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The Long-Term Effects Of Random Breath Testing In Four Australian States: A Time Series Analysis

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EXECUTIVE SUMMARY

This study is about the long-term effectiveness of random breath testing, as judged by time series analyses of statistical data on accidents and police enforcement in four Australian states: New South Wales (RBT introduced December 17, 1982), Queensland (RBT introduced December 1, 1988), Western Australia (RBT introduced October 1, 1988), and Tasmania (RBT introduced January 6, 1983). This report, which focuses on the statistical evidence, is designed to be read in conjunction with a sequel, that explores in more detail police enforcement practices in the various jurisdictions.

Analytic Methods

Although considerable research on random breath testing has been conducted in Australia, there are few studies that use rigorous time series methods to assess the impact of RBT and other legal interventions on accidents, especially controlling for economic factors such as unemployment rates that are known to have a marked impact on road usage and accidents. This study is innovative in that analyses were based on daily accident data, allowing the introduction of controls for weather conditions, day of week, and public holidays. Change in a time series is not evidence of causality unless the change can be detected in the first post-intervention observation, and so daily data - the lowest level of temporal aggregation - are the ideal (and most natural) unit for analysis. Since daily accident data follow a Poisson distribution, log-linear methods are appropriate, provided residuals exhibit no evidence of autocorrelation.

Serious and fatal accidents were analysed because of their importance and because of the role of alcohol. Single vehicle night-time accidents were used as a more accurate surrogate for alcohol-related accidents, in preference to accidents involving a controller with a positive blood alcohol concentration. BAC data were not considered sufficiently accurate, particularly in the late 1970s and early 1980s. Only accident incidents were analysed, not persons involved in accidents. Accident data were analysed over as long a time period as possible, with most series commencing between 1976 and 1980 and concluding in 1991 or 1992.

Major factors controlled included seasonal effects, daily weather

patterns, indices of economic and road use activity, alcohol consumption, and the day of the week. The mathematical model applied to data from each state (where data quality permitted) allowed for the decomposition of the overall impact of RBT into three components: an "introduction effect" that could be short-lived; a "program effect" that represents the ongoing impact of the existence of RBT, independent of levels of enforcement; and a component that represents the effects of changes in ongoing enforcement levels. A further feature of the model was a capacity to estimate the lagged effect of enforcement; that is, the period of time after a given RBT operation over which the apparent effect on accidents could be discerned. This analytic approach has not been used previously in its full form in accident research, so the present study represents a significant methodological advance.

Research Questions

The design of the study involved a comparison of two states that could be said to be "revolutionary" in the way they introduced RBT, and two states that could be said to be "evolutionary" in their approach. New South Wales and Tasmania both introduced RBT at nearly the same time in a "boots and all" fashion, in the sense that RBT did not follow a period of "de facto" RBT and was enforced intensively once it was introduced. The major difference was that New South Wales spent millions of dollars on media publicity, while Tasmania spent virtually nothing, relying on press coverage and "word of mouth."

Western Australia and Queensland introduced RBT much later than Tasmania and New South Wales, and in both states RBT represented a development of the earlier de facto programs rather than being an entirely new form of enforcement. In addition, the "evolutionary" states did not devote the same level of resources for enforcement and publicity as the "revolutionary" states.

Specific research questions addressed by the study were:

(a) What are the size and duration of the impact of RBT in the "revolutionary" states that introduced RBT "boots and all" (New South Wales and Tasmania) and in the "evolutionary" states that introduced de facto RBT before full RBT (Queensland and Western Australia)?
(b) Did the small state of Tasmania achieve a similar impact as New South Wales with similar approaches to enforcement but markedly different levels of media publicity?
(c) What have been the effects of ongoing RBT enforcement on accidents?
(d) What have been the relative effects of de facto and full RBT in the "evolutionary" states?

Impact of RBT

Depending on which accident series was examined, the initial impact of RBT ranged from 48% for fatal accidents in New South Wales to 13% for all serious accidents in Western Australia. Only for single-vehicle night-time accidents in Queensland was it not possible to establish a significant effect for RBT, and this almost certainly reflects the combination of relatively low accident

frequencies and the shortness of the series. Table S.1 reproduces Table 7.1 in Chapter 7, which summarises the sizes of the initial impacts and the duration of the Introduction effects in the four states.

Table S.1. Summary of Size of the Initial Impact of RBT and the Duration of the Introduction Effect for the Four States

State	Type of Accident	Initial Impact	Duration of Introduction Effect[1]	Accidents Prevented in First Year
New South Wales	All serious	19%	15 months	522[2]
	Fatal	48%	4.5 months	204[2]
	Single-vehicle night-time	26%	10 years	686[2]
Tasmania[5]	All serious	24%	1 year	36[3]
Western Australia	All serious	13%	Ongoing	334[4]
	Fatal	28%	Ongoing	72[4]
	Single-vehicle night-time	26%	Ongoing	212[4]
Queensland	All serious	19%	Ongoing	789[4]
	Fatal	35%	Ongoing	194[4]

1 Duration of effect until impact reduced to 5% of initial value.
2 For the period December 17, 1982 to January 31, 1983.
3 These savings occurred in the first three months, after which no benefits of RBT could be measured.
4 These are the mean savings per year. Actual annual estimates fluctuate slightly around the mean.
5 Launceston and Hobart regions

In New South Wales and Western Australia the impact of RBT on single-vehicle night-time accidents was clear, with a 26% initial reduction that appeared to be sustained on an indefinite basis, although in New South Wales the effect declined to only 3% in 1989, reflecting the decay in the Introduction effect that had not at that time been counteracted by the effects of the increase in enforcement from late 1987. The reduction in single-vehicle night-time accidents achieved by RBT increased again to 22% in 1992, reflecting higher enforcement levels. In Western Australia and Queensland the permanence of the effects for most accident series examined perhaps reflects more the simplified nature of the model for these states than a definite long-term effect.

In summary, the impact of RBT in all states except Tasmania was (a) instantaneous; (b) substantial; and (c) permanent, although in

New South Wales the magnitude of the effect varied greatly over time. In New South Wales (d) the effects were amplified and RBT "saved" in the long-term through substantial increases in enforcement from 1987. New South Wales results were not as clear cut for serious and fatal accidents as for single-vehicle night-time accidents, at least in terms of the duration of the impact, but this can be explained in terms of the fact that the two former series are not as clearly alcohol-related as the latter (and also by the lower power of the analysis for fatals). The fact that only relatively small and inconsistent effects that were not strongly statistically significant could be discerned for the control series of accidents (vehicle-to-vehicle accidents during school hours) reinforces the conclusion that RBT had a permanent causal impact on alcohol-related accidents.

Despite a substantial initial impact in Tasmania, it was not possible to show that RBT had any effect on serious and fatal accidents after about three months. Possible reasons for this result were: (a) there were fewer than two fatal and serious accidents per day in the two regions analysed, compared with more than 20 throughout most of the 1970s and 1980s in New South Wales, resulting in a lack of statistical power; (b) the marked downturn in accidents that preceded RBT in the 1970s was not sustained into the 1980s, making it very difficult to measure the impact of any countermeasure in the 80s; and (c) despite high levels of enforcement there was no massive media campaign, unlike New South Wales. The long-term effects of RBT in each state except Tasmania are summarised in Table S.2.

Table S.2 Long-Term Effects of RBT in New South Wales, Western Australia, and Queensland

		NSW (17/12/82 - 31/12/92)		**WA** (1/10/88 - 31/12/92)		**QLD** (1/12/88 - 31/12/92)
Type of accident	% reduction[1]	Total accidents prevented	% reduction	Total accidents prevented	% reduction	Total accidents prevented
All serious accidents	3 - 18%	6742	13%	1443	19%	3217
Fatal accidents	17 - 42%	1487	28%	307	35%	789
SVNT accidents	3 - 26%	3246	26%	902	--	--

Note: SVNT accidents are single-vehicle night-time accidents.

1 The percentage reduction in accidents varied each year (including the period from December 17, 1982 to December 31, 1982 as a "year"), and only the range is shown. See Table 3.8 for further details.

Effects of Ongoing RBT Enforcement

Increased levels of enforcement in New South Wales since 1987 had a very clear and dramatic effect on serious and single vehicle night-time accidents. The model for all serious accidents indicated that an increase of 1000 in the daily testing rate corresponded roughly to a decline of 6% in accidents. The relationship for single-vehicle night-time accidents was stronger, with an increase of 1000 tests each day corresponding to a 19% reduction in accidents. However, from the models the relationship between changes in daily testing rates and accident reductions was not linear, so that there is an element of "diminishing returns" as daily enforcement levels increase. This is particularly the case with single-vehicle night-time accidents. This means that care must be taken in making predictions about the effects of increases in testing levels, especially when extrapolating outside the range of the data (about 2000 to 6000 tests per day)

The analyses also indicated that RBT has a "residual deterrent effect" that is of great importance. The residual deterrent effect of any given RBT operation as estimated from the models persisted for at least six months for all serious accidents, and in the case of single vehicle night-time accidents for about 18 months. These estimates are broadly consistent with the findings of survey research (Homel, 1988; Homel, Carseldine and Kearns, 1988) that suggest that exposure to random breath testing does have an effect for some time after it occurs, although the behavioural impact is subject to decay if not reinforced by further doses.

The reality of constant decay in the deterrent effect of RBT, and the need to remedy this with continued high levels of visible and unpredictable enforcement, highlights the importance of setting appropriate or optimal levels of testing. The analyses suggest that if there is some "optimum" level of enforcement beyond which accident reduction benefits are not commensurate with the costs of enforcement, it is greater than the approximately 6300 tests per day conducted by New South Wales police in 1995.

It is noted that these results have been achieved in New South Wales through a combination of careful choice of sites for stationary testing, signs proclaiming that random testing is in operation, and the increased use of general duties police for RBT. This last factor highlights the *routinisation* of RBT operations in that state and a move away from the "booze bus" model emphasised in Victoria.

There was some limited evidence for the effects of RBT enforcement levels in the Launceston region of Tasmania. It was not possible to conclude that variations in enforcement levels in Queensland or Western Australia contributed much to reductions in accidents. This could be simply because the levels did not change much over the short period post-RBT, or it could be that the data on enforcement from these states are too unreliable to have much predictive power. If further research is to be conducted profitably in this field, it is essential that the quality of police enforcement data be improved.

Effects of Other Legal Countermeasures

In every case, the impact of RBT exceeded in magnitude the impact

of de facto RBT or RID, although in a few instances RBT was not as statistically significant as de facto RBT. In several analyses the impact of RBT was substantially greater than the de facto program. It is concluded that RBT is a more effective method of enforcement than de facto RBT, even though the transition from one to the other was not marked by the kind of intensive publicity used in New South Wales, and despite the fact that the levels and methods of enforcement in some areas still reflect pre-RBT practices.

The results obtained for the impact of the .05 law in New South Wales and Queensland are of the same order of magnitude as the estimates for de facto RBT.

The impact of de facto RBT and the .05 law are summarised in Table S.3, which reproduces Table 7.4 in Chapter 7.

Table S.3. Summary of the Impact of the .05 Law and De Facto RBT

State/City	Counter-measure	Type of accident	Percentage drop in accidents	Accidents prevented per year	Total accidents prevented
NSW	0.05	All serious	7%	605	7291
		Fatal	8%	75	908
		SVNT	11%	296	3568
WA	De facto RBT	All serious	9%	217	508
Perth	De facto RBT	All serious	8%	118	277
		Fatal	23%	27	64
		SVNT	17%	68	159
Qld	0.05	All serious	14%	599	6042
		Fatal	18%	91	921
	RID campaign	All serious	12%	483	1128
		Fatal	15%	78	182

Note: SVNT is single-vehicle night-time accidents

Recommendations

1 All states should increase highly visible stationary RBT to a level equivalent to one test per licence holder per year. This could be accomplished in a cost effective manner by using general duties police and highway patrol vehicles, and possibly also booze buses, and by utilising the management techniques embodied in the random roadwatch program.

2 A cost-benefit analysis should be conducted comparing the merits of the Victorian booze bus strategy with the New South Wales strategy of relying on general duties and traffic police operating from standard police vehicles.

3 Police in all states as a matter of urgency should improve the

accuracy and comprehensiveness of their enforcement data, so that detailed analyses can be conducted on daily data broken down by mode of enforcement, location of testing, and time of day.

4 The methods used in this study should be applied to each of the time series augmented by an additional five years of data. This would be particularly important for Queensland and Western Australia for which in the present study it was not possible to include the Introduction and Enforcement components of the model. In this way the long-term impacts of RBT in each state, especially in the light of recent variations in enforcement levels, could be better understood.

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