence. In most countries the driver then needs to retake a driver's licence examination (or prove in some other way that he or she is competent to drive again).

How does licence suspension affect road safety?

There are two basic ways in which licence suspension (or revocation) may improve road safety. First, the threat of licence suspension may motivate drivers to improve their traffic behaviour and to abstain from risky driving. Second, the actual imposition of licence suspension temporarily removes risky drivers from traffic.

What are the reasons for having a suspended licence?

In most countries drivers will have their licence suspended after having once or repeatedly engaged in particularly risky driving behaviour such as drinking and driving, drugged driving, aggressive driving, high speed driving, and driving which leads to a crash. However, licence suspensions are not exclusive to traffic or driving offences. There may be also medical reasons for licence suspensions. In the USA, it is frequently the case that the suspension is not directly tied to a traffic conviction but to a failure to pay the costs associated with it.

Which factors influence the effect of licence suspension?

The effectiveness of licence suspension(or revocation) in reducing repeat violations depends upon:
- the perceived probability of detection of unlicensed driving: the higher the probability, the more effective licence suspension is,
- the presence of additional measures: licence suspension in combination with other motivating measures, such as rehabilitation programs or vehicle impoundment, is likely to perform better than licence suspension as a single measure,
- licence sanction certainty: for drinking/driving offenders increasing the certainty of licence suspension (or revocation) by implementing an administrative law procedure that automatically suspends or revokes a licence when certain conditions are fulfilled, has been shown to further reduce recidivism,
- licence sanction severity: there is some evidence that more severe licence suspensions/ revocations deliver worse recidivism results than less severe sanctions,
- social and economic conditions: drivers will be tempted to ignore licence suspension when social and economic conditions raise the need for driving.

Are there alternatives for licence suspension?

For drink- drivers, the alcohol interlock measure is an alternative that will outperform license suspension in terms of reduction of drinking and driving recidivism. The alcohol interlock measures requires convicted drink- drivers to install an alcohol interlock device in their car. This is an alcohol tester which is connected to the start-up mechanism of the car; it acts as a vehicle immobiliser if the driver has not passed the breath alcohol test. Various international studies show 65-90% fewer repeat offences for users of an alcohol interlock device than for drivers with a suspended or a revoked driving licence (Bax et al., 2001).

How is the effect of licence suspensions on road safety measured?

The effects of licence suspension(/revocation) on road safety have been measured in terms of change in:
- crash rates before/ after licence suspension, and
- violation rates before/ after licence suspension.

1.5   MAIN RESULTS

- A 2004 meta-analysis indicated that licence suspension/revocation measures reduced crashes and violations of suspended offenders by 17%, respectively, 21%.
- A 2009 meta- analysis indicated that administrative licence suspension laws reduced all fatal accidents by 4%
- Administrative licence suspension (or revocation) for drink-drivers where suspension (or revocation) follows automatically after an offence satisfies pre-established criteria performs better than the standard regulation (i.e. decision by court).

- Less severe forms of licence sanctioning (e.g. lower length of suspension period, suspension instead of revocation) have proved to perform better for certain groups of offenders.

1.6   NOTES ON RESEARCH METHODS AND TRANSFERABILITY

The research on license suspension includes one meta-analysis, and several studies on large databases containing national or state offence statistics. Most of the research has concentrated on drinking drivers. In almost all research the recidivism rate is the dependent measure. Most of the research has been done in the USA which means that in interpreting results and transferring knowledge account has to be taken of the peculiarities of the USA justice system.

2 Scientific Overview

This scientific overview on the safety effect of licence suspension first describes knowledge from the general literature (Section 2.1), it then describes characteristics of coded studies (Section 2.2), and major results of the coded studies (Section 2.3) and it presents major conclusions from the literature and coded studies (Section 2.4).

2.1 GENERAL LITERATURE

General reviews

Between 1976 and 2002 38 USA states passed laws that provide for immediate administrative (i.e., pre-conviction) licence suspension upon failure to pass an alcohol breath test (Wagenaar & Maldonado-Molina, 2007). These administrative licence suspension laws were expected to have larger effects than laws that provide for licence suspension much later after conviction by the courts. In a time-series analysis, Wagenaar & Maldonado-Molina (2007) investigated the effects of these administrative licence suspension laws on 4 outcome measures of monthly fatal alcohol-related crash involvement (fatal crashes: 1. single-vehicle night time; 2. breath or blood alcohol concentration (BAC) between 0.01 to 0.07; 3. BAC between 0.08 and 0.14; 4. BAC ≥0.15 g/dL). In a time series analysis, it was estimated that the new administrative licence suspension laws resulted in reductions of 5% in low-BAC (BAC between 0.01 and 0.07) fatal crashes, 7% in medium-BAC fatal crashes (BAC between 0.08 and 0.14), and 4% in high-BAC fatal crashes (BAC ≥ 0.15).

An evaluation study of administrative licence suspension in Canada, Ontario, confirmed the above positive USA findings (Asbridge et al. (2009). On 29 November 1996, Ontario introduced an Administrative Driver's Licence Suspension (ADLS) law. This law stipulated that any driver charged with driving with a Blood Alcohol Concentration (BAC) over the legal limit of 80 mg% or failing to provide a breath sample would have his or her licence suspended for a 90-day period. Using an interrupted time-series analysis, Asbridge et al. (2009) estimated that the introduction of the new licence suspension law was associated with a reduction of 14.5% in the numbers of fatally injured drivers.

Elvik et al. (2009) reported positive accident effects of licence suspension as a measure for all drivers (crash reductions ranging from 2% decrease to 82%) and as a measure for drinking-and-driving (crash reductions ranging from 16% to 65% decrease for specific types accidents). The positive accident effects concerned the drivers whose licence had been suspended. Although many studies have found that many drivers with a suspended licence continue driving, the observed decrease in crash involvement may be due to reduced exposure, to more cautious driving or a combination of both (Masten & Peck, 2004; Elvik et al, 2009).

Elvik et al. (2009) reviewed the literature on licence suspension. The studies on licence suspension as a general measure were very heterogeneous regarding the groups of drivers and the time periods included in the studies. The studies on the specific effects of licence suspension on the safety of suspended drivers also differed very much in terms of time periods studied and the proportions of study periods in which the licences were actually suspended. Due to the large heterogeneity for these two groups of studies no meta-analysis was done. However, Elvik et al (2009) did perform a meta-analysis on the general accident effects of administrative licence suspension studies. Administrative licence suspension laws allow the police to suspend the licence of drivers who do not pass a BAC test without involving a court (Elvik et al., 2009). The meta-analysis used 12 studies (11 USA, 1 Canada; 1991-2007). According to the meta-analysis, the introduction of administrative

licence suspensions led to a significant 4% reduction in fatal accidents and a 8% reduction in alcohol-related fatal accidents.

Modifying conditions

The effectiveness of licence suspension(/revocation) depends upon several factors such as:
- the perceived probability of detection of unlicensed driving,
- the presence of additional measures ,
- sanction certainty,
- sanction severity,
- social and economic conditions of drivers whose license has been suspended.

Perceived detection probability:
According to general deterrence theory, the effectiveness of a sanction depends upon the probability of detection (Zaal, 1994). Many suspended drivers choose to drive whilst unlicensed because they perceive the probability of detection as low (Lenton et al., 2010).

Sanction certainty:
For drink-drive offenders, increasing the certainty of licence suspension(or revocation) by implementing an administrative law procedure that automatically suspends or revokes a licence when certain conditions are fulfilled has been shown to further reduce drinking and driving recidivism (Ma et al., 2015; Fell & Scherer, 2017; further discussed in Sections 2.2 and 2.3)

Sanction severity:
The most severe sanction is not necessarily the best sanction in terms of motivation to comply. Reducing the severity of some punishments can serve as an effective incentive for deterring offenders from committing further offences (Smith et al., 2015). In South Korea, the less severe 'licence suspension'-sanction led to lesser traffic violations and lesser at-fault crashes than the more severe 'licence revocation'-sanction (Kim et al., 2009; further described in see Sections 2.2, and 2.3). In Australia, longer periods of licence suspension led to increased recidivism (Moffat & Poynton, 2007, further described in Sections 2.2 and 2.3)

Presence of additional measures:
There is evidence that certain measures may increase the effects of licence suspension. The DRUID-experts conclude that the combination of licence suspension or withdrawal and treatment/ rehabilitation is more effective in terms of deterrence than licence suspension or withdrawal alone (Schulze et al., 2012). This holds true especially for addicted drivers and in cases of medicines misuse (Schulze et al, 2012). In Canada, Byrne et al. (2016) found that: 1. impoundment, or its threat, improved compliance with drinking and driving licence suspensions, and 2. addition of impoundment to licence suspension reduced drinking and driving recidivism.

Social and economic conditions:
Drivers may choose to drive whilst unlicensed as the social and economic costs of not driving can be high. In an interview study among suspended drivers by Lenton et al. (2010), employment and social factors were key themes emerging in respondents' accounts of driving whilst under licence suspension.

2.2   DESCRIPTION OF CODED STUDIES

Five (5) studies on the effects of licence suspension were coded, one of which was an international meta-analysis.

2004 meta-analysis

In a fixed effects meta-analysis of 35 USA studies on driver offender sanctions, of which 7 were studies on licence suspension/revocation, Masten & Peck (2004) examined the effect of licence suspension on crash and violation rate. The researchers also compared the effects of licence suspension to other offender interventions (warning letters, group meetings, individual meeting, probation, educational information material, contingent point reduction, licence extension).

Additional studies
In Australia, Moffat & Poynton (2007) studied the effectiveness of financial penalties and the length of licence suspension in reducing recidivism rates of convicted offenders. The study examined the history and subsequent reoffending of approximately 70,000 persons who received a court imposed fine for a driving offence between 1998 and 2000. In an attempt to control for selection bias in recidivism analysis, the researchers used Heckman 2-Step Model to simultaneously estimate two regression equations: a selection equation and an outcome (or recidivism) equation.

A South-Korean study (Kim et al., 2011) examined the differences in traffic violations and crashes between two administrative sanctions, licence revocation and licence suspension. The study compared the traffic violation records and at-fault crash occurrences between the suspension and revocation groups at 6, 12, and 18 months after the offenders regained their driving privileges.

Traffic offenders who were sentenced to licence revocation and received either of two administrative sanctions (licence suspension or revocation) between July 1, 2002, and June 30, 2003, were selected for the study. The study data of about 154,000 driving records in the two study years represent about 8.5% of all suspension or revocation records. Among the offenders, about 10% received a reduced sanction - licence suspension with the total penalty point reset to 110 - and the others received the originally sentenced sanction of licence revocation. The study employed analysis of covariance (ANCOVA) and the t-test for stratified samples to control for influential factors and used the police profiles of approximately 154,000 drivers in South Korea. 6 covariates (gender, age, driving experience, licence classification, and prior traffic violations, prior traffic crashes) were controlled for in ANCOVA. Three ANCOVA models, one for each of the three follow up periods (6, 12, and 18 months), were estimated.

In Ontario, Canada, Ma et al. (2015) examined the effect of administrative licence suspensions for drink- drivers on drinking and driving recidivism. The study period, covering the time between November 28, 1991 and November 28, 2001 was divided into quarterly bins of three-month duration. Analysis was conducted using an interrupted time series approach based on segmented Poisson/negative binomial regression. In a first analysis, the researchers examined recidivism in the 90-days immediately after the initial offence. In a second analysis, they attempted to examine recidivism in the post 90-day suspension/ pre-conviction period when an offender was legally allowed to drive, but the data proved to be insufficient to perform the second analysis.

In an analysis covering USA states, Fell & Scherer (2017) set out to determine the relationship of the suspension length of Administrative Licence Revocation (ALR) law to the prevalence of drink-drivers relative to sober drivers in fatal crashes, and to estimate the extent to which the relationship is associated to the general deterrent effect, compared to the specific deterrent effect of the law. The researchers compared the impact of ALR law implementation and ALR law suspension periods with the use of structural equation modelling techniques on state data. Four main outcome measures were computed from the Fatal Accident Reporting System (FARS) data for each year by state:
1. to measure the impact of the ALR law and suspension length on drink-driver fatal crashes, the researchers used alcohol positive cases (BAC ≥ 0.01) as the numerator and alcohol negative cases (BAC = 0.00) as the denominator.

2. to measure the effect of the ALR law and suspension length on intoxicated drivers in fatal crashes, the researchers used drivers with a BAC ≥ 0.08 as the numerator and drivers below a BAC < 0.08 as the denominator.
3. to measure the general deterrent effect of ALR suspension length, the researchers used alcohol positive cases in the numerator and alcohol negative cases as the denominator among drivers with no prior DWI convictions.
4. to measure the specific deterrent effect of the ALR suspension length, the researchers used cases in which alcohol positive drivers with a DWI conviction in the prior 3 years as the numerator and alcohol negative drivers with a prior DWI conviction in the prior 3 years as the denominator.

The analyses controlled for state mileage, state unemployment rate, state urban–rural mileage mix, state per-capita alcohol consumption, state population age distribution, and the presence of key alcohol safety laws and policies. According to the authors, no other prior study on administrative licence revocation has controlled for these specific factors.

2.3   RESULTS

5 studies on the effects of licence suspension were coded, one of which was an international meta-analysis. These studies provide evidence that licence suspension (and revocation) is an effective measure in reducing violation and crash rates.

Meta-analysis

In a meta-analysis on 7 USA studies, Masten & Peck found that licence suspension/revocation was significantly associated with a 17% decrease in crash rate and a 21% decrease in violation rate. Compared to other offender interventions (warning letters, group meetings, individual meeting, probation, educational information material, contingent point reduction, licence extension), licence suspension or revocation was by far the most effective strategy for reducing subsequent crash and violation rates. According to the authors, the major limitation of the meta-analysis concerned the existence of residual heterogeneity in the composite effect size clusters after stratifying the data by a number of significant moderator variables. Also, the study did not provide evidence on the effects of suspension beyond the term of the suspension. This latter issue was beyond the scope of the present meta-analysis.

Additional studies

In Australia, Moffat & Poynton (2007) examined whether the length of licence disqualification made any difference for recidivism. In 5 analyses (for 5 subgroups: low range, mid-range, high range alcohol offence, driving while disqualified, other driving offences) neither the length of licence disqualification nor the fine amount were significant predictors of the probability of returning to court. An exception to the above findings concerned persons convicted of speeding offences. For this offender group there was a significant, positive association between the length of licence disqualification and recidivism, indicating that a longer period of licence disqualification actually increased the probability of subsequent driving offending!

In South-Korea, Kim et al. (2011) compared traffic violation and at fault crashes between drivers under licence suspension and under licence revocation. They found that:
- the traffic violation rates of the revocation group were 7.2, 4.1, and 2.6 times higher than those of the suspension group for the follow-up at 6, 12, and 18 months respectively.
- for the three follow-up periods, the suspension group had significantly fewer recorded at-fault crashes.

In Canada, Ma et al. (2015) found administrative licence suspensions effective in reducing drinking and driving recidivism. Drinking and driving recidivism occurring within the first 90 days after a drinking and driving offence (in this study: the offence categories s.253 and s.254 under the Criminal Code Canada) decreased by 65% after implementation, from 2.45 to 0.82 re-offending drivers per 100 offending drivers.

In an analysis on USA state data, Fell & Scherer (2017) found the following effects of Administrative Licence Revocation (ALR):
- The implementation of any ALR law (with any suspension length) was associated with a 13.1% decrease in the drink-/ nondrink-driver FARS but only a 1.8% decrease in the intoxicated/ non-intoxicated FARS ratio. Thus, the ALR law affects drink-drivers (BAC ≥0.01) substantially, but not intoxicated drivers (BAC ≥0.08).
- With regard to ALR suspension length, even a short suspension period of 1 to 30 days had a significant effect (p < 0.001) compared to having no ALR law. However, suspension periods of 31 to 90 days proved to be no better than periods of 1 to 30 days. States with ALR suspension periods of 91 to 180 days were significantly better (p < 0.001) than states with suspension periods of 1 to 90 days, as were the three states with suspension periods greater than 180 days compared to states with lower suspension lengths of 1 to 180 days.
- Effects on deterrence: There was evidence for a strong general deterrent effect: ALR suspension length was associated with a 4.4% decrease in FARS ratios of drivers without prior DWIs; the specific deterrent effect however was non-significant.

Both findings from Moffat & Poynton (2007), and from Kim et al. (2011) suggest that a less severe licence sanction (e.g. a lower time period for licence disqualification; or a licence suspension instead of revocation) may be more effective at reducing recidivism than the more severe sanction.

2.4   MAIN CONCLUSIONS

On the basis of the reviewed evidence (general literature and coded studies) the following can be concluded:
- License suspension(or revocation) is an effective measure to reduce violations and crashes. A 2004 meta-analysis indicated that license suspension or revocation measures reduced crashes and violations by 17% and 21% respectively.
- Administrative licence suspension (or revocation) for drink-drivers where suspension (or revocation) follows automatically after an offence and satisfies pre-established criteria performs better than the standard regulation.
- Less severe forms of licence sanctioning (e.g. lower length of disqualification, suspension instead of revocation) have proved to perform better for certain groups of offenders.
- For drink-drivers, other measures such an alcohol-interlock program will likely perform better in reducing recidivism than suspension.
- Although licence suspension is an effective measure there is no proof that its effects outlast the period of suspension itself.
- Licence suspension may perform better if it is combined with additional measures, such as rehabilitation and vehicle impoundment programs.

3   Supporting document

This Supporting Document on licence suspension describes the literature search strategy (Section 3.1), presents in tables the main characteristics and results of the 5 coded studies (Section 3.2) and presents references on coded studies and general references (Section 3.3).

3.1   LITERATURE SEARCH

The literature on licence suspension and traffic risk was searched for in the international database Scopus on May 31 2017. Scopus is the largest international peer-reviewed database. Table 1 describes the search terms and logical operators and the number of hits for the literature search.

Table 1: Used search terms and logical operators

No	Search terms/logical operators/combined queries	hits
1	(TITLE-ABS-KEY ("licence suspension" OR "licence revocation" OR "licence cancellation" OR "licence disqualification") AND TITLE-ABS-KEY (driver OR driving))	187

The search resulted in 187 hits. In a first screening round, these 187 references were screened on potential relevance for coding based on title. The main exclusion criteria were: no effects of licence suspension studied, not available in English language, duplication, general review like text instead of specific study. Also references were screened for additional studies. A lot of studies identified by keywords were not directly concerned with effects of licence suspension but were about suspension for age-related or medical reasons, about effectiveness of alcohol-interlock program, effectiveness of drink-driving enforcement or about effects of new BAC-laws. Table 2 shows the initial selection of studies after the first screening round.

Table 2: Initial selection of studies after the first screening round

Selection steps	Not selected first round	Selected first round
Excluded: No actual effect of licence suspension on safety-related outcome (violations/crashes) studied	163	
Excluded : Duplication	1	
Excluded: General review-like text	4	
Excluded: Non-English	6	
Selected after initial screening		13
Added after screening references (Moffat & Poynton)		1
Total selected after first round		14

The 14 selected studies were further screened on relevance for coding in a second screening round. In the second round the same criteria were used but now the full-text copies of the papers were

checked. Table 3 presents the results of this second screening round and describes the final decisions.

Table 3: Selection of studies to be coded in second screening round

	Reference	Relevant	Coded
1	Asbridge, M., Mann, R.E., Smart, R.G., Stoduto, G., Beirness, D., Lamble, R., & Vingilis, E. (2009). The effects of Ontario's administrative driver's licence suspension law on total driver fatalities: A multiple time series analysis. Drugs: Education, Prevention and Policy, 16 , 140-151.	Yes but retrieved very late	No
2	Byrne, P.A., Ma, T., & Elzohairy, Y. (2016). Vehicle impoundments improve drinking and driving licence suspension outcomes: Large-scale evidence from Ontario. Accident Analysis and Prevention, 95, 125-131.	No licence suspension only outcome measure	No
3	Chang, H.-L., Woo, T.H., Tseng, C.-M., & Tseng, I.-Y. (2011). Driving behaviors and accident risk under lifetime license revocation. Accident Analysis and Prevention, 43 , 1385-1391.	No	No
4	Fell, J.C., & Scherer, M. (2017). Administrative license suspension: Does length of suspension matter? Traffic Injury Prevention, DOI: 10.1080/15389588.2017.1293257	Yes	Yes
5	Kim, K.S., Myeong, M.H., & Kweon, Y.-J. (2011). Differences in traffic violations and at-fault crashes between license suspension and revocation. Accident Analysis and Prevention, 43, 755-761.	Yes	Yes
6	Lenton, S., Fetherston, J., & Cercarelli, R. (2010). Recidivist drink drivers' self-reported reasons for driving whilst unlicensed-A qualitative analysis. Accident Analysis and Prevention, 42, 637-644.	No direct effect of licence suspension studied	No
7	Ma, T., Byrne, P.A., Haya, M., & Elzohairy, Y. (2015). Working in tandem: The contribution of remedial programs and roadside licence suspensions to drinking and driving deterrence in Ontario (2015) Accident Analysis and Prevention, 85, 248-256.	Yes	Yes
8	Masten, S.V. & Peck, R.C. (2004). Problem driver remediation; A meta-analysis of the driver improvement literature. Journal of Safety Research, 35, 403-425.	Yes	Yes
9	Moffat, S., & Poynton, S (2007). The deterrent effect of higher fines on recidivism: Driving offenses. Sydney: The NSW Bureau of Crime Statistics.	Yes	Yes
10	Parrish, K.E., & Masten, S.V. (2015). The Problem of Suspended and Revoked Drivers Who Avoid Detection at Checkpoints. Traffic Injury Prevention, 16, 97-103.	No direct effects of licence suspension studied	No
11	Suo, Q. (2015). Investigation on Deterrence Effect of Legal Punishment Measures on Driving After Drinking in Chongqing, China (2015) Traffic Injury Prevention, 16 , 540-544.	No direct effect of licence suspension studied	No
12	Tseng, C.-M., Chang, H.-L., & Woo, T.H. (2013). Modeling motivation and habit in driving behavior under lifetime driver's license revocation (2013) Accident Analysis and Prevention, 51, 260-267.	No direct effects of licence suspension studied	No
13	Williams, R.L., Hagen, R.E., & McConnell, E.J. (1984). A survey of	Study was concerned with continued	No

	suspension and revocation effects on the drinking-driving offender (1984) Accident Analysis and Prevention, 16, 339-350.	driving under suspension but it did not concern effects on recidivism	
14	Wagenaar, A.C., & Maldonado-Molina, M.M. (2007). Effects of drivers' license suspension policies on alcohol-related crash involvement: Long-term follow-up in forty-six states. Alcoholism: Clinical and Experimental Research, 31 (8), 1399-1406	Yes, but retrieved too late	No

3.2 CHARACTERITISCS AND RESULTS CODED STUDIES

Table 4 presents an overview of the main characteristics of the coded studies.

Table 4: Overview of main characteristics of coded studies of the effects of licence suspension(/revocation)

Author, Year, Country	Study type	Sample/Measurement	Analysis
Masten, 2004, USA	Meta-analysis	7 USA studies concerning licence suspension or revocation measures	Fixed effects meta-analysis
Moffat, 2007, Australia	Recidivism analysis on offender database	The study examined the history and subsequent reoffending of approx. 70,000 persons who received a court imposed fine for a driving offence between 1998 and 2000.This included drink-driving (low-range, mid-range and high-range prescribed concentration of alcohol offences), driving whilst disqualified, speeding and 'other driving' offences.	The study attempted to control for selection bias in recidivism analyses by simultaneously estimating 2 regression equations (a selection equation and an outcome (or recidivism) equation) by the Heckman 2-Step Model. The main outcome measure in the study was recidivism: a count variable indicating the number of reappearances before the court for any new driving offences within five years of their reference offence being determined.
Kim, 2011, South Korea	This study examined the differences in traffic violations and crashes between 2 administrative sanctions, licence revocation and licence suspension.	The study compared traffic violation records and at-fault crash occurrences between the suspension and revocation groups at 6, 12, and 18 months after the offenders regained their driving privileges. Offenders who were sentenced to licence revocation and received either of two administrative sanctions (licence suspension or revocation) between July 1, 2002, and June 30, 2003, were selected for the study. Traffic violation and crash records were extracted for the 18 months before the administrative sanctions were executed and for the 18 months after the licence of the offenders was restored. Other information such as age and gender of the offenders at the time of the sanctions; was also collected.	Two statistical methods were used to discern differences in the traffic violations and crashes between the suspension and revocation groups: ANCOVA and the t-test for stratified samples. In ANCOVA, gender, age, driving experience, licence type and prior traffic violations, prior traffic crashes were used as covariates. Both methods produced similar results.
Ma, 2017, Canada	Time-series analysis on effects of administrative licence suspensions for drink-drivers	This study examined the effect of administrative licence suspensions for drink-drivers on drinking and driving recidivism. The study period, covering the time between November 28, 1991 and November 28, 2001 was divided into quarterly bins of three-month duration.	Analysis was conducted using an interrupted time series approach based on segmented Poisson/negative binomial regression. The analysis examined recidivism in the 90-days immediately after the initial offence.
Fell, 2017, USA	Structural equation model study on state	4 main outcome measures were computed from FARS data for each year by state:	The researchers compared the impact of ALR law implementation and ALR

Author, Year, Country	Study type	Sample/Measurement	Analysis
	data	1. To measure the impact of the ALR law and suspension length on drinking driver fatal crashes, the researchers used alcohol positive cases (BAC ≥ 0.01) as the numerator and alcohol negative cases (BAC = 0.00) as the denominator. 2. To measure the effect of the ALR law and suspension length on intoxicated drivers in fatal crashes, the researchers used drivers with a BAC ≥ 0.08 as the numerator and drivers below a BAC < 0.08 as the denominator. 3. To measure the general deterrent effect of ALR suspension length, the researchers used alcohol positive cases in the numerator and alcohol negative cases as the denominator among drivers with no prior DWI convictions. 4. To measure the specific deterrent effect of the ALR suspension length, the researchers used cases in which alcohol positive drivers with a DWI conviction in the prior 3 years as the numerator and alcohol negative drivers with a prior DWI conviction in the prior 3 years as the denominator	law suspension periods with the use of structural equation modelling techniques on state data. The analyses controlled for state mileage, state unemployment rate, state urban–rural mileage mix, state per-capita alcohol consumption, state population age distribution, and the presence of key alcohol safety laws and policies. According to the authors, no other prior ALR study has controlled for these specific factors.

Table 5 presents an overview of main results per coded study.

Table 5: Results of coded studies on licence suspension (↙= expected decrease in road safety; ↗= expected increase in road safety; — = no expected effect on road safety).

Author, Year, Country	Measure	Offender group	Indicator	Expected effect on safety	Change indicator
Masten, 2004, USA	Licence suspension or revocation	All offenders	Crash rate	↗	17% decrease
			Violation rate	↗	21% decrease
Moffat 2007, Australia	Longer period of licence disqualification	Speed offenders	Probability of returning to court for a traffic offence	↙	A longer period of licence disqualification increased the probability of subsequent driving offending.
Kim, 2011, South Korea	Licence suspension (compared to licence revocation)	All offenders	Traffic violations 6 month follow-up	↗	7 times fewer violations
			Traffic violations 12 months follow-up	↗	4 times fewer violations
			Traffic violations 18 months follow up	↗	2.5 times fewer violations
			At-fault crashes 6 months follow-up	↗	2.4 times fewer crashes
			At-fault crashes 12 months follow-up	↗	2 times fewer crashes
			At fault-crashes 18 months follow-up	↗	1.5 times fewer crashes

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Author, Year, Country	Measure	Offender group	Indicator	Expected effect on safety	Change indicator
Ma, 2015, Canada	Administrative licence suspension	Drinking and driving offenders	Drinking and driving recidivism occurring within the first 90 days after an initial offence	↗	65% decrease recidivism rate
Fell, 2017, USA	Administrative licence revocation	Drink-drivers	Ratio drinking driver involved fatal crashes, operationalised as: alcohol positive cases (BAC ≥ 0.01) (numerator)/alcohol negative cases (BAC = 0.00) (denominator).	↗	13.3% decrease
			Ratio intoxicated drivers in fatal crashes, operationalised as: drivers with a BAC ≥ 0.08 (the numerator)/drivers below a BAC < 0.08 ((denominator).	↗	1.8% decrease
	Higher length of licence suspension	Drink-drivers	Ratio drink-driver involved fatal crashes, operationalised as: alcohol positive cases (BAC ≥ 0.01) (numerator)/alcohol negative cases (BAC = 0.00) (denominator).	↗	4.1% decrease
			Ratio intoxicated drivers in fatal crashes, operationalised as: drivers with a BAC ≥ 0.08 (the numerator)/drivers below a BAC < 0.08 ((denominator).	↗	0.7% decrease
			General deterrent effect operationalised as: alcohol positive cases (numerator)/alcohol negative cases (denominator) among drivers with no prior DWI convictions.	↗	4.4% decrease
			Specific deterrent effect operationalised as: cases in which alcohol positive drivers with a DWI conviction in the prior 3 years (numerator)/ alcohol negative drivers with a prior DWI conviction in the prior 3 years (denominator)	—	0.2% decrease (Not Significant)

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