New Zealand Drink-driving Statistics: The Effectiveness of Road Safety Television Advertising

Terry Macpherson and Tony Lewis

This paper examines the claim of the New Zealand Land Transport Safety Authority, that the reduction in the road toll in New Zealand from October 1995 to mid-1996 was predominantly due to a television advertising campaign conducted over that time. The method of analysis was similar to that used to evaluate a similar, successful campaign conducted earlier in Victoria, Australia, on which the New Zealand campaign was modelled. Data on campaign advertising exposure, and other variables thought to be associated with drink-driving behaviour, were subjected to regression analysis to measure the relationship between the incidence of the campaign advertisements and positive evidential breath tests. At best, only a tenuous relationship was found. This result may be because there is no strong relationship. Or, it may be because of the inherent difficulty of extracting useful information from non-experimental data of this type. Or, it may be due to the weak linking of the campaign to enforcement activities; the Victorian study found that it was important for the success of an advertising campaign, that it be linked to enforcement

Keywords: drink-driving campaigns, effectiveness, advertising, television, New Zealand, road safety.

Introduction

The tragedy of road accidents is with us every day, and the cost is enormous, but what to do about it seems to defeat us. In OECD countries alone, the annual number of road fatalities is about 120,000, and the estimate for road accidents world-wide is that about 400,000 people die in road accidents each year. While accident rates in OECD countries dropped in the seventies and eighties, this trend appears to have slowed. It seems to be more difficult and expensive to further reduce the number of fatalities as traffic increases. Many countries are trying new initiatives to counter expected increases in mobility, and the consequent fatalities (OECD 1994).

One such initiative was undertaken in Victoria, Australia. In December 1989, the Victorian Transport Accident Commission (TAC) ran a series of evocative television advertisements that highlight the shocking reality of road trauma. The television advertisements were characterised by graphically violent car crashes, and bloody crash scenes. The advertising campaign was combined with an intensive enforcement programme that included booze buses and hidden speed cameras. From 1989 to 1994, the number of road fatalities in Victoria fell from 796 to 378 - a 53% decrease.

In October 1995, the Land Transport and Safety Authority (LTSA) of New Zealand began a $7 million per year intensive publicity campaign in an attempt to reduce road fatalities and accidents. The campaign was based on the Victorian programme, but without the booze buses and hidden speed cameras.

Justification for the adoption of the Victorian 'blueprint' by the LTSA was largely based on research conducted by Cameron, Haworth, Oxley, Newstead & Le (1993)[1]. Cameron et al

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[1] Conducted by the Accident and Research Centre at Monash University

concluded that the Victorian Transport Accident Commission (TAC) drink-driving television advertising had contributed from 6.7% to 7.5% to the reduction in all serious casualty crashes from 1990 to 1993, while speed and driver attention advertisements contributed a further 6.2% to 8.7%. They also concluded that it was necessary, for an effective campaign, to link publicity to enforcement. It is not clear why this latter conclusion was not taken into account in the design of the New Zealand campaign.

Despite the publicity campaign, the number of people hurt in New Zealand road crashes continued to grow. Though there was a drop in road fatalities during the year to March 1996, ambulances attended 24,358 road accidents compared with 23,054 the previous year. The number of accidents in 1995 was 34,525, up by 14% from the previous year (Bailey cited in Vasil 1996). In addition, drink-drive statistics, as measured by positive Evidential Breath Tests[1] (EBT's), remained constant at about 26,000, over the period. These periods do not correspond precisely to the period of the campaign, but the statistics are sufficiently at odds with the expectations of the campaign organisers, to make them worth further investigation.

The LTSA claimed that the reduction in New Zealand's road toll in 1995/96 was predominantly a result of the television advertising campaign (Falconer 1996; Gregg 1996). This claim seemed to be founded on Cameron et al's (1993) research, and the results of roadside surveys that showed a shift in awareness and attitudes towards road safety, and a drop in the road toll. However, the New Zealand road toll was decreasing well before the introduction of the advertising campaign in 1995 (see Figure 1), and the other New Zealand road safety statistics, referred to above, indicate that the LTSA's claim should be questioned.

The estimated social cost of traffic accidents in New Zealand is in the order of $3.4 billion a year (Gregg 1996). Even though just a few million dollars is spent on prevention through advertising, those few million should be spent effectively. To help guide expenditure, a good understanding of the impact of any prevention measures on driving behaviour is needed. As the LTSA campaign is justified on the basis of the outcome of research conducted by Cameron et al (1993), the authors felt it was appropriate that a similar methodology be applied to the evaluation of the New Zealand campaign.

Cameron et al (1993) adopted a standard approach to modelling road safety (Hakim, Shefer, Hakkert & Hocherman 1991), using double-log linear, ordinary least squares regression to analyse past data. They predicted serious casualty crashes during low and high alcohol hours, using the following predictor variables:

- tests that were carried out, the greater the show of enforcement.
- A measure of advertising intensity, known as *Adstock*. This variable was measured for the drink-driving advertisements, and for both drink-driving, speeding and other safety themes.
- The unemployment rate. This variable was a proxy for economic conditions, and was included on the basis that when economic conditions improve, people might drink and get out and about more. A seasonal variable; the month of the year. This variable was included to capture the effect of celebratory and other periods when people might drink more or be less careful than they would otherwise be.

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[1] An Evidential Breath Test (EBT) is a positive Compulsory Breath Test (CBT). Where appropriate, EBT's will henceforth just be referred to as "positive tests", and CBT's will be simply be referred to as "tests", for ease of reading

- A linear trend. This variable was included to capture the effect of a constant increase, or decrease, in casualties caused by such things as the tightening of safety standards in cars, or more cars on the road.
- Alcohol sales. This variable was included for the same reason as the seasonal variables, but where there was not a regular pattern.

Source: Land Transport and Safety Authority (September, 1996). *Road Deaths.* Official road fatality statistics prepared by LTSA Research and Statistics section

Figure 1. New Zealand road fatalities (1991 to 1995)

The use of serious casualty crashes as a dependent variable, while it is the statistic of vital interest, presents a problem when analysing the effect of drink-driving advertisements. There are a number of factors, other than driver alcohol levels, that could contribute to a serious crash. Road conditions, driving skills, vehicle age, and time of day, all play a part. Also, people watching an advertisement may drink and drive and not have a crash, and others who don't see the advertisement may drink and drive and crash. Others still, may not drink as a result of watching the advertisement, and also have a crash. A more direct behavioural measure of the effect of the advertisement would be to measure the drink-driving behaviour of people during the campaign, and Evidential Breath Tests (EBT's) would better serve this purpose. The use of EBT's as the dependent variable provides a more direct measure, than the number of serious accidents, of the advertising's effect on the specific behaviour. Therefore EBT's, were used as the dependent variable in the analysis of the New Zealand statistics.

Method

Initially, monthly positive tests were tracked over time to look for any seasonal regularity or trend. The next step was to try to relate levels of road safety advertising to changes in positive tests. To take account of other influences on the positive tests a regression analysis was carried out using the same variables that were identified in the Victorian study as being important.

Data

Data relating to road safety statistics is collected by the LTSA and the Ministry of Justice, and is publicly available. Data relating to the number unemployed were obtained from Statistics New Zealand INFOS service. Monthly levels of alcohol sales were not available so this variable was missing from the analysis of the New Zealand statistics.

As pointed out before, EBT's (positive tests) are the positive result of police conducting CBT's, (tests). The current study makes the assumption that tests are carried out as if with a quasi-random sample of drivers, even though that is not strictly correct. Tests are generally conducted in urban areas and in the evening hours, perhaps giving a systematic bias to any estimates from these data, of unknown proportions.

The positive test data fluctuate, but appear to follow a one year cycle that begins with a low point in January/February, increasing through the year, with a decrease in November followed by a high point in December (see Figure 2). Total positive tests for the year ending September 1996, actually decreased 8% from the previous year, but this decrease was substantially less than the reduction in the road toll.

Figure 2. The number of Positive Evidential Breath Tests per month

As in the study by Cameron et al (1993), exposure to the advertising was represented by the function "Adstock" which attempts to measure retained awareness of current and past levels of advertising (Broadbent, 1979, 1988, 1990). Basically, an Adstock is a measure of total advertising exposure from a number of advertisements, each of whose effect declines over time. For example, if an advertisement was run for the first time on a Monday, and was run again a week later, the first week's exposure would be just that from the first screening, but the second week's exposure would be made up of the continuing (but declining) impact of the first, plus the second. The impact is supposed to decline in such a way that half of it has dissipated after a given period has elapsed, and half what is left has gone after a further period has elapsed, and so on. The period taken for half the impact to go is known as the "half-life". An Adstock is calculated from a measurement called the Target Audience Rating Points (TARPS), which is a measure of audience reach, and which depends on the number of viewers in the target population thought to be watching the channel when the advertisement is run.

The LTSA advertising campaign included not only drink-drive advertising, but also speeding and other themes. The content of the advertising for the various themes is very similar and an advertisement targeted at speeding may effect drink-drive behaviour and vice versa. For this reason, the Adstock was calculated for both drink-drive advertisements and for all-themes, so that both the effect of the drink-drive themes, and the effect of the overall campaign could be investigated.

The drink-drive and all-themes Adstocks were calculated using a half-life of five weeks; this corresponds to a retention factor of approximately 87% per week. A number of studies have found that a half-life of five weeks, in terms of recall, is very common (Broadbent, 1979, 1990). Furthermore, Cameron et al (1993) found that a half-life of five weeks was well matched to levels of spontaneous recall for the same period ($r = 0.77$).

In line with Cameron et al (1993), seasonal variation was allowed for by using monthly dummy variables. They account for the regular variation in positive tests due to, for example: the effect of winter sport socialising, the effects of holiday periods such as Christmas, or the differing number of days in each month, none of which are otherwise included in the models fitted here.

A long-term trend was also included. A trend is typically due to factors that continuously either increase, or decrease. Examples are: population increases, driver licence increases, gradual and continual improvement in the efficiency of enforcement efforts or any other time-variant, non-seasonal factor. The trend component represents the average effect of all the non-seasonal factors that are not included explicitly in the models.

As with the Cameron et al (1993) study, the number of unemployed was used as a proxy for economic conditions. The number of unemployed tends to be negatively related to fatalities and serious injury accidents (Hakim, Shefer, Hakkert, & Hocherman 1991; Newstead, Cameron, Gantzer, & Vulcan 1995). We assume that the number of unemployed will have a similar relationship to positive tests, as it does to accidents. That is, an increase in unemployment would effect people's ability to purchase alcohol, and their total distance driven. Over the period of the analysis (October 1993 to September 1996) the number unemployed was steadily decreasing with a slight interruption to the downward trend around the Christmas holiday period.

As the positive tests arise from drivers who are apprehended in the operation of the tests, the

number of positive tests will increase with the number of tests, regardless of anything else. Therefore, it is necessary to include the number of tests as one of the explanatory variables to account for this. Of course, the ratio of positive tests to tests could have been used instead, but the presence of extra police patrols may have an effect on behaviour, which could be measured if CBT's are used as an explanatory variable. The tests (see Figure 3) appear to follow a cycle with large peaks for the month of December with a general fluctuation in-between. While test levels for the December months seem to be slightly increasing, the months in-between appear to be slightly decreasing.

Figure 3. The number of Compulsory Breath Tests per month

Procedure

Previous researchers (Hakim et al, 1991; Thoreson, Fry, Heiman, & Cameron, 1992; Cameron et al, 1993; Newstead et al, 1995), using road accident statistics, have presumed that the explanatory variables have a multiplicative effect on accidents. That is, the model takes the form of $Y = B_0 x_1^{B_1} x_2^{B_2} ....$ rather than $Y = B_0 + B_1 x_1 + B_2 x_2 ....$ (additive). The same approach is followed here. We began with an inspection of the correlations between the variables involved in the study. A regression analysis was then used to explore the relationship between the Adstock, measured for both the drink-drive campaign and for all-themes campaign, and the other explanatory variables, and the dependent variable, EBT's.

Results

The initial correlation analysis identified a strong negative correlation (-.90) between the

number unemployed and the trend, indicating that if both variables were included in the regression analysis, their separate effects would be difficult to isolate. Because of this, it was decided to exclude the number of unemployed and retain the trend, as the trend gave a greater explanation of the variation in positive tests.

An important conclusion of the Victorian study was that, to be effective, an advertising campaign needs to be conducted in association with increased levels of enforcement (Cameron et al, 1993). In this context, a correlation worth noting is that between the advertising, as measured by TARPs, and enforcement, as measured by the number of CBT's. When compared to the correlations found in Cameron et al (1993), the LTSA campaign appears to have a weaker link between monthly advertising levels and enforcement (see Table 1). This means that the LTSA campaign is not a strict replica of the Victorian 'blueprint', at least in regard to the linking of enforcement to advertising.

Table 1. Correlation of advertising (TARPs) and enforcement (CBT's)

TARPs	New Zealand		Victoria*	
	Drink-drive	**All Themes**	**Drink-drive**	**All Themes**
Number of CBTs (Pearson's r)	0.34	0.14	0.63	0.81

*Source: Cameron et al (1993).

The regression analysis began with the modelling of positive tests by 'all-themes' and 'drink-drive' Adstocks separately, with the seasonal monthly dummies, the trend, and the number of tests (see Table 2).

Table 2. Regression results for EBT's by Adstocks (All Themes and Drink-drive), seasonal dummies, trend, and number of CBT's

	Adstock	
	All Themes	**Drink-drive**
<u>Fit</u>		
R^2	0.72	0.69
Adjusted R^2	0.53	0.49
Sig F	0.003	0.006
<u>Coefficient Value</u>		
Adstock	-.037 (-.023)	-.021 (-.024)
Trend	.005 (.003)	.005 (.004)
CBT's	.446 (.158)	.418 (.165)

Standard errors in brackets.
The coefficients on <u>Adstock</u> and <u>CBT's</u> give the percentage change in EBT's for a one percent change in the particular variable, but the <u>Trend</u> is linear.
The monthly coefficients are not reported as they are not relevant to the study.

The model using the all-themes Adstock explains the highest proportion of the variation in positive tests, as estimated by the Adjusted R^2. Both of the models are highly significant. In neither model is the estimate of the Adstock coefficient precise enough to have any confidence that there is any effect whatsoever.

In both models, the CBT's clearly provide the most explanation. The contribution of Adstock variables are negligible, although because the sign on the coefficient is negative, we could say that an increase in Adstock results in a decrease in EBT's, if we had any confidence that the coefficients were not actually zero. There is an outside chance[1] that a 100% increase in advertising will decrease positive tests by 8%. There is the same chance that a 100% increase in advertising will have no effect.

In a further attempt to extract something from the data to explain the effect of advertising, we removed the seasonal effect, the trend effect, and the effect of total number of tests, by regressing the EBT's against those variables, and using the residuals as "adjusted" positive tests, to be regressed against the Adstocks. We realise that this is a procedure of dubious merit.

The results of this analysis, shown in Table 3 below, where these "adjusted" positive tests were regressed against the Adstock variables, indicate that drink-drive Adstock explains none of the remaining variation in positive tests. However, the results for the all-themes Adstock estimate that the overall campaign explains 7.5 % of the variation in the remaining variation in positive tests.

According to this model, there is an outside chance that 100% increase in all-themes advertising will decrease positive tests by 7%, and there is the same chance that the effect is zero.

Table 3. Regression output for adjusted EBT's by each Adstock (Drink-drive and All-themes)

	Adstock	
	All-themes	**Drink-drive**
R^2	0.101	0.023
Adj R^2	0.075	-0.006
Coefficient (B)	-0.034	-0.014
Standard Error of B	0.018	0.016
Sig F	0.059	0.375

Discussion

This study looked at the drink-driving and other safety themes of the LTSA advertising campaign, matched it to drink-driving behaviour, and sought to answer the question, 'Is exposure to drink-drive or general road safety television advertisements translating into a

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[1] Calculated as being within two standard errors of the estimate.

shift in drink-drive behaviour?' The discussion will initially focus on the relationship between advertising and drink-drive behaviour, then on the link between the advertising and enforcement. Finally, the limitations of the study will be discussed.

Television Advertising and Drink-driving

We failed to find any substantial relationship between road safety or drink-drive television advertising, and drink-drive behaviour. The specific 'drink-drive' advertising appeared to provide virtually no explanation of the variation in positive evidential breath tests.

When the influence of monthly seasonal variation, the general trend effects, and the number of compulsory breath tests conducted were controlled for, the 'all-themes' advertising explained 7.5% of the variation in positive evidential breath tests. If we can disregard the dubious nature of this procedure, these latter results appear to support the idea that there is some crossover effect from the overall message delivered from the road safety television advertisements. In other words, messages directed at other behaviours, such as speeding, appear to have some effect on other non-targeted behaviours such as drink-driving. Given the similarity of the content of the advertisements, this is not unexpected.

If $7 million is to be spent on the television advertising, against an estimated social cost of road accidents of $3.4 billion, it is important to be reasonably certain that the advertisements are effective, otherwise the money could probably be better spent elsewhere. The findings of this study provide no evidence to suggest that the current advertising is having any substantial effect on drink-drive behaviour. Simply to do as the LTSA did - to note the decrease in road fatalities that occurred over the period of the campaign, and attribute the decrease to the campaign - is not enough.

Advertising - Enforcement Link

The correlation analysis indicates that the LTSA and Victorian campaigns are dissimilar in an important respect; the campaign was not as strongly linked to enforcement. In addition, New Zealand enforcement in the form of Compulsory Breath Tests actually decreased by 13% for the year ending September 1996 (refer Figure 3). Given Cameron et al's (1993) findings that road safety advertisements not linked to enforcement, showed no evidence of contributing to a decrease in the number of crashes, it could be argued, inversely, that a strong relationship between enforcement and publicity may be a requirement for an effective campaign. The lack of a strong link between publicity and enforcement in New Zealand may be an explanation for the weak relationship between the television advertising and drink-driving behaviour.

Limitations

This study analysed non-experimental data and no conclusions can be drawn about the direction of causality. If, as is probably the case, the advertisements were purposely put on when positive tests were expected to be high, then the regression estimates will be biased, and we may be underestimating the effect of the advertisements. The only way to overcome this limitation is to use an experimental approach to the operation of a campaign.

There is also a question of the reliability of the independent variable used in the analysis. The Evidential Breath Test data are collated by the LTSA upon receipt of copies of offence

notices. Regional police offices supply these to the LTSA. Unfortunately, there is often a discrepancy between the Evidential Breath Test slips received and the number of people convicted of drink-driving.

Another problem has to do with the sample. The Compulsory Breath Tests from which the Evidential Breath Test data were collected are not taken from a truly random sample of the driving population. The Compulsory Breath Tests are conducted largely at night and largely in urban areas. It is possible that there is a different effect in rural areas, and during the day. We have thus not captured the effect of the advertisements on the behaviour of people who drink and then drive in rural areas. The effect of daytime driving cannot be measured either.

This study only addresses drink-driving behaviour as measured by monthly levels of positive tests. While this should give a fair reflection of the effectiveness of the advertisements in relation to drink-driving behaviour, it says nothing of other possible effects of the television advertisements on the driving behaviour of non-drinking drivers. It is conceivable that exposure to drink-drive advertisements has an effect on the driving behaviour of people who don't drink and drive anyway. The advertisements may make these responsible people even more careful as they become more aware of the dangers they face from drinking drivers. This is an area of road safety advertising research that has not yet been studied.

Conclusions

Any efforts to reduce the number of people killed in road accidents should be applauded. However, if efforts to reduce the toll are to be effective, a greater understanding of the behavioural impact of countermeasures, such as television advertising, needs to be known. This preliminary study has resulted in the following conclusions for the period, October 1995 to September 1996:

* There is little evidence to suggest that the road safety or drink-drive television advertising made any change in drink-driving behaviour.
* LTSA drink-drive television advertising was not as strongly linked to drink-drive enforcement as was the case for the successful campaign in Victoria Australia, and this may have reduced the effectiveness of the New Zealand campaign.

The main outcome of this research is to emphasise how very difficult it is to come to any conclusions from analysis of non-experimental data. The reason that we have not found a relationship between drink-driving campaigns and drink-driving behaviour is *either*, because no such relationships exist, *or* because it cannot be detected by analysing the outcome of a campaign that assumes such a relationship exists. We should be wary of any claims based on these data. We think that, at the same time that the LTSA carries out its duties to reduce the road toll as best it can, it should be designing its campaigns and producing the sort of data that will allow the results to be adequately monitored.

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Terry Macpherson is a Lecturer, and Tony Lewis is an Associate Professor, in the Department of Marketing, Massey University, New Zealand.