The Association Between Alcohol Interventions and Dui Incidents in Geelong, Victoria

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Abstract

Introduction and aims: Driving under the influence of alcohol is a major public health problem, every year affecting the lives of billions around the world - and not least in Australia. Since 2001, several Traffic Accident Commission (TAC), police, and community interventions have been implemented in Geelong, Australia to curb drink-driving. The current paper aims to assess the impact of 13 alcohol interventions on drink-driving rates in the Geelong region of Australia. The interventions comprised seven TAC media campaigns, three Victoria Police operations, two community interventions targeting licensed premises, and the alcohol interlock program.

Method: This study examined two types of Victoria Police frequency data: Driving under the influence (DUI) offences, and roadside preliminary breath testing (PBT) rates. Multiple regressions were carried out to determine if any of the interventions were significantly associated with frequency fluctuations in the data.

Results: Of the 13 alcohol interventions examined, three TAC campaigns and one Victoria Police operation precipitated significant decreases in drink-driving rates, while another three TAC campaigns were associated with significant increases in drink-driving rates. Over one in five (22.5%) had recorded prior DUI offences.

Conclusions: The most promising approach to curbing DUI-rates in Geelong, appear to be through informative media campaigns which show people specific settings where they might become mildly intoxicated without being aware of it, such as TAC's 'Education 1' campaign. However, there remains a worrying level of recidivist drink drivers in Geelong suggesting the need for tailored approaches.

Keywords: Drink-driving; DUI; Alcohol; Alcohol-harm; Intervention

Introduction

Traffic fatalities constitute a serious public health problem, with 1.2 million lives lost worldwide every year as a result of traffic accidents [1]. In Australia, over one third of all serious traffic accidents involve alcohol, with nearly 400 of these resulting in death [2]. Further, in 2008 in Victoria alone, 5700 motorists recorded an illegal blood alcohol concentration (BAC–alcohol concentration in the blood) level (>0.05%), and 50 people with BACs higher than the legal level were killed in traffic accidents [3]. Previous studies have also shown that 10% of nightclub patrons would prefer to drive while over the legal alcohol limit instead of using public transport [4].

The most effective strategies to reduce alcohol-related harm– including driving under the influence (DUI) offences–appear to be large-scale government policy interventions, such as increasing alcohol price, increasing minimum purchase age and tighter licensing controls [5,6]. However, these are not interventions that can be implemented at a community-level such as a city or town. Consequently, to combat drink-driving, state-wide interventions implemented around Australia mainly comprise awareness campaigns and high profile policing. However, empirical evaluation of these strategies is lacking. Smaller-scale community-level interventions have also been attempted in towns and cities around Australia focusing on the local night-time economy (NTE) [7]. These approaches include random breath testing and sobriety check points [5], licensed premises liability [5] and mandated responsible beverage service programs [8]. Similar to the state-wide campaigns, however, there is little research on the effects of such interventions on drink-driving rates.

The Victorian city of Geelong has implemented a number of anti-alcohol community interventions over the past decade. These include

the installation of ID-scanners (which record patrons' ID-cards) at licensed venues as a way of deterring troublesome patrons. Further, in 2008 the local newspaper launched the 'Just Think' campaign (www.geelongadvertiser.com.au/justthink) which employed Australian Football League [9] players to endorse the message to 'just think' about their behaviour when consuming alcohol. Finally, the Victoria Police ran two operations (Operation Nightlife 1 and 2) in 2007 and 2009 respectively, which centred on maximum police visibility and personnel during high alcohol hours (HAH–weekend evenings and early mornings) [10] in the NTE, as well as improved radio contact between police and licensees. Other police-led interventions include Operation Razon (2009) which had undercover police officers enforcing on-premise licensing conditions (e.g. responsible service of alcohol).

In addition to the community-level interventions described above, the Victorian Traffic Accident Commission (TAC) also ran a range of campaigns, including television awareness advertisements (Table 1). The content of these media-campaigns were generally variations of three main themes: education, emotion, and law enforcement [3]. The education topic centred on educational topics to do with drink-driving

Intervention type	Intervention	Implementation (mm/yr)	Content
1. TAC media awareness campaigns			
	Enforcement 1	12/2001	Targets low level drink-driving by showing consequences of drink-driving (fines, police crack-down).
	Enforcement 2	12/2003	Targets low level drink-driving by showing consequences of drink-driving (death, fines, etc).
	Education 1	03/2003	Shows the potentially serious consequences of low-level drinking, or intoxication without being 'drunk'. Shows common settings where low-level drinking may occur and informs of symptoms of light intoxication.
	Education/Emotive	11/2004	Shows consequences of receiving a conviction of drink-driving in a range of situations (financial, family, employment).
	Emotive	11/2005	Shows the potentially serious physical and psychological consequences of low-level drinking, or intoxication without being 'drunk' (causing death).
	Enforcement 3	09/2006	Targets low level drink-driving, and promises it is a matter of when and not if one is caught.
	Education 2	05/2008	Shows how personal factors affect BAC-level, and hence that a two standard drinks limit is not a guarantee of being under the legal limit.
2. Law enforcement campaigns			
	Alcohol interlock program	03/2003	Targets recidivist drink-drivers. An alcohol interlock is fitted to offender's vehicle ignition, and only unlocks if the device measures driver's BAC as below legal limit.
	Operation Nightlife 1	01/2007	Pre-advertised police crack-downs on drink-driving, typically over several days.
	Operation Nightlife 2	07/2009	Pre-advertised police crack-downs on drink-driving, typically over several days.

Table 1: Intervention description and date of implementation.

(e.g. legal driving alcohol-limit). Next, the emotive themed media campaign attempted to deter people from drink-driving by tapping into their emotional states with graphic demonstrations of possible consequences (traffic accidents, injury, death) of DUI [3]. Finally, the enforcement campaign promised enforcement of the law, and thus aggressively threatened potential drink-drivers that they would be caught if they drove under the influence. The TAC campaigns were implemented in cooperation with Victoria Police, and thus often served as advertisement for increased police activity.

Another intervention which requires mention is the alcohol interlock program. This initiative targets repeat offenders. An alcohol interlock is fitted to a car's ignition by court order, and measures the driver's blood alcohol level, only unlocking if the driver is under the legal limit [11].

Although the mentioned interventions have been implemented in good faith, none were developed in a systematic fashion, nor have any of them been empirically evaluated. Thus, the purpose of this study is to document DUI-trends in Geelong, and to establish whether the aforementioned interventions are associated with decreases in DUI-rates.

Method

This study examined DUI frequencies across adjacent intervention phases in Geelong Victoria, Australia, from 2000 to 2009, as indicated by Victoria Police data. Two types of data were used: 1) Victoria Police data on drink driving offences (DUI); 2) Victoria Police data on preliminary breath tests (PBT). The former data set comprised a raw frequency of DUI-incidents, whereas the latter data involved the proportion of breath tests taken which were over the legal limit (Table 1).

Data

Frequency data for the number of DUI-offences recorded was acquired for the dates of 1 January, 1999 through 31 July, 2009. A total of 9421 DUI-records were extracted and included details of offender demographics, offender blood-alcohol level (BAC), time of offence, and prior DUI-record. Data were subsequently aggregated into categories of all DUI offences, BAC (the percentage of alcohol in the blood)-level 1, 2, and 3 (BAC ≤ 0.10, BAC ≤ 0.20, BAC ≤ 0.30, respectively. The legal limit is BAC ≤ 0.05), HAH (high alcohol hours–8 pm-5:59 am) [10,12] and recidivist (re-offenders) variables.

Preliminary breath test (PBT) data was obtained for the dates of 1 January, 2000 through 31 December 2009. This data set comprised 954 offences. As the PBT-data was not as detailed as the DUI-data, this data-set was aggregated by all offences and HAH variables only.

Analysis

The study was conducted in two stages. First, frequencies were generated detailing the time of day and day of week for DUI- and PBT-data. Offending rates aggregated for month intervals were computed and then plotted as time-line graphs. The DUI-data was further divided into subgroups denoted by BAC-levels as indicated above, and number of prior DUI-offences. Second, changes across intervention phases were assessed using multiple linear regression analyses. A dichotomous independent variable was created for each intervention and coded 0 (pre-intervention) and 1 (post-intervention). Thus, the phases preceding an intervention were compared to the phase following it.

Time-series approaches are usually recommended for longitudinal frequency data such as the data obtained for this study [13]. A fundamental assumption of time-series techniques is the presence of temporal autocorrelation–that is, successive observations are not statistically independent, thus resulting in autocorrelation of the errors [14]. Specific tests are used to assess this assumption; specifically the Durbin-Watson statistic [15]. Another central assumption involves data-stationarity which refers to the stability of mean, variance, and autocorrelation over time [13,16]. Results failed to indicate significant stationarity or autocorrelation in all of the data categories. For these reasons it was not possible to use a time-series analysis. Instead, linear regression was used to determine how much of the variance could be predicted by the implemented interventions (IVs) on DUI-rates (DV). Polynomial trend lines were also fitted to data-aggregates.

Results

Descriptives

DUI-data: The age-range of offenders was 12 to 98 years (mean age of 33, modal age of 20). The age-groups of 18-27, 28-37, and 38-47 comprised 83.2% of the recorded offences with 18-27 year-olds being responsible for 41.3% (n=3894) of offences. Over one in five (22.5%) had recorded prior DUI offences; 14.1% (n=1324) had one prior offence, 5.4% (n=513) had two priors, 1.6% (n=147) had three priors, and 1.1% (n=101) had between 4 and 5 priors. Of note, .3% (n=31) had between 6 and 15 prior DUI-convictions. Males (n=7601, 80.7%) were more frequently involved in DUI cases than were females (n=1820, 19.3%).

PBT-data: Similar to the DUI-data, males were overrepresented in the PBT-data with 76.2% (n=988) of offenders being male, and 23.8% (n=309) female. The PBT-data contained no information on age or prior arrests.

Rates by time of day and day of week

DUI: The majority of DUI-incidents were intercepted on Thursday through Sundays (n=7384, 78.4%), with most cases on any one day being recorded on Saturdays (n=2429, 25.8%). Most offences were registered between the hours of 7 pm and 5 am (n=7300, 77.5%) with 5809 (61.7%) cases occurring within this time-frame Thursday through Sunday, and 1940 (20.6%) incidents on Saturday within this time-frame.

PBT: Similar to the DUI-data, most PBT-cases were recorded during HAH between 7 pm and 9 pm on Thursday, Friday, and Saturday evenings, with 46.8% (n=447) of the entire sample being registered during this time.

Rates by year

Figures 1-4 show the frequency of DUI- and PBT-rates between January 1999 and July 2009 with reference points for each intervention phase implemented within this time-frame (Figures 2 and 4). Trend lines (Figures 1 and 3) indicate flat inverted U-curves in DUI and PBT-frequency over time with R^2 Quadratic=0.07 and 0.02 respectively, indicating relatively weak positive DUI- and PBT-trends up until January 2005 after which they level off and eventually decrease. Visually Figures 2 and 4 suggest that the interventions do not precede lasting declines in DUI- or PBT-rates (Figures 1-4).

Regression analysis

DUI-data: The regression analyses revealed significant overall results for all of the DUI-data categories with the exception of BAC
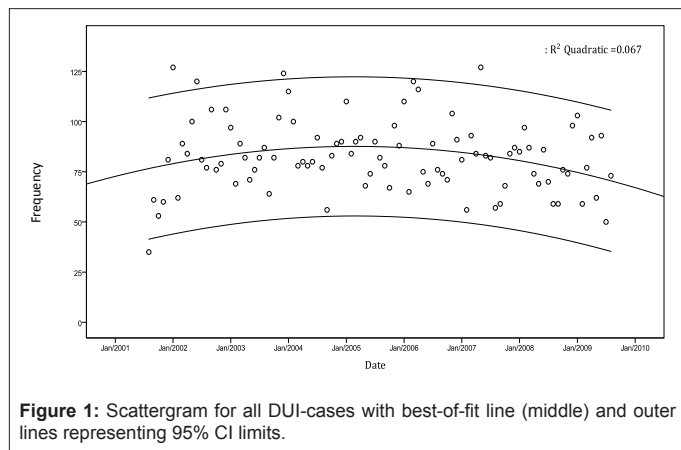

Figure 1: Scattergram for all DUI-cases with best-of-fit line (middle) and outer lines representing 95% CI limits.
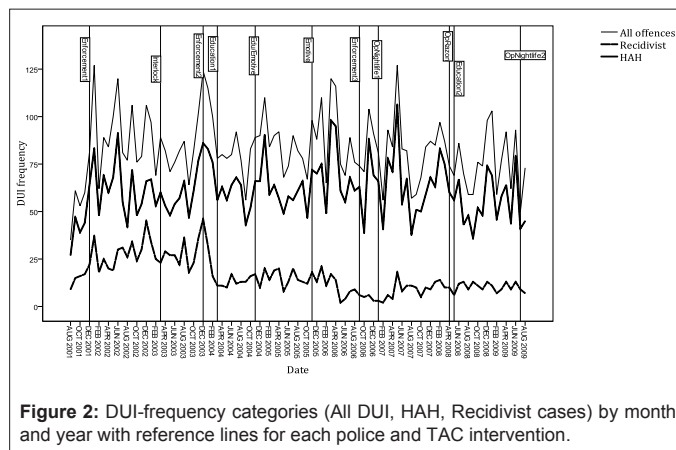

Figure 2: DUI-frequency categories (All DUI, HAH, Recidivist cases) by month and year with reference lines for each police and TAC intervention.
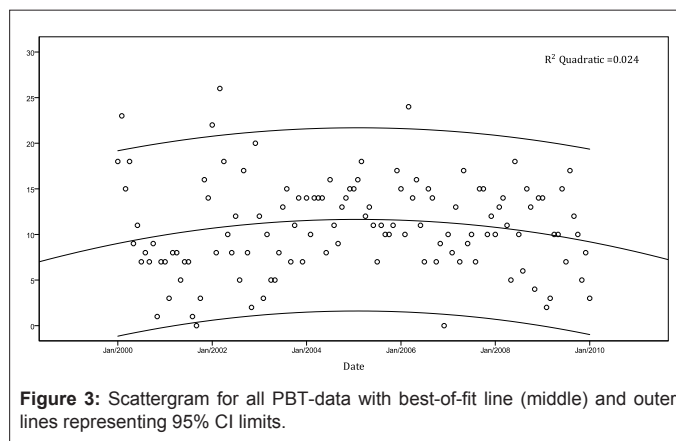

Figure 3: Scattergram for all PBT-data with best-of-fit line (middle) and outer lines representing 95% CI limits.
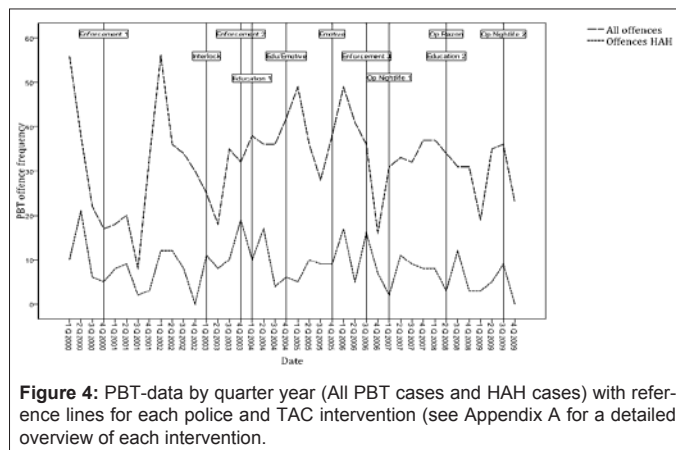

Figure 4: PBT-data by quarter year (All PBT cases and HAH cases) with reference lines for each police and TAC intervention (see Appendix A for a detailed overview of each intervention.

	R^2	Adjusted R^2	F
All DUI	0.62	0.57	14.04*
BAC 1	0.62	0.58	14.44*
BAC 2	0.40	0.33	5.78*
High-alcohol hrs	0.59	0.55	13.93*
Recidivist	0.68	0.64	18.42*

Note. *$p<0.001$; All df=13, 126

Table 2: DUI-data: Significant regression results for all interventions on different offence types.

3 (Table 2). Thus, for the categories All DUI, BAC-1, HAH, and Recidivist, the interventions combined to account for over 50% of

Intervention (IV)	All DUI		BAC 1		BAC 2		BAC 3		High alcohol hrs		Recidivist	
	β	t	β	T	β	t	β	t	β	t	β	t
1. Enforcement 1	0.67	2.67**	0.71	2.82**	0.25	0.96	0.09	0.30	0.66	2.60*	0.05	0.32
2. Enforcement 2	0.36	3.72***	0.32	3.30**	0.25	2.52*	0.15	1.40	0.30	3.07**	0.22	3.51**
3. Education1	-0.93	-3.30**	-0.76	-2.63**	-0.58	-2.00*	-0.27	-0.83	-0.77	-2.64**	-0.63	-3.50**
4. Edu/Emotive	0.19	0.93	-0.16	-0.76	0.63	3.05**	0.22	0.95	0.12	0.56	0.07	0.54
5. Emotive	0.18	0.93	0.31	1.60	-0.16	-0.81	0.06	0.30	0.30	1.52	-0.25	-2.04*
6. Enforcement 3	-0.16	-0.62	-0.42	-1.61	0.32	1.22	0.00	0.00	-0.18	-0.70	-0.57	-3.60**
7. Op Nightlife 1	-0.23	-0.71	0.20	0.60	-0.76	-2.30*	-0.12	-0.33	-0.10	-0.31	-0.19	-0.92

Note. * p<0.05, ** p<0.01, *** p<0.001; please see Table 1 for a detailed overview of each of the interventions.

Table 3: DUI-data: Significant regression results for individual interventions and their association with specific DUI-categories.

the variance of the respective data-categories. Significant results were also generated for BAC 2 where the interventions predicted 40% (33% adjusted) of the variance of DUI-rates. Further, as indicated in table 3, in the data aggregates for All DUI, BAC 1, and HAH, three of the individual interventions (Education 1, Enforcement 1, Enforcement 2) all indicated significant changes in frequencies across pre- to post-intervention phases. Of these interventions, however, only Education 1 was associated with a reduction in DUI-rates when referenced against the previous phase. Different results were observed for the BAC 2-category where the interventions Edu/Emotive, Education 1, Enforcement 2 and Operation Nightlife 1 produced significant differences pre- to post-intervention. Here, only Operation Nightlife 1 and Education 1 were associated with reductions in DUI-rates. Further, analyses for Enforcement 1, Enforcement 2, Education 1 and Emotive produced significant results in the Recidivist category. Of these, Education 1, Enforcement 3, and Emotive were associated with decreases in DUI-frequency in the post-intervention phases.

PBT-data: There were no significant overall results for the PBT-data, indicating that none of the interventions together accounted for variance in the PBT-rates at a significant level. Further, Enforcement 3 was the only individual intervention associated with a significant effect in PBT-rates. The intervention predicted a significant decrease in the All PBT-category with β=-0.73, p<0.01 (Tables 2 and 3).

Discussion

The purpose of this study was to document DUI-trends in Geelong, and further to establish whether interventions were associated with any decreases in DUI-rates. The findings indicated no association between level of drink-driving and interventions that focus on licensed venues (Just Think and ID-scanners). On one level, this is somewhat unexpected considering the strong links between licensed venues and drink-driving observed in the past [17]. However, previous findings regarding these specific interventions, have demonstrated them as ineffective in reducing hospital emergency department attendances or assault incidents reported to police [18,19]. Certainly, other interventions which have been successful in dealing with alcohol-related harm in the NTE, such as increasing the price of alcohol [17] and reducing trading hours [20], have demonstrated sustained effects on drink-driving.

Similarly, no association with drink-driving rates was detected for the interlock intervention, the TAC interventions Education 2, Edu/Emotive, or the police interventions Operation Nightlife 2 and Operation Razon. While the TAC's Enforcement 1 and 2 did correlate significantly with rises in several of the DUI-data categories, this is likely to reflect the increased police activity occurring with the campaigns.

The findings did show significant reductions for four interventions -the TAC's Emotive, Enforcement 3 and Education 1 media campaigns, and the Victoria Police intervention, Operation Nightlife 1. Enforcement 3 was associated with decreases in Recidivist and the all PBT category, while Education 1 was associated with decreases in every DUI-category except the BAC-3 category. Operation Nightlife 1 and Emotive only precipitated a significant decrease on one outcome each (BAC 2 and Recidivist, respectively). It may be reasonably expected that effects would be evident in more than one data-category if the interventions actually affected drink-driving behaviour in the community, and as such these results are likely to be statistical artefacts associated with large data-sets. That is, significant findings, but small and trivial effect sizes.

The Education 1 campaign is thus the only initiative associated with reductions in multiple categories. This intervention was broad in nature and relied on creating awareness and knowledge around the topic of drink-driving by displaying common settings in which alcohol is consumed prior to driving (e.g. a barbeque, after work drinks, drinks with friends). The commercial demonstrated typical behaviours of 'light' intoxication, and emphasised the fact that drivers do not need to be heavily drunk for alcohol to affect driving performance significantly. Education 1 thus informed people of the potentially devastating effects of low-level, seemingly harmless drinking, and perhaps most importantly, provided common examples of the symptoms of light intoxication, as well as where and when this type of drinking is likely to take place. This approach is different to other TAC campaigns which underscore the consequences of drinking and driving – fear of accident (Emotive), detection (Enforcement)–but fail to offer any real guidelines, information or examples of how to avoid these fates other than the simple message to not drink and drive. As such, at its core Education 1 relied on the provision of information and guidance in the avoidance of DUI, the message that one does not have to be drunk to be under the influence, as well as the depiction of consequences. This is in contrast to 'merely' creating fear of injury or law enforcement through the portrayal of consequences alone, as is characteristic of other TAC campaigns. Thus, in light of its approach, the Education 1 campaign may have directly affected DUI-rates in the lower and medium levels of intoxication as well as repeat offenders. Further, the fact that BAC 3 was the only category not associated with Education 1 is not surprising as this category represents extreme intoxication. The related decrease in cognitive function is likely to further inhibit any effect a media intervention may have on driver behaviour.

Finally, a high proportion of the drink driving offences noted were committed by repeat offenders. One in five offences was committed by people who had been previously convicted, and 3% of offenders had been convicted on more than three occasions. These figures are of substantial concern given drivers in the USA with a BAC of 0.08 or higher involved in fatal crashes were four times more likely to have a prior conviction

for driving while impaired [21]. These data combined, with the noted lack of effect of interlocks, suggests the need for interventions which have been found effective elsewhere, such as the 24/7 Sobriety project from South Dakota [22]. South Dakota's fundamental innovation is to require offenders to stop drinking, rather than stop driving. Simple trend data found that traffic fatalities involving alcohol impairment dropped from 71 in 2004 to 34 in 2008 [22]. In light of the above data, such approaches merit further investigation in the Australian context.

Limitations

Limitations of this study are related to the nature of the data and the data-analysis. A major consideration when investigating police records of drink-driving is that the vast majority of arrests are initiated by police activity. Random breath testing stations (RBTS; 'booze buses') represent the major avenue through which drink-driving offences are detected. Therefore, major spikes in arrests actually reflect major campaigns or 'blitzes', and hence, the trends presented do not necessarily represent a true reflection of the number of drink-drivers on the roads, but rather the capacity of the given RBTSs. Hence, police DUI-data are likely to underestimate actual frequencies. This is supported by international evidence which suggests that arrest data cover only 0.5% of total self-reported rates of drunk driving [23]. This problem, however, is less of an issue in the PBT-records, as this data indicates the proportion of people intercepted during RBTS operations who were under the influence of alcohol. Thus, the combination of PBT- and DUI-data may still provide relatively balanced insight into actual DUI-frequency.

Given the nature of the data, the analyses assessing pre- to post-intervention effects do not permit statements about possible causal relationships between the implemented interventions and DUI frequency. However, the analyses could determine the strength of relationships between DUI-rates and implemented interventions, and thus give an indication of whether any intervention might successfully predict variation of DUI-rates over time.

Conclusions

Findings show that community interventions focusing on licensed premises (Just Think and ID-scanners) did not significantly reduce drink-driving behaviour when referenced against preceding intervention phases. On the other hand, significant reductions in drink-driving rates were evident for three of the TAC initiatives. While campaigns focussed on the potentially serious consequences of low-level drinking, or intoxication without being 'drunk' in terms of causing harm or being caught (Emotive and Enforcement 3), these campaigns were only associated with reductions in single data categories. On the other hand, the Education 1 campaign centred on creating awareness around the danger of 'light' intoxication by informing people of common settings where seemingly insignificant amounts of alcohol are consumed, as well as demonstrating typical symptoms of 'light' intoxication. This intervention was associated with decreases on multiple outcome measures. Thus, the Education campaign is by far the most promising method of intervention based on the present findings, and thus suggests maximum potency of campaigns employing educational information and provision of practical guidelines to avoid drink-driving.

The findings also highlighted the ongoing problem of recidivist drink drivers in Geelong. The finding that more than one in five drivers caught drink driving were repeat offenders suggests the need for more targeted interventions other than the interlocks which were not found effective in the current study.

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