Random Breath Tests and Their Effectiveness Revisited. An Examination of RBT and Alcohol-Related Crash Data from 2000-2011 across Australia

Random Breath Testing in Australia: Is there an Optimum Level of Intensity?

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Abstract

Background Random Breath Testing (RBT) is the main drink driving law enforcement tool used throughout Australia. International comparative research considers Australia to have the most successful RBT program compared to other countries in terms of crash reductions (Erke, Goldenbeld, & Vaa, 2009). This success is attributed to the programs high intensity (Erke et al., 2009). Our review of the extant literature suggests that there is no research evidence that indicates an optimal level of alcohol breath testing. That is, we suggest that no research exists to guide policy regarding whether or not there is a point at which alcohol related crashes reach a point of diminishing returns as a result of either saturated or targeted RBT testing.

Aims In this paper we first provide an examination of RBTs and alcohol related crashes across Australian jurisdictions. We then address the question of whether or not an optimal level of random breath testing exists by examining the relationship between the number of RBTs conducted and the occurrence of alcohol-related crashes over time, across all Australian states.

Method To examine the association between RBT rates and alcohol related crashes and to assess whether an optimal ratio of RBT tests per licenced drivers can be determined we draw on three administrative data sources from each jurisdiction. Where possible data collected spans January 1st 2000 to September 30th 2012. The RBT administrative dataset includes the number of Random Breath Tests (RBTs) conducted per month. The traffic crash administrative dataset contains aggregated monthly count of the number of traffic crashes where an individual’s recorded BAC reaches or exceeds 0.05g/ml of alcohol in blood. The licenced driver data were the monthly number of registered licenced drivers spanning January 2000 to December 2011.

Results The data highlights that the Australian story does not reflective of all States and territories. The stable RBT to licenced driver ratio in Queensland (of 1:1) suggests a stable
rate of alcohol related crash data of 5.5 per 100,000 licenced drivers. Yet, in South Australia were a relative stable rate of RBT to licenced driver ratio of 1:2 is maintained the rate of alcohol related traffic crashes is substantially less at 3.7 per 100,000. We use joinpoint regression techniques and varying regression models to fit the data and compare the different patterns between jurisdictions.

**Discussion** The results of this study provide an updated review and evaluation of RBTs conducted in Australia and examines the association between RBTs and alcohol related traffic crashes. We also present an evidence base to guide policy decisions for RBT operations.

**Introduction**
Random Breath Testing (RBT) is the main drink driving law enforcement tool used in Australia. RBT was introduced in Victoria, Australia in 1976. Over the period 1981-2006, the percentage of fatally injured motorists with a BAC .05 or more declined from almost half to just over a quarter, a reduction of 35% (Faulks, Irwin, Watson, & Sheehan, 2010). Much of this decrease in drink driving fatalities is attributed to the nationwide introduction of random breath testing (RBT) throughout Australia during the late 1970s and early 1980s (see Harrison, Newman, Baldock, & McLean, 2003). The key elements of RBT in Australia are: legislation to implement, strong enforcement of the program with penalties, public education to raise awareness of the program and the perception that random screening is truly random and ubiquitous (Peek-Asa, 1999). Australia has strong community support for drink driving countermeasures, with nearly universal agreement for the random breath testing of drivers (Petroulias, 2011). In Australia the police have the power to pull over and breath test drivers at any time, irrespective of driving behaviour (Faulks et al., 2010).

International comparative research considers Australia to have the most successful RBT program compared to other countries in terms of crash reductions (Erke et al., 2009). This success is attributed to the programs high intensity (Erke et al., 2009). Erke et. al. (2009) conclude from their meta-analysis that testing all drivers under road block, saturation conditions is more effective than only testing those that arouse suspicion. Australian RBT programs tend to have higher intensity enforcement than other countries. For example, unlike other countries, Australia uses ‘Booze buses’ in high visibility locations, state governments spend large amounts on publicity, and the total number of drivers tested in Australia is higher than other countries (Erke et al., 2009). Nevertheless, within Australia there has been considerable diversity in RBT program implementation: firstly in how RBT was introduced and from there how they are implemented today (see (Harrison et al., 2003; Homel, 1988; Papafotiou-Owens & Boorman, 2011).

Australia does not have a regulatory nationwide policy that dictates how many RBTs should be conducted annually. Rather, each state implements targets that vary in their degree of formality. Most Australian states and territories loosely adopt an annual RBT target equivalent to one-third of the annual number of licenced drivers within its jurisdiction which is largely based on the reviews of Homel and others. To keep police enforcement operating at high levels of visibility requires high levels of police resourcing, sustained overtime (Harrison et al., 2003). Our review of the extant literature suggests that there is no research evidence that indicates an optimal level of alcohol breath testing. That is, we suggest that no research exists to guide policy regarding whether or not there is a point at which alcohol related crashes reach a point of diminishing returns as a result of either saturated or targeted RBT testing.
In this paper we address the question of whether or not an optimal level of random breath testing exists by examining the relationship between the number of RBTs conducted and the occurrence of alcohol-related crashes over time, across all Australian states.

Methods
Our research draws on three administrative data sources to assess whether an optimal ratio of RBT tests per licenced drivers can be determined. Where possible data collected spans January 1st 2000 to September 30th 2012.

Random Breath Testing (RBT)
The RBT administrative dataset includes the number of Random Breath Tests (RBTs) conducted per month and, where available, spanning January 2000 – December 2011. With the assistance of the Queensland Police Service (QPS), police departments in each state and territory (for example Traffic Analysis Unit within the QPS) provided the data.

Alcohol-Related Traffic Crashes (ARTC)
The ARTC administrative dataset contains unit level count of the number of traffic crashes where an individual’s recorded BAC reaches or exceeds 0.05g/ml of alcohol in blood for both states. Data was made available by the ARTC data custodians from each jurisdiction (in most cases this was the Police Service). Limitations in the period of data were due to administrative processes. For example in Queensland the alcohol related traffic crashes data is only available for the period spanning July 2004 to June 2009. The ARTC data was aggregated to monthly counts.

Registered Licenced Drivers
The licenced driver administrative data was provided for by appropriate data custodians in each state and territory. Most data provided were annual numbers of registered licenced drivers for the years 2000 to 2011. As monthly data were required for analysis, where annual data was provided, the monthly count of registered licenced drivers were extrapolated by interpolating monthly numbers between consecutive pairs of annual numbers. While data spanning 2000 to 2011 was requested, in some jurisdictions data for this full period was not provided.

Statistical analyses
Prior to analysis all administrative data was transformed to be monthly counts. Due to the high volume of RBTs conducted we present RBTs either as a factor of 1,000 (e.g., 310,298 would be presented as 310) or as a factor of 10,000 to simplify data presentation. As the estimated annual number of RBTs is based on a percentage (or ratio) of the annual count of licenced drivers to present to calculate monthly ratios of RBTs to licenced drivers we divide the monthly number of licenced drivers by 12 to get a ratio estimate for the number of RBTs to licenced drivers.
We first use Joinpoint Regression software (Statistical Research and Applications Branch, 2013) to evaluate and quantify any significant deviations in trends over time for each of administrative datasets. This software is data driven and uses joinpoint (or piecewise) regression as a statistical method to identify significant variations in trends within epochs. Using this approach, avoids the need to arbitrarily select a base for estimating the direction and magnitude of slopes within a data series. The software uses statistical criteria to determine when and how often the monthly percent change (MPC) across a series by fitting rates using joined log-linear segments. We specified the model to test with the maximum number of three join points within the series and allow the calculations to adjust for any auto-correlation error estimated directly from the data. Based on the number estimated line segments drawn from the analysis, each segment of the series is characterized by an MPC (Kim, Fay, Feuer, & Midthune, 2000) and the associated 95% confidence interval is indicative of the adequacy of the final model and the degree of random variation inherent in the underlying rates. In text, we have used asterisks (*) to indicate if the MPC segment is significantly different from zero. The model uses a Monte Carlo Permutation method to test if an apparent change in trend is statistically significant. A re-sampling method of 5000 iterations is specified. For further information the reader is encouraged to visit surveillance.cancer.gov/joinpoint.

All descriptive analysis and the regression analysis (and associated diagnostics) estimates where undertaken using Stata (StataCorp LP, 2011).

Results

We provide a series of graphical models contrasting the rate of RBTs per 1000 licenced drivers against the number of ARTC per 100,000 licenced drivers. As seen in Figure 1, the RBT rate in Queensland has been slightly decreasing over the past 11 years. At the turn of the millennium the RBT per licenced driver ratio was approximately 111:100 (111 RBTs per 100 registered licenced drivers) this decreased to 104:100. For the Queensland series the MPC rate was significantly different from zero (MPC: -0.086; 95% CI: -0.146--0.025). For the period where ARTC data was available the MPC rate was 0.012 (CI: -0.174-0.199) which was not significantly different from zero (or a flat line).
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We use a simple OLS regression to model (see Equation 1) the effect of alcohol related traffic crashes (per 100,000 licenced drivers) after account for the number of RBTs (per 1,000 licenced drivers). The model indicated that in Queensland maintaining a RBT to licenced driver ratio of approximately 1:1 maintained a stable crash rate at 5.5 (95% CI 5.4-5.7).

Equation 1: OLS regression ARTC on RBT

\[ \text{ARTC per 10,000 RBTs} = \beta_0 + \beta_1 \times \frac{\text{RBTs}}{\text{Licenced Drivers}} \]

We provide a similar review of the data from other states and territories and explore ways of combining this data.

Discussion

Motor vehicle traffic crashes are a significant cost to society, both socially due to loss of life or serious injury, and financially, through economic costs, the associated burden on health systems and human capital. The introduction and use of RBT in Australia is a central and important law enforcement initiative, embraced by all states and territories since the 1980s. As both a general and specific deterrent measure against drinking and driving, international comparative research considers Australia to have the most successful RBT program compared to other countries in terms of crash reductions (Erke et al., 2009). RBT success in Australia, compared to other countries, is often attributed to its high intensity enforcement, high visibility to all drivers, large amounts of publicity (Erke et al., 2009).

Nevertheless, within Australian jurisdictions RBT program implementation and effectiveness varies considerably (Homel, 1990). This study addresses the question of whether or not an
optimal level of random breath testing exists by examining the relationship between the number of RBTs conducted and the occurrence of alcohol-related crashes over time, across XX Australian states.

Our research demonstrates a strong link between the number of RBTs conducted annually and the number of alcohol-related crashes that occur where a driver’s BAC reached or exceeded 0.05g/dL of alcohol in the blood. However, the direction of these links is not equal for all states and territories.

For jurisdictions such as Western Australia, Queensland, Northern Territory, New South Wales and Victoria, our research shows that after accounting for population (proxy by licenced drivers) as the number of RBTs conducted increases the number of alcohol related traffic crashes decreases; perhaps as the perceived risk of being detected is considered greater. By contrast, the story for South Australia, Australian Capital Territory, and Tasmania is reversed. In these jurisdictions, as the number of RBTs conducted increases the number of alcohol related traffic crashes also increases. The results of this study suggest that the ‘Australian’ model is not equal for all states and that ‘state’ specific characteristics may be important when developing an evidence base for policy decisions for RBT operations.

Future research

It is clear that that to increase (or potentially decrease) the number of RBTs in any state has economic concerns. For example, to double the ratio in Western Australia from 1:2 to 1:1 means doing an additional 50,000 RBTs per month. Counter to this cost though is a saving of 1.5 alcohol related crashes per month. We find a silence in the literature on the question about what is meant by a “return.” For example, should a “return” on the RBT policy be measured as a reduction in the number of alcohol related traffic crashes or as marginal changes in crash reductions relative to marginal changes in costs of greater intensity? Full treatment of this issue is critical to further discussions of optimal levels of random breath testing in the future.

References


