The impact of safety measures on the re-offence and crash rates of drink-driving offenders in Victoria

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Abstract

Alcohol is a major factor in road deaths and serious injuries. In Victoria, between 2008 and 2013, 30% of drivers killed were involved in alcohol-related crashes. From the early 1980s Victoria progressively introduced a series of measures, such as driver licence cancellation and alcohol interlocks, to reduce the level of drink-driving on Victoria's roads. This project tracked drink-driving offenders to measure and understand their re-offence and road trauma involvement levels during and after periods of licensing and driving interventions. The methodology controlled for exposure by aggregating crashes and traffic violations within relevant categories (e.g. licence cancelled/relicensed/relicensing not sought) and calculated as rates 'per thousand person-years'. Inferential statistical techniques were used to compare crash and offence rates between control and treatment groups across three distinct time periods, which coincided with the introduction of new interventions. This paper focuses on the extent to which the Victorian drink-driving measures have been successful in reducing re-offending and road trauma involvement during and after periods of licence interventions. It was found that a licence cancellation/ban is an effective drink-driving countermeasure as it reduced drink-driving offending and drink-driving crashes. Interlocks also had a positive effect on drink-driving offences as they were reduced during the interlock period as well as for the entire intervention period. Possible drink-driving policy implications are briefly discussed.

Introduction

Drink-driving continues to be a serious and persistent problem in Victoria as in other highly motorised jurisdictions, as alcohol-related crashes result in substantial fatalities and injuries. Alcohol-related crashes are one of the leading causes of death on the roads with 32% of Victorian driver fatalities between 2008 and 2011 having a BAC over zero (28% of driver fatalities had an illegal BAC and 10% had a BAC over 0.2) (Coroners Prevention Unit, 2013). The gravity of the problem is reflected in the enormous amount of literature that has focused on the personal and economic cost of drink-driving, as well as the development and implementation of various countermeasures to reduce the prevalence of the offending behaviour. Of particular concern is the proportion of repeat drink-driving offenders. For example within Victoria 30% of detected drink-drivers had a previous drink-drive conviction (Boorman, 2012).

Countermeasures to address drink-driving vary across different jurisdictions, although licence disqualification has historically formed the foundation of many legislative responses to such offending behaviours. The application of licensing sanctions has consistently proven an effective general and specific deterrent (Peck, 1991; Ross, 1992). However, drink-drivers are not a homogeneous group (Nochajski & Wieczorek, 2000), as research has demonstrated that first time and repeat offenders often differ in both characteristics and treatment needs (Stewart, Boase, & Lamble, 2004). Consequently these groups display a tendency to respond differently to the application of sanctions (Ferguson, Sheehan, Davey, & Watson, 1999; Freeman, 2004). More specifically, sanctions in isolation appear to be less effective in reducing alcohol-impaired driving among “hard-core” repeat offenders (Hedlund & McCartt, 2002), and there is evidence that some repeat offenders may in fact be immune or impervious to the threat of legal sanctions (Freeman,

Liossis, & David, 2006). As a result, alcohol ignition interlocks are increasingly being combined with licence intervention in an effort to reduce the prevalence of re-offending, particularly among recidivist offenders. However, a common theme to emerge from the international literature is that while interlock devices are effective in preventing drink-driving recidivism while installed, re-offence rates are comparable between interlock and non-interlock drivers upon removal of the device (Willis, Lybrand, & Bellamy, 2004). Despite this, the utility of interlock devices to address the problem of drink-driving remains clearly apparent. As a result, policy makers are now varying the legislative use of interlock devices in an attempt to maximise the technology's ability to create lasting behaviour change.

In Victoria, such interventions have been progressively introduced over time. An examination of the impact of the approach on Victorian re-offence and crash rates was undertaken to asses the impact of such measures in the Victorian context. This examination is important to inform future policy development. More specifically, there is a need to accurately determine the impact of specific interventions not only on recidivism rates, but corresponding crash rates. In regards to the latter, there is a large body of literature that has demonstrated drink-drivers are disproportionately represented in crash statistics, particularly repeat offenders (Brown et al., 2002; Freeman et al., 2006; Hedlund & McCartt, 2002). Furthermore, there is a need to determine what may occur for convicted drink-drivers who elect not to install the interlock (e.g., the driver may drive unlicensed).

The current study involved an examination of a large sample of Victorian drink-drivers' responses to licence cancellation and interlocks in order to guide and inform future policies. This was achieved by examining whether these interventions influence offenders subsequent crash and re-offence rates. Therefore the study assesses the specific deterrence effects of these interventions in Victoria. Specifically, the research considered the impact of:

- Licence cancellation for drink-driving offenders before interlocks came into effect (1 January 1996 to 12 May 2002).
- Mandatory interlock fitment for repeat drink-drivers (13 May 2002 to 10 October 2006).
- Mandatory interlock fitment for repeat drink-drivers and drink-drivers with high BACs or younger drivers in the range greater than 0.07 BAC (11 October 2006 to 30 September 2014). It should be noted that for some low-range repeat offenders interlocks were discretionary.

Method

Drivers and riders convicted of a drink-driving offence (index offence) committed between 1 January 1996 and 30 September 2014 (inclusive) were considered eligible persons for analyses (N = 129,618). Data files relating to all offences (from 1 January 1986 to 30 September 2014), licence status changes, bans from driving, licence conditions, and driver and rider demographics were provided from the VicRoads Driver Licensing System (DLS). Data for the 10 years before the index offence were required to determine whether it was the first or repeat offence. The crash involvement file was provided from the VicRoads Road Crash Information System (RCIS).

The above changes were considered in relation to three time periods (stages) as outlined in the table below. These changes concern major legislation changes in Victorian drink-driving laws (e.g. introduction of interlocks). Offenders were assigned to groups as described in Table 1. It is noted that an interlock condition was not mandatory for all repeat offenders in Stage 3 (i.e., those with a low-range BAC). However, only those with an interlock condition applied were included in analyses relating to the interlock period. The results in this paper focus on drink-driving offences and drink-driving casualty crashes.

Table 1. Offender groups for analysis

Stage 1 **1 Jan 1996 to 12 May 2002** (N = 29,204)	**Stage 2** **13 May 2002 to 10 Oct 2006** (N = 37,143)	**Stage 3** **11 Oct 2006 to 30 Sept 2014** (N = 63,271)
Group A (N = 4,563) All drivers with an index drink-driving offence between 1 January 1996 and 12 May 2002 that had a prior drink-drive offence in the 10 years prior to the index offence (no interlocks)	**Group D** (N = 3,188) All drivers with an index drink-driving offence between 13 of May 2002 and 10 October 2006 that had prior drink-drive offence in the 10 years prior to the index offence (interlocks applied)	**Group G** (N = 8,662) All drivers with at least one drink-driving offence between 11 October 2006 and 30 September 2014 that had a prior drink-drive offence in the 10 years prior to the index offence (interlocks applied)
Group B (N = 8,713) All drivers with a drink-driving offence between 1 January 1996 and 12 May 2002 with a BAC >= 0.15 OR driver aged less than 25 or with a probationary licence with BAC > 0.07 and < 0.15 with no previous eligible offence in the 10 years prior to the index offence (no interlocks)	**Group E** (N = 9,155) All drivers with a drink-driving offence between 13 of May 2002 and 10 October 2006 with a BAC >= 0.15 OR driver aged less than 25 or with a probationary licence with BAC > 0.07 and < 0.15 with no previous eligible offence in the 10 years prior to the index offence (no interlocks)	**Group H** (N = 13,681) All drivers with a drink-driving offence between 11 October 2006 and 31 December 2013 with a BAC >= 0.15 OR driver aged less than 26 or with a probationary licence with BAC > 0.07 and < 0.15 with no previous drink-driving offence in the 10 years prior to the index offence (interlocks applied)
Group C (N = 15,928) All drivers with a drink-driving offence between 1st January 1996 and 12 May 2002 that do not fit into **A** or **B** (no interlocks)	**Group F** (N = 24,800) All drivers with a drink-driving offence between 13th of May 2002 and 10th October 2006 that do not fit into **D** or **E** (no interlocks)	**Group I** (N = 40,928) All drivers with a drink-driving offence between 11th October 2006 and 31st December 2013 that do not fit into **G** or **H** (no interlocks)

The analyses were conducted in three phases.

Phase 1 - Crash and offence rates during and after licence cancellation (Stage 1 offenders)

This phase applied to Stage 1 offenders only, with a drink-driving offence between1 January 1996 and 12 May 2002. For all Stage 1 groups combined (A+B+C), crashes and drink-driving offences were aggregated within relevant licensing/intervention periods (licence ban/relicensed) and then calculated as offence and crash rates with the related metric of 'per thousand person-years' as the denominator (Siskind, 1996). Offence and crash rates were calculated for the period between the offence and the start of the licence ban; the licence ban period, the post-licence restoration period, and the post-ban unlicensed period (where re-licensing was not sought). In order to test the differences in rates across the different licence/intervention periods, rate ratios were calculated separately for drink-driving crash rates and drink-driving offence rates and compared.

Phase 2 - Mandatory interlocks for repeat drink-drivers (Stage 2 offenders)

As with Phase 1, the rates of offences and drink-driving crashes were calculated per thousand person-years for all the licence/intervention periods. In addition, rates for the period of interlock

condition and the post-interlock licence restoration period (after completion of an interlock condition) were also calculated for those offenders eligible for this condition. In order to evaluate the effectiveness of interlocks for repeat drink-drivers, treatment and control groups were identified as follows (Table 1):

- Pre-treatment group (Group A – repeat offenders no interlock)
- Post-treatment group (Group D – repeat offenders interlock)
- Pre-control group (Groups B and C – all other drink-drivers no interlock before change)
- Post-control group (Groups E and F – all other drink-drivers no interlock after change)

Rate ratios were calculated for the pre- and post-periods separately for the treatment and control groups for each licence intervention period and for the entire pre- and post-periods.

Phase 3 - Mandatory interlocks for drink-drivers with a BAC of equal to or greater than 0.15 - or less than 26 years for a probationary licence holder with BAC greater than 0.07 (Stage 3 offenders)

As with Phases 1 and 2, the rates of drink-driving offences and drink-driving crashes were calculated per thousand person-years for all the licence/intervention periods. In order to evaluate the effectiveness of interlocks for these high-range offenders, treatment and control groups were identified as follows (Table 1):

- Pre-treatment group (Group E – no interlock – before change)
- Post-treatment group (Group H – interlock – after change)
- Pre-control group – non-repeat (Group F – other offenders – no interlock – before change)
- Post-control group – non-repeat (Group I – other offenders – no interlock – after change)

Rate ratios were calculated comparing pre to post separately for the treatment and control groups for each licence/intervention period and for the entire pre and post periods.

Statistical significance testing

For the three phases, confidence intervals for each of the rate ratios were also calculated based on an alpha level of .05. Interpretations of statistically significant differences in rates were based on the confidence interval not including the value 1. For Phases 2 and 3, comparisons between the control rate ratios and the treatment rate ratios were completed using the difference in the log of the rate ratios and a Z-test for statistical significance. Note that for Phases 2 and 3 the specific effect of the interlock was analysed separately to the other licence intervention periods. Althought the analyses of the licence intervention periods analyse the period after the interlock, results are indicative of whether the licence cancellation and interlock regime work as whole package.

Results

Phase 1 - Crash and offence rates during and after licence cancellation

Stage 1 offenders had a statistically significantly lower rate of drink-driving offending during licence bans compared to the pre-licence ban and post-licence restoration periods by 70% and 47% respectively (Rate Ratio (RR) = 0.30 and 0.53 respectively). There was, however, no statistically significant difference in rates of drink-driving offending between the ban period and the unlicensed period (those who did not re-licence after cancellation) (RR = 1.05). The offending rates were statistically significantly lower during the unlicensed period compared to the post-licence restoration period by 44% (RR= 0.56). Finally, the post-licence restoration period had a statistically significantly lower rate of offending by 43% compared to the pre-licence ban period (RR = 0.57) (Table 2).

There was a statistically significantly lower rate of drink-driving crash involvement during licence bans compared to the pre-licence ban and post-licence restoration periods by 79% and 55% respectively (RRs = 0.21 and 0.45 respectively). There was, however, no statistically significant difference in rates of drink-driving crash involvement between the licence ban period and the unlicensed period (RR = 1.17). The drink-driving crash rates were statistically significantly lower during the (post ban) unlicensed period compared to the post-licence restoration period by 47% (RR = 0.53). Finally, the post-licence restoration period had a statistically significantly lower rate of drink-driving crash involvement compared to the pre-licence ban period by 53% (RR = 0.47) (Table 2).

Table 2: Offence rate ratios all Stage 1 groups

Comparison	Rate ratio (95% CI)	
	Drink-driving offences	Drink-driving crashes
Licence ban vs. Pre-licence ban	0.30* (0.27 – 0.33)	0.21* (0.15 – 0.30)
Licence ban vs. Post-licence restoration	0.53* (0.49 – 0.57)	0.45* (0.34 – 0.60)
Unlicensed vs. Licence ban	1.05 (0.92 – 1.21)	0.85 (0.50 – 1.47)
Unlicensed vs. Post-licence restoration	0.56* (0.49 – 0.63)	0.53* (0.32 – 0.86)
Post-licence restoration vs. Pre-licence ban	0.57* (0.53 – 0.62)	0.47* (0.35 – 0.62)

* Rate ratios statistically significant $p < .05$

Phase 2 - Mandatory interlocks and licence intervention periods for repeat drink-drivers

Effect of the interlock period

The interlock period was assessed with rate ratios by comparing post-treatment recidivists' (Group D) interlock period versus pre-treatment recidivists' (Group A) post-licence restoration period. This rate ratio was then compared to the rate ratio for pre- to post-control licence restoration period. The post-treatment recidivists had a statistically significantly lower (by 81%) drink-driving offence rate (RR = 0.19, 95% CI [0.10 – 0.35]) during their interlock period compared to the pre-treatment recidivists during their post-licence restoration period. For the pre- versus post-control licence restoration period, there were also statistically significant reductions for drink-driving offences (0.90, 10% reduction). However, this reduction was not to the same level as for the treatment groups ($Z = -4.88$, $p < .001$), indicating the interlock had been effective in reducing drink-driving offences. There were no drink-driving casualty crashes during the interlock period for the post-treatment recidivists, so the rate ratio was not able to be calculated.

Drink-driving offences for other licence intervention periods

For drink-driving offences (Figure 1), the rate decreased from pre- to post-treatment over the entire period by 12% (RR = 0.88, 95% CI [0.81 – 0.97]), but not in any specific licensing/intervention period. For the control groups, there were some statistically significant reductions from pre- to post-control, but none statistically significantly different from the pre- to post-treatment groups with the exception of the period between index offence and licence ban. For this period, there was a statistically significant 32% reduction for the pre- to post-controls (RR = 0.68, 95% CI [0.60 – 0.76]), but not for the pre- to post-treatment (RR = 0.97, 95% CI [0.76 – 1.25]) ($Z = 2.54$, $p = .011$). Therefore, the licence intervention periods did not have an effect on these offences.

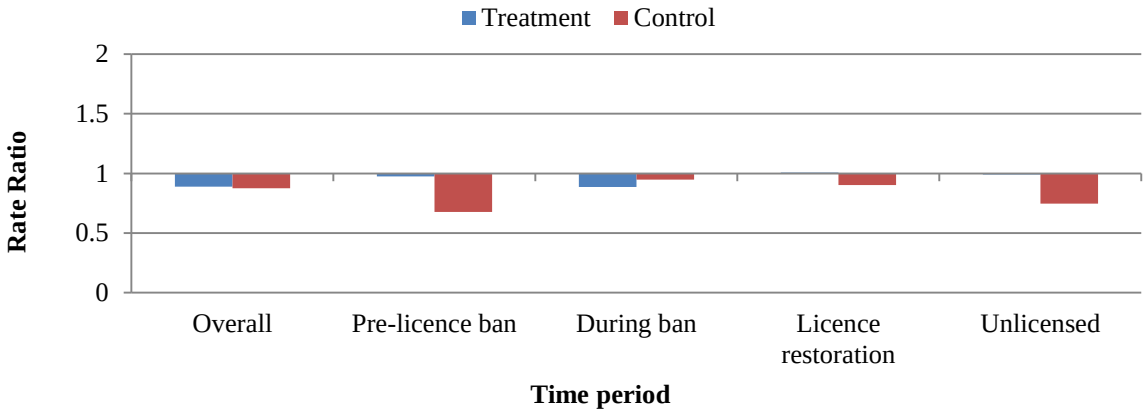

Figure 1. Rate ratios pre to post drink-driving offences for each period by treatment and control

Drink-driving casualty crashes for other licence intervention periods

The drink-driving (Figure 2) crash rates showed no statistically significant change from pre-treatment to post-treatment for recidivists with the exception of the entire stage reducing drink-driving casualty crashes by 44% (RR = 0.56, 95% CI [0.32 – 0.98]). However, there was also a similar level of reduction in this period from pre-control to post-control by 36% (RR = 0.64, 95% CI [0.53 – 0.76], Z = -.42, p = .674). Therefore, the licence intervention periods did not have an effect on these crashes.

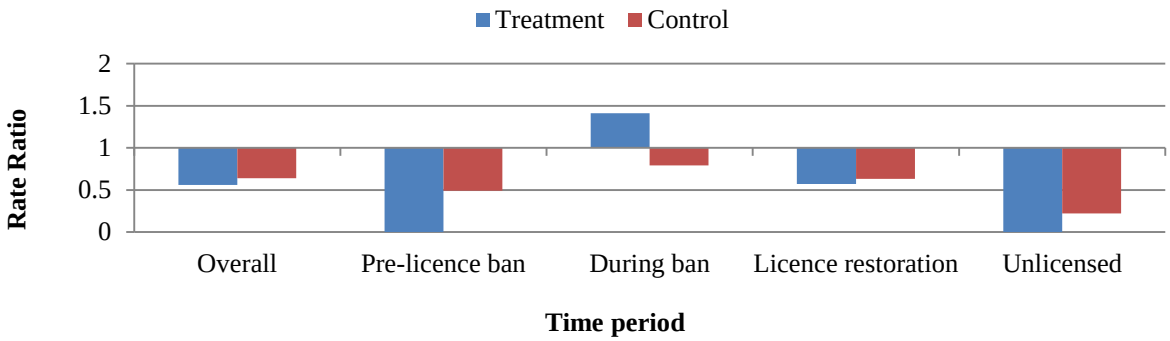

Figure 2: Rate ratios pre to post drink-driving casualty crashes for each period by treatment and control

Phase 3 - Mandatory interlocks and licence intervention periods for drink-drivers with a BAC of equal to or greater than 0.15 - or less than 26 years of age for a probationary licence holder with BAC greater than 0.07 (Stage 3)

Effect of the interlock period

The post-treatment group had statistically significantly lower drink driving offence (RR = 0.37, 63% lower) and drink driving crash rates (RR = 0.19, 81% lower) during their interlock period compared to the pre-treatment group during their post-licence restoration period**.** There was also a statistically significant reduction for drink-driving offences from pre- to post-control (RR = 0.64, 36% reduction). However, this reduction was not as large as those found for the treatment groups (Z = -7.07, p < .001), indicating a positive effect of the interlock condition. There was no statistically significant difference between treatment and control on the level of reduction for drink-driving crashes (Table 3). The small sample size for drink-driving casualty crashes may have resulted in insufficient power for a statistical significance, and therefore the results for crashes were inconclusive.

Table 3: Post-treatment (interlock period) versus pre-treatment (licence restoration) compared to post-control versus pre-control (licence restoration) crash and offence rates

	Post-treatment (interlock) vs. Pre-treatment (no interlock) (95% CI)	**Post-control (no interlock) vs. Pre-control (no interlock) (95% CI)**	**Statistical significance**
Drink-driving casualty crashes	0.19[1] (0.08 – 0.46)	0.38[1] (0.29 – 0.51)	Z = -1.46, p = .144
Drink-driving offences	0.37[1] (0.32 – 0.42)	0.64[1] (0.60 – 0.68)	Z = 7.07*, p < .001

*Statistically significant difference between treatment and control rate ratios (p < .05)
[1]Statistically significant rate ratios (post versus pre) (p < .05)

Drink-driving offences for other licence intervention periods

The rate of drink-driving offending (Figure 3) statistically significantly decreased by 38% overall (RR = 0.62, 95% CI [0.57 – 0.67]) and for the post-licence restoration period by 56% (RR = 0.44, 95% CI [0.40 – 0.49]) from pre-treatment to post-treatment (Groups E to H).

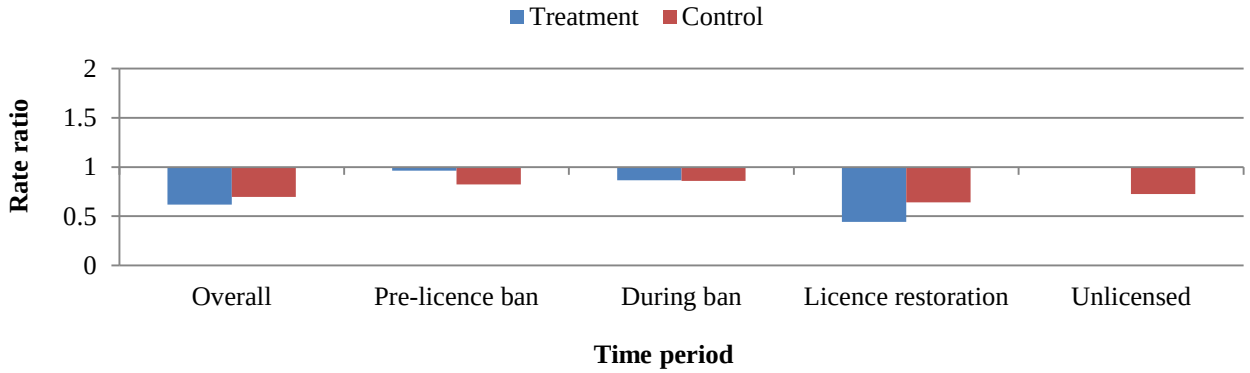

Figure 3: Rate ratios pre to post drink-driving offences for each period by treatment and control

There were no statistically significant reductions for any other period. While there were reductions from pre- to post-control (Groups F and I) for the post-licence restoration period by 36% (RR = 0.64, 95% CI [0.60 – 0.68]) and by 30% overall (RR = 0.70, 95% CI [0.66 – 0.73]), these reductions were not as large as those found for the treatment groups (Z = -6.38, p < .001 and Z = -2.57, p = .010 respectively), indicating that the licence intervention periods have been effective. The specific effect of the interlock, analysed in the same way as described above, is discussed below (Table 3).

Drink-driving casualty crashes for other licence intervention periods

The rate of drink-driving crashes (Figure 4) statistically significantly decreased by 66% overall (RR = 0.34, 95% CI [0.24 – 50]) and by 77% for the post-licence restoration period (RR = 0.23, 95% CI [0.14 – 0.36]) from pre-treatment to post-treatment. There were no statistically significant reductions for any other period. There were also statistically significant reductions from pre- and post-control by 62% for the post-licence restoration period (RR = 0.38, 95% CI [0.29 – 0.51]) and by 80% overall (RR = 0.20, 95% CI [0.16 – 0.25]), and this reduction was greater than the reduction for the treatment groups (Z = 5.18, p < .001). Therefore the licence intervention periods had no effect on drink-driving casualty crashes.

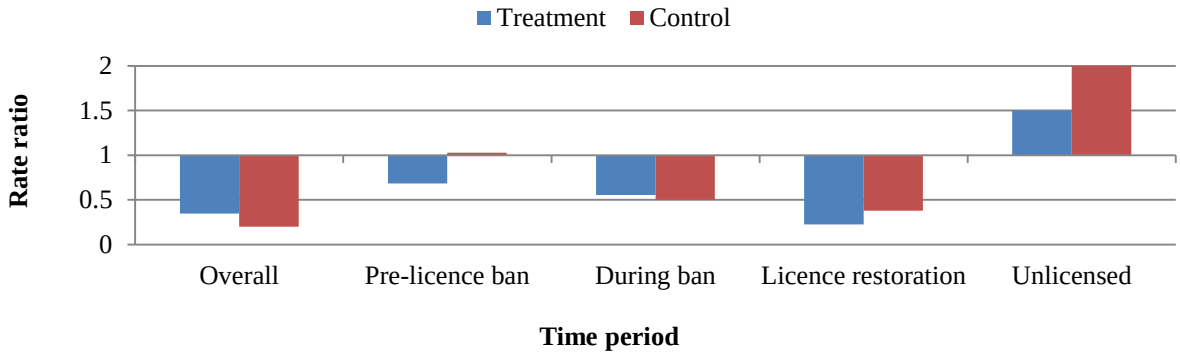

Figure 4: Rate ratios pre to post drink-driving crashes for each period by treatment and control

Discussion and Implications

The aim of this paper was to determine drink-driving casualty crash and offence rates during and after licence cancellation and/or an interlock condition. Given some evidence that licence disqualification in isolation may not prevent drink-driving recidivism among repeat or high-range offenders (Ahlin, Rauch, Zador, Baum, & Duncan, 2002; Freeman et al., 2006), sanctions have more recently been increasingly combined with interlock installation (Bailey, Lindsay, & Royals, 2013).

Results of Phase 1 of this study suggest that licence bans had a positive road safety effect while drivers were disqualified from driving, with reductions of up to 70% observed in drink-driving offences and up to 79% reductions in drink-driving casualty crashes while they were banned. This finding is consistent with a large body of research that has generally demonstrated licence disqualification periods to be one of the most effective methods for reducing further drink-driving offences (Jones & Lacey, 1991; McArthur & Kraus, 1999; Nichais & Ross, 1991; Peck, 1991). Additionally, evidence emerged that indicated licence bans had an on-going positive impact once offenders were re-licensed, with post-ban offending rates being lower than the rates prior to the ban. This is again consistent with previous research that has demonstrated licence bans have a specific deterrent effect (Homel, 1988; Siskind, 1996). There was evidence that some individuals offended even while on a ban. That is, they were detected drink-driving while unlicensed, demonstrating that licence ban does not have the desired impact on some individuals. This is again consistent with research that has reported unlicensed driving is often combined with other illegal behaviours such as drink-driving (Watson, 2004).

A key finding to emerge from the study was that the highest rate of drink-driving offences and drink-driving casualty crashes was actually during the period between being detected by police (the index offence) and the commencement of the licence ban. That is, the group were most likely to drink and drive after they had been apprehended by the police, but had yet to attend court and/or receive a licence ban. This finding has clear implications in regards to immediate licence loss at the time of offence for all drink-driving offenders.

Encouragingly, and consistent with previous research (Bailey et al., 2013), Phase 2 and 3 analyses found that interlock conditions had a positive effect. That is, a statistically significantly lower rate of drink-driving offending for the interlock period was evident for those who received an interlock condition for repeat drink-drivers and for a higher level BAC first time offence and young drink drivers. This can be considered to represent either a treatment effect (whereby offenders decide to change their drinking and driving behaviours) or an incapacitatory effect (which is associated with being unable to start a vehicle once the driver has been drinking). Overseas research suggests that interlocks are effective in incapacitating or restricting individuals from drink-driving whilst installed in the vehicle, but the device appears to provide few long-term benefits as post-interlock

recidivism rates are similar to those of control groups (Elder et al., 2011; Frank, Raub, Lucke, & Wark, 2002). For the current study, however, a legislative change that required high BAC offenders to install an interlock, resulted in a reduction in subsequent drink-driving offences even after the interlock condition was completed. This result again confirms the positive road safety effect of interlocks in regards to reducing the likelihood of drink-driving and provides some suggestion of long-term benefits for using interlocks with all repeat and first-time high range offenders.

For crashes, it is noted that an overall reduction in drink-driving casualty crashes across the entire licence/intervention period was identified for both the treatment (e.g., recidivist and high BAC interlock groups) and control groups. While a general reduction is positive, it is not specifically related to the interlock condition as the reduction was similar for both treatment and control groups. This finding is somewhat inconsistent with a small body of research that has demonstrated interlock installation has a positive effect on crash reduction (Bjerre, 2005). However, it should also be noted that because crashes are relatively rare events, it sometimes difficult to detect effects due to lack of power. Also, some offenders most likely did not install the required interlock, and thus, they may have chosen to drive more safely (and less often) as a result of being disqualified from driving. It is noteworthy that research has demonstrated a proportion of suspended drink-driving offenders may continue to drive without a licence or insurance (McCartt, Geary, & Berning, 2003).

In terms of policy development in this area, it may be worth considering requiring offenders to undergo a drink-driving related intervention or other effective alcohol treatment program, especially for those with alcohol dependence. It is also possible to consider applying a brief intervention to such offenders whilst they await their court date. Brief interventions are a treatment approach that aim to change behaviour by motivating individuals who use alcohol at harmful levels to reduce their alcohol misuse. This behaviour change approach is about motivating participants, not educating or informing them (Filtness, Sheehan, Fleiter, Armstrong, & Freeman, 2015). It may also be necessary to extend the interlock period for as long as the driver continues to have an alcohol problem. However, the effectiveness of a permanent fitment strategy remains unknown.

This study focused primarily on the specific deterrence effects of these interventions and general deterrence was not able to be directly assessed. The study was not able to identify which offenders had an interlock installed, just that they had an interlock condition applied to their licence. As a result, it is possible that some of the effects may be diluted as sn interlock condition would operate in a similar way to a ban if the interlock is not installed. A further limitation of this study is that the control groups were not matched and had characteristic differences in terms of offence profile that may have affected the results. It is not possible to determine if changes unrelated to the introduction of interlocks (e.g., enforcement, media) affected the control groups differently to the treatment groups.

This study has provided evidence within Victoria, Australia, that bans from driving and alcohol ignition interlocks are effective safety interventions for reducing drink-driving rates for offenders as well as improving overall road safety. This confirms the applicability of these interventions within the Australian context.

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