

1 **The effects of licence disqualification on drink-drivers:**
2 **Is it the same for everyone?**

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15

16 **Abstract**

17 Drink-driving remains a major road safety concern that creates a significant social
18 burden. Licence disqualification continues to play a key role in drink driving deterrence
19 and sanctions together with police enforcement to address the problem in most
20 motorised countries. However, on-going questions remain regarding the differing effect
21 of licence disqualification periods between first time and repeat offenders, and between
22 other sub-groups of offenders. As a result, this study aimed to determine whether: (a)
23 differences exist in re-offence rates of convicted drink-drivers between: the period
24 between committing the drink-driving offence and licence disqualification (pre-licence
25 disqualification), during the period of licence disqualification, and after being re-
26 licensed (post-licence restoration); and (b) differential effects of offence rates are
27 evident based on Blood Alcohol Content (BAC), gender, age, repeat offender status and
28 crash involvement at the time of offence. The sample consisted of 29,204 drink-driving
29 offenders detected in Victoria, Australia between 1 January 1996 and 30 September
30 2002. The analysis indicated that licence disqualifications were effective as drink-
31 driving offenders had a significantly lower rate of offending (both drink-driving and
32 other traffic offences) during licence disqualifications compared to pre-licence
33 disqualification and post-licence restoration periods. The influence of licence
34 disqualification appeared to extend beyond the disqualification period, as offence rates
35 were lower during post-licence restoration than during pre-licence disqualification.
36 Interestingly, the highest rate of offending (both for drink-driving and other traffic
37 offences) was during the pre-licence disqualification period, which suggests offenders
38 are particularly vulnerable to drink and drive while waiting to be sanctioned. A
39 consistent pattern of results was evident across genders and age groups. Additionally,

40 those who were involved in a crash at the same time as their index offence had lower
41 offence rates (compared to those who were not involved in a crash) for all periods,
42 although for general traffic offences, the offence rate was highest in the post-licence
43 restoration period for those who had a crash at index offence. This indicates that being
44 involved in a crash may deter these offenders, at least in the short-term. The
45 implications of the results for managing both first time and repeat offenders are
46 discussed.

47 **Keywords:** drink-driving, drunk-driving, licence disqualification, sanctions, offences

48 **Highlights**

- 49 • 6.5 years of offence history data for 29,204 drink-driving offenders was
50 considered.
- 51 • Licence disqualification was effective at reducing drink-driving offence rates, as
52 well as reducing general traffic offences.
- 53 • Licence disqualification had residual benefits as offence rates were lower post-
54 than pre-disqualification.
- 55 • Offences were most prevalent in the lag time between offence and application of
56 sanction.

57 **1. Introduction**

58 Drink-driving continues to be a serious and persistent problem in all motorised
59 jurisdictions, as alcohol-related crashes result in substantial fatalities, injuries and
60 property damage. Alcohol-related crashes are one of the leading causes of death on the
61 roads, for example in Victoria, Australia 32% of driver fatalities between 2008 and
62 2011 had a Blood Alcohol Concentration (BAC) over zero. In fact, 28% of driver

63 fatalities had an illegal BAC ($\geq .05$) and 10% had a BAC over .2. Nearly 23% of
64 motorcyclist fatalities had a BAC over zero (18% of motorcyclist fatalities had an
65 illegal BAC ($\geq .05$) and 4% had a BAC over .2) (Coroners Prevention Unit, 2013). The
66 legal BAC limit in Victoria is less than .05. Of particular concern is the proportion of
67 repeat drink-driving offenders, for example within Victoria 30% of detected drink-
68 drivers had a previous drink-drive conviction (Boorman, 2012). In regards to crashes,
69 research has also demonstrated that repeat offenders are disproportionately represented
70 in crash statistics (Beirness, Mayhew, & Simpson, 1997; Brewer et al., 1994).

71 The gravity of the problem is reflected in the enormous amount of literature that has
72 focused on the personal and economic cost of drink-driving, as well as the development
73 and implementation of various countermeasures to reduce the prevalence of the
74 offending behaviour (Beirness et al., 1997). Countermeasures to address drink-driving
75 vary across different jurisdictions, although licence disqualification has historically
76 formed the foundation of many legislative responses to such offending behaviours. The
77 application of licensing sanctions has consistently proven an effective general and
78 specific deterrent (Peck, 1991; Ross, 1991), although questions remain as to whether the
79 sanction improves general driving behaviour for offenders post relicensing. *General* and
80 *specific* deterrence stem from the Classical Deterrence Doctrine, which remains the
81 mostly widely cited model for the study of sanctions effect(s) within road safety
82 (Freeman et al., 2015). *Specific deterrence* is the process whereby an individual who has
83 been apprehended and punished for a criminal act refrains from further offending
84 behaviour for fear of incurring additional punishment (Homel, 1988). This phenomenon
85 will remain the primary focus of the current study, in particular, the effect of licence
86 disqualification.

87 While there has been considerable focus on the impact of sanctions (Wagenaar, &
88 Maldonado-Molina, 2007), there has been limited consideration as to whether
89 apprehended drink-drivers re-offend during the period of time between apprehension
90 and application of sanction, despite waitlisting times to appear in court often being long
91 (e.g. six to twelve months on average). However, it is noted that some preliminary
92 research has focused on the positive impact of changes to administrative
93 suspension laws that has resulted in a reduction in the penalty application
94 timeframe (McArthur, & Kraus, 1999; Voas, Tippetts & Fell, 2000). What is known is
95 that drink-drivers are not a homogenous group (Nochajski & Wieczorek, 2000), as
96 research has demonstrated that first time and repeat offenders often differ in both
97 characteristics and treatment needs (Stewart, Boase, & Lamble, 2004). These two
98 groups display a tendency to respond differently to the application of sanctions
99 (Ferguson, Sheehan, Davey, & Watson, 1999; Freeman, 2004), in particular, Northern
100 American research has demonstrated that the application of licence sanctions on repeat
101 offenders (in isolation) is relatively ineffective (Beirness et al., 1997; Coben & Larkin,
102 1999).

103 An important consideration for the current study was to not only identify the
104 effectiveness of licence disqualification, but also to assess the impact of this approach
105 on different groups of offenders. Currently, questions also remain regarding the impact
106 of licence disqualification periods on gender, age and BAC level at time of
107 apprehension. That is, whether motorists respond differently to the sanction depending
108 on their gender, age and level of alcohol consumption. Therefore, the project focuses on
109 drink-driving outcome data and also considers the general demographics of the
110 population (e.g., age, sex, drink-driving history). Without such a comprehensive

111 investigation, a deeper understanding into the specific impact of licence sanction on re-
112 offence rates cannot be achieved. This project considers all facets in order to maximise
113 the potential to obtain large safety gains through the on-going sanctioning of drink-
114 drivers.

115 The aims of this study were to determine whether:

- 116 • drink-drivers differ in re-offence rates during the licence period between offence
117 incidence and licence disqualification (pre-licence disqualification), during the
118 period of licence disqualification, and after being re-licensed (post-licence
119 restoration); and
- 120 • effects of licence disqualification on offence rates are differential based on BAC,
121 gender, age, repeat offender status and crash involvement at the time of offence.

122 **2. Method**

123 Drivers and riders convicted of a drink-driving offences committed between
124 1 January 1996 and 30 September 2002 (inclusive) were considered eligible persons for
125 analysis (N = 29,204). The time period was determined as part of a larger project to
126 coincide with a period prior to alcohol ignition interlocks coming into effect. This was
127 so that the unique effect of licence disqualification (without the influence of interlocks)
128 could be assessed. Data files relating to all offences, licence status changes,
129 disqualifications from driving, licence conditions, and driver and rider demographics
130 were provided from the VicRoads Driver Licensing System (DLS).

131 For each offender, the index drink-driving offence between 1 January 1996 and 30
132 September 2002 (the first drink-driving offence recorded) was identified. Offence rates
133 were calculated for the period between the index offence and the licence disqualification

134 (pre-licence disqualification period), the licence disqualification period, and the post-
135 licence restoration period. The rates of offences (drink-driving and other traffic
136 offences) were calculated per thousand person-years for all the licence/sanction periods.
137 This approach was based on previous research by Siskind (1996) to account for the
138 different length of disqualification periods for offenders (i.e. as a form of exposure
139 control). Other offences included speeding, unlicensed driving, using a mobile phone
140 while driving, violations of road rules and red-lighting running. In order to test for
141 statistical significant differences in these rates across the different licence/sanction
142 periods, rate ratios were calculated separately for drink-driving and general traffic
143 offence rates for:

- 144 • Licence disqualification versus pre-licence disqualification;
- 145 • Licence disqualification versus post-licence restoration; and
- 146 • Post-licence restoration versus pre-licence disqualification.

147 In order to determine the statistical significance of the rate ratios, confidence intervals
148 for all rate ratios were calculated as follows:

149
$$95\% \text{ Lower confidence level} = \text{Exp}(\ln(\text{Rate Ratio}) - 1.96 \times SE)$$

150
$$95\% \text{ Upper confidence level} = \text{Exp}(\ln(\text{Rate Ratio}) + 1.96 \times SE)$$

151 Where:
$$SE = \sqrt{\left(\frac{1}{X_1} + \frac{1}{X_2}\right)}$$

152 Where: X_1 = Number of offences in period 1 and X_2 = Number of offences in
153 period 2.

154 Statistical significance was determined by the confidence interval not including 1.

155 Rate ratios were calculated and compared for each period by index offence BAC level
156 category (Low-range – between .001 and .070; Mid-range – between .071 and .149;
157 High-range – .150 and above), gender, age group (16-24, 25-49, 50+), repeat offender
158 status (at index) and involvement in a crash at index offence.

159 The weighted mean of the rate ratios across the strata (e.g., male versus female) was
160 calculated using the Cochran-Mantel-Haenzel for incidence rates. The rate ratios for
161 each variable stratum were then compared to the Cochran-Mantel-Haenzel rate ratio
162 using a Chi-square test for homogeneity. The formula is as follows:

$$163 \frac{\sum a_i(PY_{oi})/PY_i}{\sum c_i(PY_{ei})/PY_i}$$

164 Where: a_i is the number of offences/crashes for period 1 and c_i is the number of
165 offences/crashes in period 2, PY_{oi} and PY_{ei} are the person-years in each period
166 and PY_i is the total person-years for the stratum.

167 Then this average (pooled) rate ratio was used to calculate a Chi-square test for
168 homogeneity to determine if the rate ratios differ across strata. The formula for this was
169 as follows:

$$170 \chi^2 = \sum \frac{(R_i - \hat{R})^2}{V_i}$$

171 Where R_i = stratum specific rate ratio; \hat{R} = estimated pooled rate ratio; and V_i =
172 the variance ($V_i = \sum \frac{1}{x_i}$) with x_i = number of offences in the stratum. The Chi-
173 square was then assessed at a significance level of .05.

174 **3. Results**

175 The characteristics of the drink-driving offenders in the licence period are outlined in
 176 Table 1. The majority of offenders were male. There was a greater prevalence of first
 177 time than repeat offenders. Approximately, 5% of offenders were involved in a crash at
 178 the time of their index offence.

179 *Table 1: Characteristics of the drink-driving offender sample*

Characteristic	N	%
<i>Gender</i>		
Male	25,391	86.9
Female	3,813	13.1
<i>Age group</i>		
16-24	11,474	39.3
25-49	15,687	53.7
50+	2,043	7.0
<i>BAC level (index offence)</i>		
Low-range (between .001 and .070)	3,269	11.2
Mid-range (between .071 and .149)	15,705	53.8
High-range (.150 and above)	4,155	14.2
<i>Licence type</i>		
Learner	813	2.8
Probationary	8,138	27.9
Open	20,253	69.4
<i>Offender status at index</i>		
First time offender	24,641	84.4
Repeat offender	4,563	15.6
<i>Crash at index offence</i>		
Yes	1,540	5.3
No	27,664	94.7

180
 181 Table 2 shows the re-offence and crash rates (drink-driving and other) for all drink-
 182 driving offenders. The highest rates of re-offending were in the licence period between

183 the index offence and the licence disqualification, followed by the period post-licence
 184 restoration.

185 *Table 2: Offence rates (per 1,000 person years) for all offenders for each licence period*

Time period	Drink-driving offences	General traffic offences¹
Period between index offence and licence disqualification (pre-licence disqualification)	93.7	914.4
Period during licence disqualification	28.3	307.5
Period post-licence restoration	53.7	664.0

186 ¹ Excluding drink-driving offences

187 As shown in Table 3 below, all drink-driving offenders had a statistically significantly
 188 lower rate of offending (both drink-driving and other traffic offences) during licence
 189 disqualifications compared to the pre-licence disqualification and post-licence
 190 restoration periods. Also, the post-disqualification licensed period had a statistically
 191 significantly lower rate of offending compared to the pre-licence disqualification period.

192 *Table 3: Offence rate ratios all drink-drivers*

Comparison	Rate ratio (95% CI)	
	Drink-driving offences	Other traffic offences
Licence disqualification vs. Pre-licence disqualification	0.30* (0.27 – 0.33)	0.34* (0.33 – 0.35)
Licence disqualification vs. Post-licence restoration	0.53* (0.49 – 0.57)	0.46* (0.45 – 0.48)
Post-licence restoration vs. Pre-licence disqualification	0.57* (0.53 – 0.62)	0.73* (0.71 – 0.74)

193 *Statistically significant rate ratios (p < .05)

194 *Gender*

195 As shown in Table 4, males had higher rates of offending for all licence periods. The
 196 pattern of offending across periods was similar however, with both males and females
 197 having the highest rate of offending (both drink-driving and other traffic offences) in the

198 pre-licence disqualification period, followed by the post-licence restoration period and
 199 then the licence disqualification period.

200 *Table 4: Offence rates (per 1,000 person years) by gender for each licence period*

Period	Male		Female	
	Drink-driving	General traffic ¹	Drink-driving	General traffic ¹
Between index offence and licence disqualification (pre-licence disqualification)	96.3	952.7	75.3	643.0
During licence disqualification	29.0	314.2	23.0	259.4
Post-licence restoration	56.2	690.3	37.3	493.9

201 ¹ Excluding drink-driving offences

202 Table 5 shows the rate ratios for drink-driving and other offences for each licence
 203 period comparison stratified by gender. Chi-square tests for the homogeneity showed no
 204 statistically significant differential effects of gender for any licence period comparisons.

205 *Table 5: Offence rate ratios by gender*

Comparison	Rate ratios (95% CI)			
	Male		Female	
	Drink-driving offences	Other traffic offences	Drink-driving offences	Other traffic offences
Licence disqualification vs. pre-licence disqualification	0.30* (0.27 – 0.33)	0.33* (0.32 – 0.34)	0.31* (0.22 – 0.42)	0.40* (0.34 – 0.45)
Licence disqualification vs. Post-licence restoration	0.52* (0.48 – 0.55)	0.46* (0.45 – 0.47)	0.62* (0.49 – 0.77)	0.53* (0.47 – 0.56)
Post-licence restoration vs. Pre-licence disqualification	0.58* (0.54 – 0.64)	0.72* (0.71 – 0.74)	0.50* (0.38 – 0.64)	0.77* (0.71 – 0.84)

206 *Statistically significant rate ratios for licence periods (p < .05)

207

208 *Age*

209 As shown in Table 6, those offenders aged 16-24 years had the highest rate of offending
210 in all licence periods, followed by those aged 25-49 years. The pattern of offending
211 across periods was similar however, with all age groups having the highest rate of
212 offending (both drink-driving and other traffic offences) in the period between index
213 offence and the licence disqualification, followed by the post-licence restoration period,
214 and then the licence disqualification period.

215 *Table 6: Offence rates (per 1,000 person years) by age group for each licence period*

	16-24		25-49		50+	
	Drink-driving offences	General traffic offences¹	Drink-driving offences	General traffic offences¹	Drink-driving offences	General traffic offences¹
Period between index offence and licence disqualification	97.2	1187.8	92.0	773.8	88.7	579.5
Period during licence disqualification	35.9	431.6	24.6	254.6	20.8	131.9
Period post-licence restoration	57.8	839.8	52.1	568.7	42.6	380.9

216 ¹ Excluding drink-driving offences

217 Table 7 shows the rate ratios for drink-driving and other offences for each licence period comparison stratified by age group. For drink-
 218 driving and other traffic offences, Chi-square tests for the homogeneity showed no statistically significant differential effects of age.

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223 *Table 7: Offence rate ratios by age group*

Comparison	Rate ratios (95% CI)					
	16-24 years		25-49 years		50 years+	
	Drink-driving offences	Other traffic offences ¹	Drink-driving offences	Other traffic offences ¹	Drink-driving offences	Other traffic offences ¹
Licence disqualification vs. Pre-licence disqualification	0.37* (0.32 – 0.43)	0.36* (0.35 – 0.38)	0.27* (0.23 – 0.31)	0.33* (0.31 – 0.34)	0.23* (0.16 – 0.35)	0.23* (0.19 – 0.27)
Licence disqualification vs. Post-licence restoration	0.62* (0.56 – 0.69)	0.51* (0.50 – 0.53)	0.47* (0.43 – 0.52)	0.45* (0.43 – 0.46)	0.49* (0.36 – 0.66)	0.35* (0.31 – 0.39)
Post-licence restoration vs. Pre-licence disqualification	0.59* (0.52 – 0.68)	0.71* (0.68 – 0.73)	0.57* (0.51 – 0.63)	0.73* (0.71 – 0.76)	0.48* (0.35 – 0.66)	0.66* (0.58 – 0.74)

224 *Statistically significant rate ratios for licence periods (p < .05)

225 ¹ Excluding drink-driving offences

226 *BAC level*

227 As shown in Table 8, those offenders with a low-range index BAC had higher rates of offending across all licence periods, followed by
228 those with a mid-range index BAC, with the lowest rates of offending for offenders with a high BAC index offence. Again, the pattern of
229 offending was similar across licence periods with all BAC levels having the highest rate of offending (both drink-driving and other traffic
230 offences) in the period between index offence and the licence disqualification, followed by the post-licence restoration period, and then the
231 licence disqualification period.

232 *Table 8: Offence rates (per 1,000 person years) by BAC level for each licence period*

	Low-range		Mid-range		High-range	
	Drink-driving offences	General traffic offences ¹	Drink-driving offences	General traffic offences ¹	Drink-driving offences	General traffic offences ¹
Period between index offence and licence disqualification	90.4	1284.3	84.3	705.6	56.5	337.5
Period during licence disqualification	49.2	644.1	21.8	199.8	15.1	183.3
Period post-licence restoration	62.7	805.9	39.6	460.3	38.3	334.0

233 ¹ Excluding drink-driving offences

234 Table 9 shows the rate ratios for drink-driving and other offences for each
235 comparison period stratified by BAC level at index offence. For other traffic
236 offences, Chi-square tests for the homogeneity showed some statistically significant
237 differential effects of BAC level. Specifically, low-range and high-range BAC
238 offenders had higher rate ratios for other traffic offending for the licence
239 disqualification period versus the pre-licence disqualification period [$\chi^2 (2) =$
240 14.18, $p < .001$]. Further, for other traffic offences, high-range BAC offenders had
241 no statistically significant effect for post-licence restoration period versus the pre-
242 licence disqualification period, while low- and mid-range offenders had lower other
243 traffic offence rates during post-licence restoration period compared to the pre-
244 licence disqualification period [$\chi^2 (2) = 10.65, p < .001$]. For drink-driving
245 offences, there was a differential effect for the licence disqualification period versus
246 the post-licence restoration period [$\chi^2 (2) = 9.78, p = .008$] with low-range BAC
247 offenders having a higher rate ratio of offending compared with mid- and high-
248 range offenders.

249 *Table 9: Offence rate ratios by BAC level at index offence*

Comparison	Rate ratios (95% CI)					
	Low-range BAC		Mid-range BAC		High-range BAC	
	Drink-driving offences	Other traffic offences ¹	Drink-driving offences	Other traffic offences ¹	Drink-driving offences	Other traffic offences ¹
Licence disqualification vs. Pre-licence disqualification	0.54* (0.42 – 0.71)	0.50* (0.47 – 0.54)	0.26* (0.23 – 0.29)	0.28* (0.27 – 0.30)	0.27* (0.20 – 0.36)	0.54* (0.48 – 0.61)
Licence disqualification vs. Post-licence restoration	0.80* (0.65 – 0.95)	0.78* (0.76 – 0.84)	0.55* (0.50 – 0.61)	0.43* (0.42 – 0.45)	0.39* (0.33 – 0.48)	0.53* (0.50 – 0.57)
Post-licence restoration vs. Pre-licence disqualification	0.69* (0.56 – 0.87)	0.63* (0.59 – 0.67)	0.47* (0.42 – 0.52)	0.65* (0.63 – 0.68)	0.68* (0.53 – 0.87)	1.02 (0.92 – 1.13)

250 *Statistically significant rate ratios for licence periods (p < .05)

251 ¹ Excluding drink-driving offences

252 *Repeat and first offenders*

253 Repeat offenders had lower offence rates compared to first offenders for all periods except
254 the post-licence restoration period (Table 10). The pattern of offending across licence
255 periods, however, was consistent as per all drink-drivers and the previous comparison groups.

256 *Table 10: Offence rates (per 1,000 person years) by repeat offender status at index for each*
257 *licence period*

	First offenders		Repeat offenders	
	Drink-driving offences	General traffic offences ¹	Drink-driving offences	General traffic offences ¹
Period between index offence and licence disqualification	97.1	938.7	78.6	807.8
Period during licence disqualification	30.2	332.8	22.7	232.2
Period post-licence restoration	53.2	663.3	56.6	667.9

258 ¹ Excluding drink-driving offences

259 Table 11 shows the rate ratios for drink-driving and other offences for each licence period
260 comparison stratified by whether the offender was a repeat or first offender at index offence.
261 For drink-driving offences, Chi-square tests for the homogeneity showed a statistically
262 significant effect for the licence disqualification versus the post-licence restoration period [χ^2
263 (1) = 4.50, $p < .001$]. Specifically, while both groups had lower drink-driving offence rates
264 during a disqualification in comparison with post-licence restoration, the rate ratio was lower
265 for repeat drink-driving offenders at index offence. For other traffic offences, Chi-square tests
266 for the homogeneity showed no statistically significant effect.

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270 *Table 11: Offence rate ratios by repeat and first offender at index offence*

Comparison	Rate ratios (95% CI)			
	First offenders at index		Repeat offender at index	
	Drink-driving offences	Other traffic offences ¹	Drink-driving offences	Other traffic offences ¹
Licence disqualification vs. Pre-licence disqualification	0.31* (0.28 – 0.35)	0.35* (0.34 – 0.37)	0.29* (0.23 – 0.36)	0.29* (0.27 – 0.31)
Licence disqualification vs. Post-licence restoration	0.57* (0.52 – 0.61)	0.50* (0.49 – 0.51)	0.40* (0.34 – 0.47)	0.35* (0.33 – 0.37)
Post-licence restoration vs. Pre-licence disqualification	0.55* (0.50 – 0.60)	0.71* (0.69 – 0.73)	0.83* (0.59 – 0.88)	0.72* (0.78 – 0.88)

271 *Statistically significant rate ratios for licence periods (p < .05)

272 ¹ Excluding drink-driving offences

273 *Crash at index offence*

274 Those who were involved in a crash at the same time as their index offence had lower offence
 275 rates for all licence periods compared to those that did not have a crash at index offence
 276 (Table 12). The pattern of results across licence periods was somewhat consistent. However,
 277 for general traffic offences, the offence rate was highest in the post-licence restoration period
 278 for those who had a crash at index offence (although still a lower rate than those who were
 279 not involved in a crash at index).

280

281 *Table 12: Offence rates (per 1,000 person years) by crash at index offence status for each*
 282 *licence period*

	Crash involved		Non-crash involved	
	Drink-driving offences	General traffic offences ¹	Drink-driving offences	General traffic offences ¹
Period between index offence and licence disqualification	45.0	460.5	99.0	963.5
Period during licence disqualification	14.4	179.6	29.2	315.6
Period post-licence restoration	41.7	542.5	54.3	670.1

283 ¹ Excluding drink-driving offences

284 Table 13 shows the rate ratios for drink-driving and other offences for each licence period
 285 comparison stratified by whether the offender was involved in a crash at the index offence or
 286 not. For other traffic offences, Chi-square tests for the homogeneity showed a statistically
 287 significant effect for the post-licence restoration period versus the pre-licence disqualification
 288 period [$\chi^2 (1) = 14.51, p < .001$]. Specifically, those offenders who were involved in a crash
 289 at the time of their index offence had a higher other offence rate during the post-licence
 290 restoration period compared to the pre-licence disqualification period, while those who were
 291 not involved in a crash had lower other offence rates during the post-licence restoration
 292 period. There were no other differential effects based on crash involvement at index offence.

293

294 *Table 13: Offence rate ratios by crash involvement at index offence*

Comparison	Rate ratios (95% CI)			
	Crash involved at index		Not crash involved at index	
	Drink-driving offences	Other traffic offences ¹	Drink-driving offences	Other traffic offences ¹
Licence disqualification vs. Pre-licence disqualification	0.32* (0.20 – 0.53)	0.39* (0.34 – 0.45)	0.29* (0.27 – 0.33)	0.33* (0.32 – 0.34)
Licence disqualification vs. Post-licence restoration	0.35* (0.23 – 0.51)	0.33* (0.30 – 0.37)	0.54* (0.50 – 0.58)	0.47* (0.46 – 0.48)
Post-licence restoration vs. Pre-licence disqualification	0.93 (0.63 – 1.36)	1.18* (1.05 – 1.32)	0.55* (0.51 – 0.60)	0.70* (0.68 – 0.71)

295 *Statistically significant rate ratios for licence periods (p < .05)

296 ¹ Excluding drink-driving offences

297 **4. Discussion**

298 The primary aims of this project were to determine: (a) whether drink-drivers' re-offence
 299 rates differed during the period between offence incidence and licence disqualification (pre-
 300 licence disqualification), the period of licence disqualification and the post-licence restoration
 301 period; and (b) identify if there are any differential effects of licence disqualification on re-
 302 offence rates based on BAC, gender, age, repeat offender status and crash involvement at the
 303 time of offence. The offences analysed were drink-driving offences and other traffic offences.
 304 Key findings that emerged will be sequentially discussed below.

305 *Re-offending Between Apprehension and Sanctioning*

306 In regards to the rate of offending, the highest rate of offending (both drink-driving and other
 307 traffic offences) was during the period between the index offence and the commencement of
 308 the licence disqualification (pre-licence disqualification). This is a key finding to emerge
 309 from the study that needs to be re-examined with other traffic offence data in other
 310 jurisdictions in the future. In Victoria, we found that offenders are at the highest risk of

311 drink-driving (or committing other traffic offences) after they have been apprehended, but
312 before they receive the corresponding sanctions. This finding supports the assertion that the
313 celerity of punishment (in regards to deterrence models) is an important factor in maximising
314 a deterrent effect. However, the celerity of sanction application is commonly overlooked with
315 deterrence-based research (Freeman, 2004), except for preliminary research that has
316 focused on the positive impact of changes to administrative suspension laws (McArthur,
317 & Kraus, 1999; Voas, Tippetts & Fell, 2000; Zador et al., 1988). For example, Wagenaar &
318 Maldonado-Molina (2007) reviewed the impact of mandatory preconviction licence
319 suspension laws in 46 American states and reported the policy had a statistically significant
320 reduction in alcohol-related crash involvement. This is despite models of learning and
321 experimental psychology reinforcing that the time between stimulus and response is vital for
322 learning new behaviours (Nagin & Pogarsky, 2001).

323 *The Positive Effect while Disqualified*

324 More encouragingly, drink-driving offenders had statistically significantly lower rates of
325 offending (both drink-driving and other traffic offences) during disqualification periods
326 compared to the pre-licence disqualification and post-licence restoration periods. In regards
327 to first time versus recidivist offenders, both groups had lower drink-driving offence rates
328 during disqualification in comparison with post-licence restoration. High BAC offenders also
329 had low rates of re-offending during disqualification relative to other BAC offender groups
330 contrary to perceptions that they are less responsive to countermeasures. This finding is
331 consistent with a large body of research that has generally demonstrated licence
332 disqualification periods to be one of the most effective methods for reducing further drink-
333 driving offences (Jones & Lacey, 1991; McArthur & Kraus, 1999; Nichais & Ross, 1991;
334 Sadler & Perrine, 1984; Wagenaar, Zoeck, Williams & Hingson, 1995). In fact, compared to
335 other sanctions, disqualification periods have proven to be the most effective short-term

336 countermeasure that can be applied to drink-drivers (Nichais & Ross, 1991; Sadler & Perrine,
337 1984; Siskind, 1996; Watson, 1998). The current finding is particularly encouraging in
338 relation to high BAC and recidivist offenders, as ongoing questions have remained regarding
339 the efficacy of applying sanctions to persistent offenders (Freeman, Liossis, & David, 2006)
340 and high BAC offenders who are perceived as difficult to influence – in contrast this study
341 clearly shows an impact of licence sanction on drink driving offenders during and following
342 licence disqualification for most detected offenders. However, there still was evidence that a
343 small minority of individuals were detected again for drink-driving even while disqualified
344 from driving as found for 4% of the sample. That is, they combined drink-driving with
345 unlicensed driving, demonstrating that licence disqualification does not have a positive
346 impact on all individuals. This is again consistent with research that has reported unlicensed
347 driving is often combined with other illegal behaviours such as drink-driving (Griffin &
348 DeLaZerda, 2000; Watson, 2004).

349 Further analyses revealed that there was in fact a greater effect of the disqualification on
350 repeat drink-driving offenders compared to first time offenders, as well as for high BAC
351 offenders. This is contrary to previous research that has demonstrated that licence sanctions
352 are least effective for repeat offenders (Beirness et al., 1997; Coben & Larkin, 1999).

353 Different theories can account for this finding. Firstly, it is possible that (for the current
354 sample) repeat offenders reduced their frequency of driving to a greater extent than first time
355 offenders, perhaps due to a magnified deterrence effect, as they had already been caught and
356 sanctioned more than once, and thus were more aware of the probability of apprehension e.g.,
357 objective certainty. Another hypothesis proposed by Pogarsky and Piquero (2003), that needs
358 to be further investigated, is whether first time offenders experience a “resetting effect” after
359 apprehension, whereby offenders believe they are less likely to be apprehended again soon
360 after coming in contact with the police. However, the above results should be interpreted with

361 caution as there is no comparison group; so, for example, it is not possible to tell if a
362 disqualification period is the most effective sanction compared to any other sanction (e.g.,
363 immediate interlock condition).

364 *Post Licence periods*

365 Another key finding was that there was also a statistically significantly lower rate of
366 offending (both drink-driving and other traffic) in the post-licence restoration period
367 compared to the pre-licence disqualification period (40% lower), both for first time and
368 repeat drink-drivers. In regards to first time offenders, this is consistent with previous
369 research that has demonstrated licence disqualifications have a specific deterrent effect post
370 licence restoration. (Homel, 1988; Siskind, 1996). That is, convicted offenders are less likely
371 to re-offend due to experience with the consequences of penalties. The results were also
372 positive for repeat offenders. While there has generally been consensus in the literature that
373 the application of legal sanctions alone does not produce long-term behaviour change for this
374 group (Ahlin, Rauch, Zador, Baum, & Duncan, 2002; Beirness et al., 1997; Brewer et al.,
375 1994; Frank, Raub, Lucke, & Wark, 2002; Homel, 1988; Marques, Voas, & Hodgins, 1998;
376 Yu, 2000), the current study has provided evidence that disqualifications can have a
377 corrective effect on tendencies to drink and drive among recidivist offenders. However, it
378 should be noted, that as there was no control group for this analysis (i.e., offenders who did
379 not have licence sanctions applied) the changes in offending rates may have been due in part
380 to other influences (e.g., enforcement practices). Furthermore, while the offending rate
381 decreased post-sanction, it is not possible to tell if this is a genuine positive effect of
382 experiencing the sanction or if, for example, offenders improved their ability to avoid
383 detection once they have experienced this sanction. In regards to the latter, previous research
384 has found that offenders, particularly repeat offenders, can drink and drive on numerous
385 occasions whilst avoiding detection (Wiliszowski, Murphy, Jones, & Lacey, 1996). For

386 example, Smith (2003) interviewed a small sample of repeat offenders who reported regularly
387 drink-driving whilst avoiding apprehension (e.g., ratios up to 100:1) as well as actively
388 attempting to evade police enforcement (e.g., Random Breath Testing).

389 *Differential Effects*

390 In regards to the differential offence rate effects, the second aim of the study, males had
391 higher rates of drink-driving offending for all licence periods, which is consistent with
392 previous research that has demonstrated that males are disproportionately represented in
393 drink-driving statistics (Beirness et al., 1997; Stewart et al., 2004; Voas & Tippetts, 2002).
394 However, while absolute rates of offending differed by gender and between age groups, the
395 pattern of rates of offending across the three study periods for each of these subgroups was
396 similar. No subgroups were more likely to drink and drive (or commit other traffic offences)
397 in the pre-licence disqualification period, the post-licence restoration period or the licence
398 disqualification period. The current findings indicate that disqualifications can have a positive
399 effect on both genders as well as motorists of all ages. This is one of the first studies to
400 specifically examine offence rates with respect to age and gender, and therefore further
401 research is required to confirm this finding.

402 There were however, some statistically significant differential effects of BAC level and of
403 repeat offender status. While all BAC groups demonstrated a reduction in drink-driving
404 offence rates during the licence disqualification period compared to the post-licence
405 restoration period, low-range BAC offenders had a higher offence rate ratio compared with
406 mid- and high-range offenders. Therefore, the disqualification period appeared to have a
407 lesser impact on the low-range BAC group for drink-driving and other traffic offences. This
408 could be considered an unexpected finding, as a higher range BAC could be considered
409 evidence of an alcohol problem, which has been demonstrated to be a significant predictor of
410 recidivism (Freeman et al., 2006). While it remains unclear why this was found, two possible

411 explanations can be proposed. Firstly, it may be because the disqualification period this group
412 received was not as severe (compared to high BAC range offenders) and thus, less of a
413 specific deterrent effect was experienced for the less severe sanction. Secondly, this group
414 may have experienced less of an overall experiential effect (e.g., number of times exposed to
415 punishment), and thus, have yet to be sufficiently deterred from drink-driving. Further
416 research is required to determine the significance of this finding, as it has historically been
417 hypothesised that low-range BAC groups predominantly involve social drinkers who may
418 make a judgement error in their decision to drive after drinking (Ferguson et al., 1999;
419 Howard & McCaughrin, 1996). As a result, these drivers are usually deterred from
420 committing further offences by their experience of both formal and informal sanctions such
421 as fines and licence loss, as well as peer disapproval from friends and family (Ferguson et al.,
422 1999). However, some low-range BAC offenders (apprehended in the morning) may have
423 consumed large quantities of alcohol the night before, and this phenomenon also deserves
424 further exploration.

425 There were also some differential effects for other traffic offending. High-range BAC
426 offenders had no statistically significant effect for post-licence restoration period versus the
427 pre-licence disqualification period, while low- and mid-range offenders had lower offence
428 rates during the post-licence restoration period compared to the pre-licence disqualification
429 period.

430 Importantly, offenders who were involved in a crash at the time of their index offence had a
431 higher general traffic offending rate during the post-licence restoration period compared to
432 the pre-licence disqualification period, while those who were not involved in a crash had
433 lower offence rates during the post-licence restoration period compared to the pre-licence
434 disqualification period. It is not clear whether this is a direct result of the disqualification or a
435 bias of having experienced a crash. For example, crash involved offenders may be injured

436 and unable to drive, or without a vehicle in the immediate period following the crash. These
437 factors may have a greater impact on influencing driving behaviour than the actual sanction.

438 There were a number of limitations associated with this study that need to be considered.
439 Firstly, as with any study of this nature, the sample only includes those who are caught for an
440 offence. It is possible that some offenders are not captured as they are able to avoid detection.
441 For example, an earlier study by Voas (1982) reported that the drinking driver is arrested
442 once out of every 5000 miles (approximately 8,000 kilometres) driven under the influence of
443 alcohol. A similar estimation in the Australian context offered by Homel, Carseldine, and
444 Kearns (1988) suggested that only 0.5% to 1.5% of intoxicated drivers are detected by the
445 police at any one time. While more recent calculations are not available, the deleterious
446 impact of 'punishment avoidance' on intentions to re-offend is well documented (Freeman &
447 Watson, 2006; Watling, Freeman, Palk, & Davey, 2011). In the current context, this would
448 result in an under-estimate of the drink-driving problem. It is also possible that particular
449 types of offenders are better at avoiding detection and thus the study may not capture all
450 types of drink-driving offenders. Some offenders within the study sample may also avoid
451 detection some of the time or even improve their avoidance over time. This may impact on
452 the re-offence rates for some of these offenders and bias the results to some extent if
453 particular types of offenders (e.g., repeat offenders) become better at detection avoidance
454 than others.

455 It should be noted that the BAC level for classification may lack some sensitivity to offender
456 differences within BAC groups. While BAC groupings in this study were consistent with the
457 legislative levels relating to sanctions as well as reflecting escalating trauma risk with higher
458 BAC levels, it could be argued that there may be some distinct differences within these level
459 classifications that were not able to be explored. For example, there may be little difference
460 between an offender with a BAC of .14 and one with a BAC of .15 (in different categories)

461 and a large difference between a person with a BAC of .08 and one with a BAC of .12 (in the
462 same category for some analyses). Research suggests that drink-driving offenders are not a
463 homogenous group even within these categorisations of low-, mid- and high-range BACs
464 (Fetherston, Lenton, & Cercarelli, 2002; Nadeau, 2002; Nochajski & Wieczorek, 2000).
465 Thus, differences explored between these groups may lack sensitivity. Additionally, some of
466 the study's findings may be unique to the data set (and time period), and thus, the study
467 methodology needs to be implemented with different datasets.

468 The present study has provided further confirmatory evidence that licence disqualification
469 periods are effective at reducing drink-driving offending, both while drivers are disqualified
470 as well as post relicensing. Encouragingly, the application of the sanction also had a positive
471 effect on general traffic offending, recidivist drink-drivers and the effectiveness of the
472 approach was not diluted by gender or age group. High BAC offenders had lower re-offence
473 rates than moderate BAC offenders who both had lower rates than low BAC offenders.

474 However, the study identified a significant area of concern. Specifically, the highest rate of
475 offending (both for drink-driving and other traffic offences) was during the pre-licence
476 disqualification period, which suggests offenders are particularly vulnerable to drink and
477 drive whilst waiting to be sanctioned. There is a need to develop effective methods to deal
478 with offenders when they are first apprehended, including consideration of immediate licence
479 disqualification which has been shown to be effective in studies where such an administrative
480 sanction has been applied and evaluated (National Highway Traffic Safety Administration,
481 2014). An additional method may involve a brief behaviour change intervention program,
482 which has previously been suggested in Shults et al (2001) review of drink driving
483 countermeasures. The importance for early intervention is also evident in the corresponding
484 offending histories of motorists involved in alcohol-related crashes, which may again be
485 utilised as a screening tool for referral to additional services.

486 The findings of this study show that the application of licence disqualification periods for
487 drink-drivers of all types appears to be an effective response to improve road safety. The
488 study was able to identify areas of opportunity where countermeasures could be applied to
489 further improve offenders' compliance with BAC limits, specifically the period immediately
490 following police detection, compliance by lower BAC and first offenders, and following the
491 licence disqualification period.

492 **Acknowledgements**

493 The authors would like to acknowledge that this study was part of a larger funded project by
494 VicRoads. We would like to thank VicRoads and John Catchpole of ARRB Group Ltd for the
495 preparation and provision of data.

496 **References**

- 497 Ahlin, E., Rauch, P., Zador, P., Baum, H., & Duncan, D. (2002). *Social bonds in an ignition*
498 *interlock license restriction program in Maryland*. Paper presented at the Proceedings
499 of the 16th international conference on alcohol, drugs and traffic safety.
- 500 Beirness, D. J., Mayhew, D. R., & Simpson, H. M. (1997). *DWI repeat offenders: A review*
501 *and synthesis of the literature*.
- 502 Boorman, M. (2012). *Victoria Police: The drink and drug driving enforcement link to public*
503 *health*. Paper presented at the The First International Conference on Law Enforcement
504 and Public Health, Melbourne, Australia.
- 505 Brewer, R. D., Morris, P. D., Cole, T. B., Watkins, S., Patetta, M. J., & Popkin, C. (1994).
506 The risk of dying in alcohol-related automobile crashes among habitual drunk drivers.
507 *New England Journal of Medicine*, 331(8), 513-517.
- 508 Coben, J. H., & Larkin, G. L. (1999). Effectiveness of ignition interlock devices in reducing
509 drunk driving recidivism. *American Journal of Preventive Medicine*, 16(1), 81-87.

510 Coroners Prevention Unit. (2013). Presence of alcohol and drugs amongst deaths from on-
511 road transport crashes in Victoria 2008 – 2011: Coroners Court of Victoria.

512 Ferguson, M., Sheehan, M. C., Davey, J. D., & Watson, B. C. (1999). *Drink driving*
513 *rehabilitation: the present context*: Australian Transport Safety Bureau.

514 Fetherston, J., Lenton, S., & Cercarelli, L. R. (2002). *The repeat drink drivers study*: National
515 Drug Research Institute, Curtin University of Technology.

516 Frank, J. F., Raub, R., Lucke, R. E., & Wark, R. I. (2002). *Illinois ignition interlock*
517 *evaluation*. Paper presented at the Proceedings of the 16th International Conference
518 on Alcohol, Drugs and Traffic Safety.

519 Freeman, J. (2004). Influencing recidivist drink drivers' entrenched behaviours: the self-
520 reported outcomes of three countermeasures.

521 Freeman, J., Armstrong, K., Truelove, V., Szogi, E. Left on the Side of the Road? (2015). A
522 Review of Deterrence-based Theoretical Developments in Road Safety. *Peer*
523 *Reviewed proceedings of the Road Safety Research, Policing and Education*
524 *Conference, Gold Coast*.

525 Freeman, J., Liossis, P., & David, N. (2006). Deterrence, defiance and deviance: An
526 investigation into a group of recidivist drink drivers' self-reported offending
527 behaviours. *Australian & New Zealand Journal of Criminology*, 39(1), 1-19.

528 Freeman, J., & Watson, B. (2006). An application of Stafford and Warr's reconceptualisation
529 of deterrence to a group of recidivist drink drivers. *Accident Analysis & Prevention*,
530 38(3), 462-471.

531 Griffin, L. I., & DeLaZerda, S. (2000). *Unlicensed to kill*: AAA Foundation for Traffic Safety
532 Washington, DC.

533 Homel, R. (1988). Policing and punishing the drinking driver. A study of specific and general
534 deterrence: New York: Springer-Verlag.

535 Homel, R., Carseldine, D., & Kearns, I. (1988). Drink-driving countermeasures in Australia.
536 *Alcohol, drugs & driving*.

537 Howard, D. L., & McCaughrin, W. C. (1996). The treatment effectiveness of outpatient
538 substance misuse treatment organizations between court-mandated and voluntary
539 clients. *Substance use & misuse*, 31(7), 895-926.

540 Jones, R. K., & Lacey, J. H. (1991). *Review of the Literature Evaluating the Effect of*
541 *Countermeasures to Reduce Alcohol Impaired Driving (1980-1989): Individual*
542 *Analyses and Assessments*: National Highway Traffic Safety Administration.

543 Marques, P. R., Voas, R. B., & Hodgins, D. (1998). Vehicle interlock programs: Protecting
544 the community against the drunk driver. *Journal of Prevention & Intervention in the*
545 *Community*, 17(1), 31-44.

546 McArthur, D. L., & Kraus, J. F. (1999). The specific deterrence of administrative per se laws
547 in reducing drunk driving recidivism. *American journal of preventive medicine*, 16(1),
548 68-75.

549 Nadeau, L. (2002). *Are there better ways to predict recidivism?* Paper presented at the
550 Proceedings International Council on Alcohol, Drugs and Traffic Safety Conference.

551 Nagin, D. S., & Pogarsky, G. (2001). Integrating celerity, impulsivity, and extralegal sanction
552 threats into a model of general deterrence: Theory and evidence. *Criminology*, 39,
553 865.

554 National Highway Traffic Safety Administration. (2014). Countermeasures that work: a
555 highway safety countermeasure guide for state highway safety offices. Washington,
556 DC: National Highway Traffic Safety Administration; 2016.

557 Nichols, J., & Ross, H. (1991). The effectiveness of legal sanctions in dealing with drinking
558 drivers. *Journal of safety research*, 22(2), 117.

559 Nochajski, T., & Wieczorek, W. (2000). Driver characteristics as a function of DWI history.
560 *Alcohol, drugs and traffic safety-T2000, Stockholm: Ekonomi-Print.*

561 Peck, R. C. (1991). The general and specific deterrent effects of DUI sanctions: A review of
562 California's experience. *Alcohol, Drugs & Driving.*

563 Pogarsky, G., & Piquero, A. R. (2003). Can punishment encourage offending? Investigating
564 the "resetting" effect. *Journal of Research in Crime and Delinquency, 40(1), 95-120.*

565 Ross, H. (1991). License deprivation as a drunk-driver sanction. *Alcohol, Drugs & Driving.*

566 Sadler, D., & Perrine, M. (1984). An evaluation of the california drunk driving
567 countermeasure system, volume 2: the long term traffic safety impact of a pilot
568 alcohol abuse treatment as an alternative to license suspensions.

569 Shults, R. A., Elder, R. W., Sleet, D. A., Nichols, J. L., Alao, M. O., Carande-Kulis, V. G.,
570 Thompson, R. S. (2001). Reviews of evidence regarding interventions to reduce
571 alcohol-impaired driving. *American Journal of Preventive Medicine, 21(4), 66-88.*

572 Siskind, V. (1996). Does license disqualification reduce reoffence rates? *Accident Analysis &*
573 *Prevention, 28(4), 519-524.*

574 Smith, K. P. (2003). *A qualitative study of deterrence and deviance in a group of recidivist*
575 *drink drivers: University of Canberra.*

576 Stewart, S., Boase, P., & Lamble, R. (2004). *Criminal profiles of drinking drivers in Ontario.*
577 Paper presented at the International Conference on Traffic and Transport Psychology.

578 Voas, R. B. (1982). Drinking and driving: Scandinavian laws, tough penalties and United
579 States alternatives.

580 Voas, R. B., & Tippetts, A. S. (2002). *BACs of US drivers in fatal crashes: have they*
581 *changed in the last 20 years.* Paper presented at the Proceedings of the 16th
582 international conference on alcohol, drugs and traffic safety.

583 Voas, R., Tippetts, S., & Fell, J. (2000). The relationship of alcohol safety laws to drink
584 drivers in fatal crashes. *Accident Analysis and Prevention*, 32, 483-492.

585 Wagenaar, A.C., & Maldonado-Molina, M.M. (2007). Effects of drivers' license suspension
586 policies on alcohol-related crash involvement: long-term follow-up in forty-six states.
587 *Alcoholism: Clinical and Experimental Research*, 31(8), 1399-1406.

588 Wagenaar, A.C., Zobeck, T., Williams, G., & Hingson, R. (1995). Methods used in studies of
589 drink-drive control effects: a meta-analysis of the literature from 1960-1991. *Accident*
590 *Analysis and Prevention*, 27(3), 307-316.

591 Watling, C. N., Freeman, J. E., Palk, G. R., & Davey, J. D. (2011). Sex, drugs, and
592 deterrence: applying Stafford and Warr's reconceptualization of deterrence theory to
593 drug driving across the genders. *Psychology of Punishment*, 57-71.

594 Watson, B. (1998). The effectiveness of drink driving licence actions, remedial programs and
595 vehicle-based sanctions.

596 Watson, B. (2004). *The psychosocial characteristics and on-road behaviour of unlicensed*
597 *drivers*. Queensland University of Technology.

598 Wiliszowski, C., Murphy, P., Jones, R., & Lacey, J. (1996). Determine reasons for repeat
599 drinking and driving.

600 Yu, J. (2000). Punishment and alcohol problems: Recidivism among drinking-driving
601 offenders. *Journal of Criminal Justice*, 28(4), 261-270.

602 Zador, P.K.; Lund, A.K.; Field M., et al (1988). *Alcohol-Impaired Driving Laws and Fatal*
603 *Crash Involvement*. Washington, DC: Insurance Institute for Highway Safety.

604