Preliminary investigation of the impact of roadside oral fluid testing and increased penalties on illicit drug-driver fatalities in Western Australia

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Abstract

Background

Illicit drugs such as cannabis and methamphetamine are well-known causes of driver impairment and significant risk factors for crashing and personal injury. In Western Australia, recent research showed that 23% of drivers fatally injured during the period 2000 – 2012 tested positive for one or more illicit substances (Palamara et al. 2014). To combat illicit drug driving in Western Australia, a number of initiatives have been implemented in in recent years, namely the introduction of Roadside Oral Fluid Testing (ROFT) (October 2007) and an increase in penalties for illicit drug driving (Section 64AC offence) (October 2011). From the perspective of Deterrence Theory, these countermeasures respectively aim to increase drivers' perception of the likelihood of being detected for drug driving and the judged severity of punishment for doing so. To date there has been no investigation of the effectiveness of ROFT on the incidence of illicit drug related crashes in Western Australia or where introduced elsewhere. Similarly, there is a dearth of studies investigating the impact of increased penalties for drug driving. Consequently, it is of interest to model and quantify, where possible, the impact of drug-driving countermeasures such as those implemented in WA on illicit drug driver behaviours/outcomes.

Aims

To undertake a preliminary investigation of the impact of the WA illicit drug driving countermeasures on illicit drug related driver fatalities from January 2005 to November 2012.

Methods

The de-identified linked crash and toxicology records of WA motorcar drivers and motorcycle riders fatally injured during the period 2000 – 2012 were retrieved from WA Police. Each fatality was classified according to the presence or absence of both illicit (e.g., alcohol, caffeine, prescription medications etc.) and illicit substances (e.g., cannabis, methamphetamine, ecstasy, heroin, cocaine) by the ChemCentre, WA (formerly known as the Chemistry Centre) on behalf of the Coroner.

The introduction of increased penalties and changes in enforcement practices for drug driving over time and at varying times represent a quasi-experimental designs (because of their non-random assignment). The availability of retrospective administrative data on various outcomes related to drug driving behaviours prior to and following the introduction of these interventions means that time series of (1) the monthly proportion and (2) the monthly rate (per 100,000 motor vehicle licenses (MDL) issued in WA) of fatally injured drivers and riders testing positive for an illicit substance can be constructed and analysed as interrupted time series. Interrupted time series is regarded as the strongest quasi-experimental design for the evaluation of longitudinal effects of time specific interventions (Wagner et al. 2002) such as drug driving countermeasures.

Statistical analysis of the interrupted time series data for drug driving outcomes impact of the penalty and enforcement changes was undertaken using *segmented regression analysis* (see Wagner

et al. 2002). The segmented regression technique has been employed by other investigators to address a range of health (e.g., Wagner et al. 2002) and road safety outcomes including statutory penalties for drink driving (e.g., Briscoe, 2004; Nagata et al. 2008). This is a simple yet effective approach of analysing the potential effects of single or multiple interventions on a time series by modelling the time series and the interventions as a single multiple linear regression to statistically determine the impact of each intervention on the immediate and longer term outcomes of interest (Wagner et al. 2002). Changes, either immediate or longer term, in (1) the monthly proportion and (2) the monthly rate of fatally injured drivers/riders testing positive that coincided with the two WA drug driving countermeasures of interest were investigated in this study.

Results

Neither *ROTF* (October 2007) nor *increased penalties* (October 2011) was found to be associated with a significant change, either immediate or ongoing, in the monthly proportion of fatally injured drivers and riders testing positive for an illicit substance (*p*-values of potential changes ranged from 0.1340 to 0.8688).

In terms of the monthly rate of fatally injured drivers and riders testing positive, only *ROTF* (October 2007) was found to be significantly associated with an ongoing monthly reduction of 0.0024 fatalities per 100,000 MDL issued (*p*-value = 0.0249) (Table 1).

Table 1. Segmented Regression of the monthly rate (per 100,000 MDL) of fatally injured drivers/riders testing positive for an illicit substance; Western Australia 2000-2012 (adjusted for potential seasonal effects (by month))

	Coefficient	Standard Error	t	Significance
(Constant)	0.0709	0.0317	2.2348	0.0269
Trend – prior to interventions	0.0006	0.0004	1.7075	0.0897
Immediate Change – ROFT	-0.0004	0.0344	-0.0111	0.9912
Change in trend – after ROFT	-0.0024	0.0011	-2.2649	0.0249
Immediate change – Increased Penalties	0.0312	0.0613	0.5089	0.6115
Change in trend – after Increased Penalties	-0.0002	0.0065	-0.0365	0.9709

While the long term change in trend after the introduction of *ROFT* was significant, one concern was that the ANOVA of this initial model was not statistically significant (*p*-value = 0.4306). Neither *increased penalties* nor the seasonal adjustments were found to be associated with a significant change in the monthly rate; consequently they were removed from the segmented regression to further streamline the model. The streamlined model, with the ANOVA now significant (*p*-value = 0.0321), had found the entire study period after the introduction of *ROFT* (October 2007 – November 2012) to have sustained an ongoing monthly reduction of 0.0019 fatalities per 100,000 MDL issued (*p*-value = 0.0115) (Table 2).

Table 2. Streamlined Segmented Regression of the monthly rate (per 100,000 MDL) of fatally injured drivers/riders testing positive for illicit drugs; Western Australia 2000-2012 (adjustment for seasonal effects and Intervention 2 (increased penalties) removed from the model)

	Coefficient	Standard Error	t	Significance
(Constant)	0.1133	0.0195	5.7973	0.0000
Trend – prior to interventions	0.0007	0.0004	1.8204	0.0706
Immediate Change – ROFT	-0.0119	0.0308	-0.3855	0.7004
Change in trend – after ROFT	-0.0019	0.0008	-2.5584	0.0115

Discussion/Conclusion

Notwithstanding limitations which relate to (1) the outcome data selected for analysis, (2) the timing of the evaluation and length of follow-up, (3) the absence of additional information related to the deterrence of driver behaviour, and (4) identifying and adjusting for other possible confounding factors, the findings provide preliminary evidence of the positive impact of *ROFT* on illicit drug driving fatalities and the limited impact of more severe penalties on illicit drug driving behaviour in the absence of a corresponding and supportive increase in the level of enforcement (either actual or perceived).

To overcome the identified limitations of the current research, future research should (1) be conducted using a lengthier period of follow up for crashes and drug driving offences; (2) use additional source of “outcome” data including *ROTF* test results and driver offence/conviction data for drug driving; (3) use linked crash, offence and licensing history data to investigate the impact of penalty changes on recidivist behaviour; and (4) adjust for monthly levels of *ROTF* for illicit drug enforcement activity.

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