TITLE

Changes in injury-related hospital emergency department presentations associated with the imposition of regulatory versus voluntary licensing conditions on licensed venues in two cities

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ABSTRACT

Introduction and Aims. Regulatory and collaborative intervention strategies have been developed to reduce the harms associated with alcohol consumption on licensed venues around the world, but there remains little research evidence regarding their comparative effectiveness. This paper describes concurrent changes in the number of night time injury-related hospital emergency department presentations in two cities that implemented either a collaborative voluntary approach to reducing harms associated with licensed premises (Geelong), or a regulatory approach (Newcastle).

Methods*.* This paper reports findings from Dealing with Alcohol-Related problems in the Night-Time Economy project (DANTE). Data were drawn from injury specific International Classification of Disease (ICD 10) codes for injuries (S and T codes) presenting during high alcohol risk times (midnight – 5.59am, Saturday and Sunday mornings) at the emergency departments in Geelong Hospital and Newcastle (John Hunter Hospital and the Calvary Mater Hospital), before and after the introduction of licensing conditions between the years of 2005 and 2011. Time-series seasonal autoregressive integrated moving average (SARIMA) analyses were conducted on the data obtained from patients' medical records.

Results. Significant reductions in injury-related presentations during high alcohol risk times were found for Newcastle since the imposition of regulatory licensing conditions (344 attendances per year, $p<0.001$). None of the interventions deployed in Geelong (e.g. ID scanners, police operations, radio networks or CCTV) were associated with reductions in emergency department presentations.

Conclusions. The data suggest that mandatory interventions based on trading hours restrictions were associated with reduced emergency department injury presentations in high alcohol hours than voluntary interventions.

Key Words: alcohol, violence, emergency department, injury, intervention

INTRODUCTION

In 2004, it was estimated that 2.5 million deaths globally were caused by alcohol, with 12.8% of these deaths occurring in 15-29 year olds (1). In Australia, alcohol-related harms are estimated to cost the community between $15.3 billion (2) and $36 billion (3) each year. The number of Australian people drinking alcohol at high-risk levels has increased over the last few years, from 3.5 million in 2007 to 3.7 million in 2010 (4). In addition, alcohol has also been identified as a factor in almost three quarters of assaults and offensive behaviour incidents on the street (5). Drinking in licensed venues is a particular predictor of assault and public disorder (6), with drinking in hotels and nightclubs being more likely to be associated with such harms than other venues (5). Previous research reports that 38.7% of all offences occurring on the street have been associated with licensed premises, although this varies between geographical areas (5). Of most relevance to the current study, it was found that 48.6% of people involved in assaults occurring in regional centres had been drinking at licensed venues (5).

EVIDENCE-BASED AND INNOVATIVE INTERVENTIONS

A number of strategies have been shown to be effective in reducing alcohol-related harm related to licensed venues. Babor et al (7) reported that the most effective strategies and interventions include, restrictions on hours and days of sale; restrictions on the density of licensed venues; varying alcohol availability based on strength; staff and management training to better manage aggression; and enhanced enforcement of liquor legislation. However, no evidence has been reported regarding whether such strategies are differentially effective when implemented on a regulatory or a voluntary basis (e.g. measures which the venue operator is able to choose whether they collaborate with or implement). Some reported evidence (8, 9) suggests voluntary approaches, such as liquor accords, ID scanners or radio networks, have limited

effectiveness in reducing harms. For example, evaluation of liquor accords suggests that such approaches are not effective unless supported by active enforcement (8, 10). Due to the lack of evidence regarding the effectiveness of voluntary or regulatory approaches to reducing alcohol-related harm, the aim of this paper is to examine concurrent changes in the number of alcohol-related presentations to hospital emergency departments (ED) in two Australian cities that implemented either a collaborative voluntary approach to reducing harms associated with licensed premises (Geelong, Victoria), or a regulatory approach (Newcastle, New South Wales). Emergency department datasets have been demonstrated to substantially improve detection of assault and violence over police recorded data (11), and it is generally accepted that police recorded data is a poor overall indicator of the patterns of public violence (12). While it is possible to hypothesise that restricted trading hours will lead to a reduction in ED attendances, we have no prior evidence regarding the effectiveness of the other interventions and subsequently propose them as research questions. On a broader topic, the issue of whether mandatory interventions are more effective than voluntary interventions is also being explored within this paper. Although the nature of the data does not allow for causal attribution, it is able to identify the ED trends associated with a set of voluntary interventions and a set of mandatory interventions. We do not believe the data allows us to test a hypothesis regarding these theoretical questions. Ultimately, the comparisons between 'the Newcastle model' and the 'Geelong model' that are being made in this paper reflect very real-world debates across Australia.

METHOD

DESIGN

This study describes alcohol-related injury ED presentations in two Australian cities during high alcohol hours (HAH, midnight-5.59am Saturday and Sunday mornings). HAH presentations were previously shown to be associated with high levels of alcohol consumption (8, 9, 13, 14) and were used in the current study as an indicator of alcohol-related harm.

SETTING

The setting for this study was two Australian regional cities, Geelong (Victoria) and Newcastle (New South Wales). Geelong and Newcastle were selected for this study as they are highly comparable in terms of their social and demographic histories and characteristics.

Geelong

Geelong is a city of approximately 250,000 people and is located 70km from Melbourne, with over 11,000 people commuting each day (http://www.censusdata.abs.gov.au). Additionally, Geelong has a concentration of late-night venues, with some trading until 7am. In 2009, the Geelong main entertainment precinct had approximately 30 hotel licenses (15).

Newcastle

Newcastle is a city of approximately 308,308 people and is located 160km north of Sydney. It is the second most populated area in NSW, and comprises five Local Government Areas. Similar to Geelong, Newcastle experienced substantial increases in alcohol-related crime between 2003 and 2008 (16). For example, police-attended assaults increased by 83%; with up to 65% being related to licensed premises (17). The number of police call-outs to hotels in the Newcastle entertainment precinct increased from 105 in 2003 to 179 in 2007 (17). Newcastle also has a high density of licensed

venues: in 2009, 75 hotel licences were located in the Newcastle Local Government Area and 21 hotels in the main entertainment precincts of Newcastle.

Table 1 provides comparative data for the central Local Government Areas (LGAs) for the two cities. While the population of Newcastle is higher than Geelong, both cities have very similar population profiles. Further, as Geelong is surrounded by coastal resort towns the population substantially increases during the summer period, especially over weekends, contributing to nightlife and emergency attendances.

INSERT TABLE 1 AROUND HERE

THE INTERVENTIONS

Geelong

In Geelong, a number of initiatives aimed at improving the safety in and around licensed venues have been implemented between 1990 and 2010 on a voluntary basis. (18). Many of the Geelong initiatives were conceptualised and implemented via collaboration between police, licensees, city officials and other stakeholders. For all interventions, compliance was voluntary. Table 2 outlines the strategies implemented in Geelong. Effectiveness ratings have been taken from the key reviews in the area (6, 7). While the Liquor Accord has been in place since 1991, it remains the key forum for negotiations about all matters related to licensed venues and is still seen as an 'intervention' in its own right. However, its impact cannot be evaluated using the available data because of how long it has been in place.

INSERT TABLE 2 AROUND HERE

The Safe Streets Taskforce and Operation Razon interventions were enacted at the state level and their involvement in Geelong was minimal and ad-hoc. These interventions will not be included in further analysis. The overall collaborative approach in Geelong including a CCTV network, the Night Watch Radio Program (NWRP) and the use of ID scanners has been anecdotally reported widely as being successful.

Newcastle

In March 2008 the NSW Liquor Administration Board formally imposed additional licensing conditions on 14 late trading hotels located in the main entertainment precinct of Newcastle. These conditions were imposed under the Liquor Act (Section 104), making licensees legally-bound to comply. The conditions are listed in Table 3. None of the interventions in either city involve price increases.

INSERT TABLE 3 AROUND HERE

Using a non-equivalent control group design, the impact of the Section 104 conditions has been reported by Kypri et al (16) in terms of the incidence of assaults in the main entertainment precinct of Newcastle. It was found that police-recorded night-time assaults (10pm to 6am) fell from 99.0 per quarter to 67.7 per quarter after the implementation of Section 104 conditions. The intervention accounted for 37%, or 33 assaults per quarter, of the relative reduction in assaults per quarter(16),

DATA

De-identified information on all injury-related ED presentations (ICD10 codes S00-T98 and ICD9 codes 800-999) from 1 January 2005 to 30 June 2011 were obtained from the Barwon Health Geelong Hospital (Geelong), and the NSW Health Emergency Department Data Collection (John Hunter and Calvary Mater Hospitals, Newcastle). Using the procedure outlined by Young et al. (19), we retained only injury presentations

during HAH (midnight to 5.59am on Saturday and Sunday mornings). This method was previously shown to result in correctly identifying 56% of all cases with prior alcohol involvement.

In Geelong, where the hospital services the entire city and surrounding areas, separate independent variables were generated representing the seven interventions: the police-licensee Night-watch Radio Program, the ID-scanners initiative at licensed venues, the Victoria Police Operation Nightlife 2, the Just Think alcohol awareness campaign, the fine increase, the So You Know campaign and the introduction of the risk-based licensing framework in Victoria. These interventions were entered simultaneously into the one ARIMA model. Safe Streets Taskforce and Operation Razon were not included in the analyses because these interventions occurred rarely and sporadically and, therefore, could not be considered on-going interventions. Similar data modelling approach was used for Newcastle with the S104 intervention being the sole independent variable.

STATISTICAL ANALYSIS

Injury-related HAH admissions were aggregated by month (Figure 1 reports quarterly aggregations for the sake of more clearly describing trends), resulting in 77 monthly observations, and were expressed per 10,000 population, using mid-year population estimates (17) for each city as the denominator. Autoregressive integrated moving-average ARIMA (20) models were used to examine associations between injury-related HAH presentations in each city and relevant interventions. ARIMA modelling was chosen for this study as it allows identification and adjustment for underlying trends in the data, seasonal variations in injury-related HAH presentations, and the serial autocorrelations between observations obtained at different time points.

Autoregressive and moving-average terms provide a means for controlling for autocorrelation, while the application of differencing and seasonal differencing deals with potential temporal and seasonal trends. Separate ARIMA models were developed for Geelong and Newcastle.

Specification of ARIMA models

Specification of ARIMA models was aided by graphical investigation of time trends in HAH admission rates, as well as autocorrelation functions (ACFs) and partial autocorrelation functions (PACF) of residuals. We tested a range of specifications for the ARIMA models presented, using the simplest final model that produced model residuals that were not statistically different from white noise, with no significant autocorrelations or trends. Residual autocorrelations were assessed using Box-Ljung Statistic, with non-significant values (α=0.05) indicative of good model fit. Plausible alternative models were also assessed using Bayesian Information Criterion (BIC) (21), with lower values indicating better models.

Injury-related HAH presentations in Geelong experienced an upward shift overall. Seasonal variations were also present, with peaks in summer and troughs in winter. Examination of ACFs revealed a clear pattern with decreasing negative values of residuals in the beginning of the series, followed by increasing positive values, consistent with the series being non-stationary. Stationarity was achieved following first order differencing. The differenced series showed decaying ACFs, significant spikes in PACFs at lag 1 and 2 and additional significant spikes in PACF at 12 lag intervals, suggesting a second-order autoregressive function, as well as a seasonal autoregressive

function. Given the presence of a seasonal component for injury-related HAH presentations in Geelong, the following seasonal ARIMA (SARIMA) was fitted to the data: SARIMA(2,1,0)(1,0,0)$_{12}$. The distribution of model residuals for SARIMA(2,1,0)(1,0,0)$_{12}$ showed no particular pattern and Ljung-Box Test was not significant (Q=14.5, df=15, p=0.490), indicating that the residuals were no more than white noise.

In Newcastle, injury-related HAH presentation rates exhibited a fluctuating pattern, with a slight downward drift. Comparable with data obtained for Geelong, stationarity was achieved following first order differencing. Injury-related HAH presentations for Newcastle also showed a seasonal pattern, with peaks during summer and troughs in winter. The ACFs and PACFs for the differenced series showed pattern similar to that found for Geelong data, with SARIMA(2,1,0)(1,0,0)$_{12}$ showing a reasonable fit with the data (Q=26.8, df=15, p=0.030). A significant spike in both the ACF and PACF was present at lag 16, as well as a spike in PACF at lag 29. The remaining residuals showed a random pattern, consistent with them being white noise.

Interventions

Interrupted time-series were used to assess the effects of interventions. Three types of intervention effects were considered: immediate change in the level of HAH admissions (lag 0), change in the level of HAH admissions after one month delay (lag 1), and gradual change in the slope of time-series (22). With an exception of the Geelong-based Nightlife 1 intervention, which was implemented between January and June 2007, interventions

investigated in this study remained in place for the duration of the study following their initial introduction. The association between injury-related HAH presentations and Nightlife 1 was assessed using pulse function, with the intervention coded as 1 for the time it was in place and 0 at all other times. Associations between the remaining various liquor licensing interventions and HAH presentations were investigated using step functions (23), with interventions coded 1 from the date of being introduced onwards and 0 beforehand. For Geelong data, where multiple interventions have been implemented during the study period, effects of individual interventions (immediate and delayed change in the level of HAH admissions and change in the slope of time-series) were first examined in univariate models, followed by a multivariate model to assess their cumulative effects. Initially, each intervention in a multivariate model was allowed to have immediate, delayed, and gradual effect. The model was then refined by removing those delayed and gradual effects that did not contribute significantly to the model. The final model contained immediate effects of all interventions introduced during the study period (so as to control for any cumulative effects of earlier intervention on outcomes of later interventions) and any significant delayed and gradual effects of the interventions studied.

Statistical analyses were conducted using IBM SPSS version 21 (IBM Corp, Chicago, 2012).

RESULTS

Alcohol-related injury ED presentation rates per 10,000 population are presented in Figure 1. The trend lines suggest that both Geelong and Newcastle had reversals of previously increasing trends.

ALCOHOL-RELATED INJURY RATES

Overall, a total of 63,282 injury cases presented at the Geelong Hospital Emergency Department (ED) between 1 January 2005 and 30 June 2011. Of these, 2,828 occurred during HAH. Of these presentations, 67.2% were male and 32.8% were female; with a mean age of 32.1 years (modal age 19 years.)

For Newcastle, a total of 127,022 injury cases presented at the EDs between 1 January 2005 and 30 June 2011. Of these, 4538 occurred during HAH; 67.2% were male and 32.8% were female; with the mean age being 32.4 years (modal age 18 years).

Effects of liquor licensing interventions

Average injury-related HAH presentations (per 10,000 population) for Geelong increased progressively between 2005 (6.9 per 10,000 population) and 2010 (14.8 per 10,000 population), followed by a decrease between 2010 and 2011 (4.1 per 10,000 population). Figure 1 indicates that a slight downward shift in HAH presentations in Geelong followed the introduction of the Safe taxi rank and the Night Watch radio program. The introduction of ID scanners, Just Think and Operation Nightlife 2 each coincided with an increase in presentations, with a slight downward shift following the introduction of the fine strategy, although these are unadjusted rates which fail to consider seasonal and temporal trends.

In Newcastle, HAH presentations peaked in 2007-2008 (4.3 per 10,000 population, compared with an average of 4.2 in 2005), followed by a decline by the end of the study period (3.8 per 10,000 population in 2011). Figure 1 indicates that the downward trend

in Newcastle's HAH presentations coincided with the introduction of Section 104 legislation.

INSERT FIGUE 1 AROUND HERE

For Geelong, univariate analyses (results not shown) indicated that the introduction of ID scanners coincided with an increase in the rate of HAH admissions, with a significant upward change in the slope of time-series (b=0.94, 95%CI 0.74, 1.13, p<0.001). None of the remaining interventions were associated with a significant change in either level (immediately or after one month delay) or slope of HAH presentations. In multivariate analyses (see Table 4), ID scanners were the only significant predictor of change in HAH presentations, with an additional 0.83 presentations per 10,000 population following their introduction (95% CI 0.09, 1.57, p=0.031), with a subsequent increase of 0.77 presentations per 10,000 population per month (95% CI 0.56, 0.98, p<0.001). The final model for Geelong had good fit with the data (Ljung-Box Q=23.0, df=15, p=0.084).

In Newcastle, the additional licensing conditions (March 2008) had a significant effect on HAH presentations. Initially, HAH admissions increased slightly, with additional 0.85 HAH presentations per 10,000 population (95%CI 0.54, 1.57, p=0.121) one month after the intervention was introduced. This was followed by a gradual decrease in the slope of time-series hereafter, with a reduction of 0.93 HAH presentations per 10,000 population per month (95% CI -1.08, -0.78, p<0.001). In a population of 308,000 people, this equates to 344 emergency department attendances which have been prevented each year. The model also had good fit with the data (Ljung-Box Q=24.3, df=15, p=0.060).

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DISCUSSION

The current study described the effects of voluntary and regulatory approaches to interventions to reduce alcohol-related emergency department presentations within the regional centres of Geelong and Newcastle, Australia. The study found that there was a significant reduction in the rate of alcohol-related injury ED presentations in Newcastle following the introduction of the Section 104 conditions. None of the interventions introduced in Geelong were associated with a significant reduction in ED presentations.

It appears that the introduction of voluntary interventions to curb excessive alcohol use and related harms within Geelong had no significant success in curbing alcohol-related injuries in this city. These results reflect the difficulty of assessing interventions which are voluntarily put in place in an ad-hoc fashion. An important issue when considering the implementation of voluntary restriction in licensed venues is that they do not normally affect proprietor's profits and are therefore focussed on reducing crime, rather than consumption. This paper has demonstrated that this approach was unsuccessful in Geelong.

Within Newcastle, the current study indicates that overall, alcohol-related injury ED presentations remained relatively stable between 2005 and 2009. However, since the introduction of the Section 104 conditions there was a significant decline in alcohol-related injury presentations at ED, although the effect was gradual rather than immediate. This gradual effect is not necessarily surprising, as alcohol-related emergency attendances from licensed venues only make up a small percentage of overall attendances and will not be as responsive to change as police arrests, although prior research has consistently demonstrated the impact of alcohol-related harm on ED

attendance, especially during HAH (19, 24). These findings are consistent with police data showing a significant reduction in the incidence of police recorded night-time non-domestic assaults (16, 25). The current study, together with other recent studies in Newcastle (16), support the use of a regulatory intervention approach targeted at licensed venues, particularly involving the use of restricted trading hours (6, 7, 10). Unlike interventions in Geelong, which incurred a high monetary community cost, the cost of the regulatory Section 104 conditions were the sole responsibility of the venue owner. This allowed police resources to be directed elsewhere in the community.

LIMITATIONS AND CONCLUSIONS

There are some key limitations of the current study. First, it should be noted that the ED data most likely underestimates the frequency of alcohol-related injury (26), as injuries sustained as a result of alcohol intoxication do not always require or seek medical attention and may also go to other sources for help such as their local GP clinic. Considering this, emergency department attendances can best be seen as a reliable proxy measure, better suited to informing us about trends, rather than absolute prevalence. Second, this study is comparing Geelong, which had many interventions implemented ad hoc over time, to Newcastle, which had a number of regulatory changes implemented all at once. This means the impact of the Newcastle intervention will logically be stronger, whereas the impact of interventions in Geelong will be watered down and more subject to other confounding factors. However, despite this, the trends clearly showed no impact, cumulative or individual, of the voluntary interventions put in place in Geelong. Thirdly, many of the Geelong-based interventions being evaluated in this study were not implemented in a consistent manner, reflecting the reality of voluntary interventions. Therefore, it cannot be definitively concluded that the

interventions had no effect, since it is possible that the effectiveness of interventions such as ID scanners could have been improved if all venues implemented these interventions in a consistent manner, such as using the same level of technology and reliably screening all patrons (27, 28), for example. Finally, this study did not have a traditional 'control' site. In a volatile policy area such as liquor licensing in Australia, there are few viable control sites. While a number of potential sites exist, these are much smaller than Newcastle and have much smaller nightlife economies. For example, Wollongong, the most likely candidate, predominantly closes at 1am, with only a single, niche clientele, nightclub operating until later in the night (29, 30).

In summary, only the implementation of regulatory conditions primarily focussed on restricted trading hours in Newcastle (Section 104 conditions) were associated with significant decreases in injury-related ED injury presentations during HAH. The findings suggest that mandatory measures which address the amount of time people are able to drink are more likely to be effective than voluntary measures which try and control patron behaviour once they are intoxicated.

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Table 1. Description of Geelong and Newcastle key demographic variables

Demographic	Geelong	Newcastle
Number population	250,651	308,308
% of total population male	48.7%	48.9%
% of population male aged between 15 and 34 years	12.2%	13.2%
Percentage of total population aged between 15 and 34 years (the population subgroup most involved in assaults)	24.3%	26.2%
Average number of people per household	2.5	2.5
Percentage of total population that speak a language other than English at home	12.6%	9.8%

Source: Australian Bureau of Statistics (http://www.censusdata.abs.gov.au)

Table 2. Description of alcohol-related interventions implemented in Geelong, Victoria.

Name of intervention	Date implemented	Description
Liquor Accord Ψ *	1991	Agreed set of interventions and regular meetings between police, licensees and other stakeholders.
Safe Taxi Rank Φ	Jan 2006	Designated taxi rank staffed by security guards between 1am and 6am Saturday and Sunday mornings.
Night-Watch Radio Program Φ	Mar 2007	Connection of security staff, street cleaners and CCTV operator via radio with police
ID-Scanners Φ	Oct 2007	Matches ID images to photographs to detect fake IDs. The ID scanners also keep a record of when a person entered and, depending on the system's capacity, identified people who are banned from the premises or the nightlife precinct.
Just Think Φ	Jun 2008	Local celebrities endorsing 'safe' drinking patterns and reduced violence. The intervention only consisted of awareness raising events and regular media identification of the issue.
Operation Nightlife 1 Ψ	Jan 2007	Maximum police visibility during high-risk hours.
Operation Nightlife 2 Ψ	Jun 2009	Improved radio contact between police and licensees. There was also a renewed focussing of police resources and enforcement of liquor licensing laws. Fines for drunkenness and rowdy behaviour on the street were also used.
Safe Streets Taskforce Ψ *	Dec 2008	Increase police visibility and numbers
Operation Razon Ψ *	Apr 2008 -	Undercover police at licensed venues
Final integration of ID scanners/ NWRP police scanner system Φ	Nov 2009	Victoria Police, CoGG, Nightlife Association. ID scanners of participating venues were linked via Bluetooth to a mobile Police unit which would update details of banned patrons.
Fine strategy/So You Know campaign Φ	Jul 2010	Primary focus on using fines, rather than arrests, to deal with anti-social behaviour. Awareness posters were also implemented.
Risk based licensing Φ	Jan 2011	New licensing regime which differentiates between venue type, trading hours and size. Fees increase with breaches of license.

ΨΨ Strong evidence of effectiveness
Ψ Some evidence of effectiveness
Φ No evidence of effectiveness
* Not evaluated in current study

Table 3. Section 104 conditions imposed on Newcastle hotels in March 2008

Trading restrictions
• **Reduced trading hours:** all premises are prohibited from trading later than 3.30am ΨΨ • **Lock-out:** patrons must be prohibited from entering after 1.30am Φ
Alcoholic drink restrictions Φ
Venues are prohibited from supplying the following alcohol products after 10pm: • 'Shots' of alcohol Φ • Mixed drinks with more than 30mLs of alcohol Φ • RTD (ready to drink) drinks with an alcohol by volume greater than 5% Φ • More than 4 drinks served to any patron at the one time Φ
Responsible service of alcohol (RSA) actions
Additional RSA actions included: • Free water stations on all bar service areas Ψ • RSA Marshall from 11pm until closure (sole responsibility of supervising RSA practices and consumption) • No stockpiling of drinks and a patron may only purchase up to 4 drinks at the one time Φ • Ceasing the sale and supply of alcohol at least 30 minutes prior to closing time. Ψ
Compliance audits
• Independent compliance audit at least every 3 months Ψ
Management plan
• The development and submission of a Plan of Management to the Liquor Administration Board Φ
Communication strategies
• All venues subjected to the conditions must enter into an agreement for the sharing of a radio network to be used by management and security for the purposes of communicating with each other Φ

ΨΨ Strong evidence of effectiveness
Ψ Some evidence of effectiveness
Φ No evidence of effectiveness

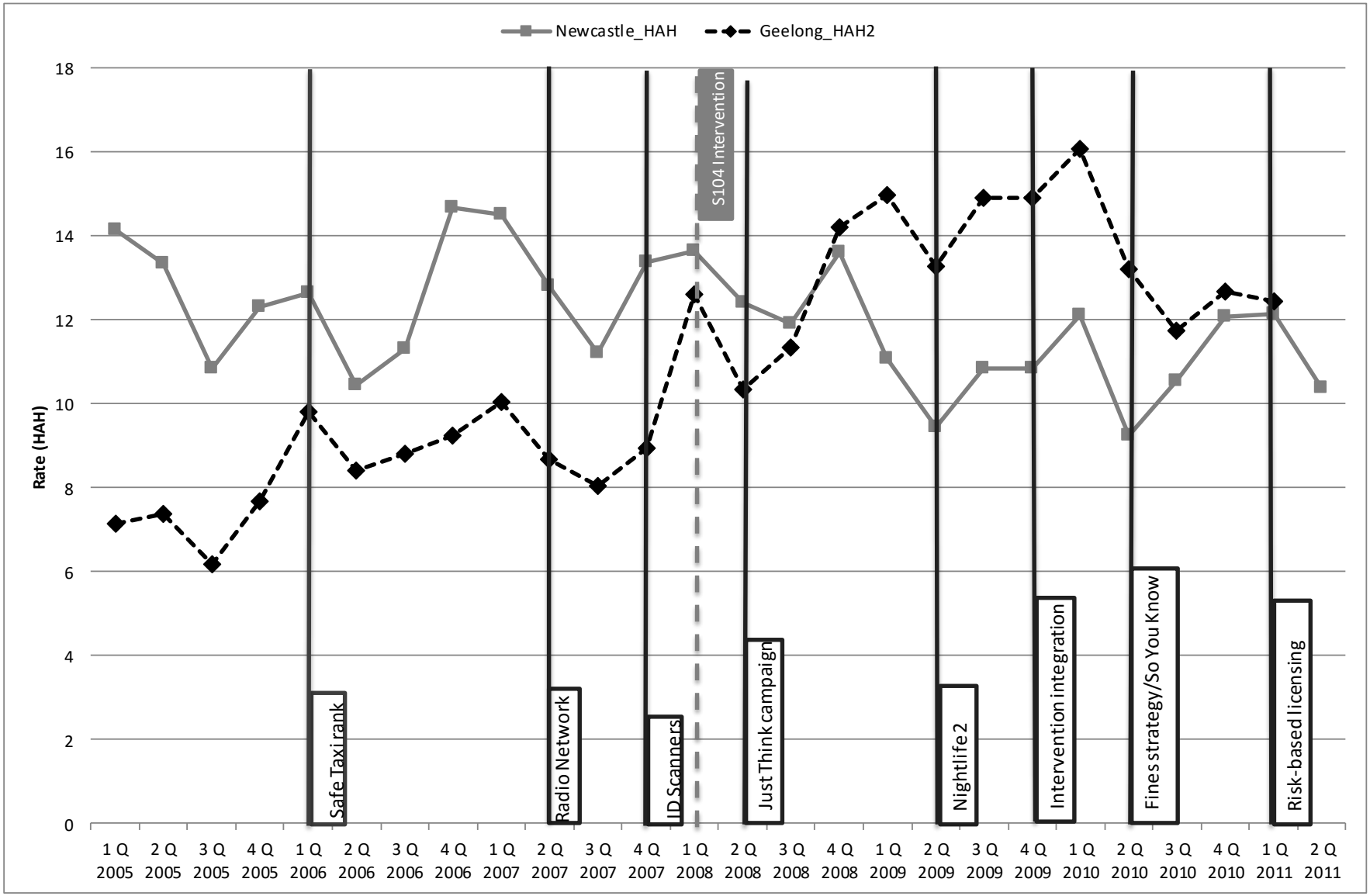

Figure 1 Geelong and Newcastle: Rate of injury-related presentations per 10,000 population, HAH (January 2005 to 30 June 2011)

Table 4: SARIMA model results for HAH presentations in Geelong and Newcastle following interventions, 2005-2011

		Regression coefficient b	(95% CI)	t	p-value
Geelong: SARIMA(2,1,0)(1,0,0)$_{12}$					
Model Parameters					
Constant		0.05	(-0.08, 0.18)	0.7	0.465
First-order autoregressive function (non-seasonal)		-0.79	(-0.99, -0.59)	7.7	<0.001
Second-order autoregressive function (non-seasonal)		-0.57	(-0.77, -0.37)	5.5	<0.001
First order seasonal autoregressive function		0.33	(0.05, 0.61)	2.4	0.022
Interventions					
Operation Nightlife 1		-0.10	(-0.37, 0.17)	0.8	0.452
Night Watch Radio Program	Numerator Lag 0	-0.07	(-0.30, 0.17)	0.5	0.593
ID scanners	Numerator Lag 0	0.68	(0.01, 1.35)	2.0	0.052
	Numerator Lag 1	0.83	(0.83, 0.83)	2.2	0.031
	Denominator	0.77	(0.56, 0.98)	7.3	<0.001
Just Think	Numerator Lag 0	0.67	(-0.10, 1.45)	1.7	0.094
Operation Nightlife 21	Numerator Lag 0	-0.04	(-0.34, 0.26)	0.3	0.779
So You Know/Fines increase	Numerator Lag 0	-0.02	(-0.29, 0.24)	0.2	0.859
Risk Based Licensing	Numerator Lag 0	0.12	(-0.27, 0.51)	0.6	0.548
Newcastle: SARIMA(2,1,0)(1,0,0)$_{12}$					
Model Parameters					
Constant		-0.01	(-0.15, 0.13)	-0.19	0.854
First-order autoregressive function (non-seasonal)		-0.83	(-1.03, -0.63)	-8.02	<0.001
Second-order autoregressive function (non-seasonal)		-0.56	(-0.76, -0.36)	-5.55	<0.001
First order seasonal autoregressive function		0.27	(0.02, 0.52)	2.08	0.041
Intervention					
Section 104	Numerator Lag 0	0.81	(-0.25, 1.87)	1.50	0.139
	Numerator Lag 1	0.85	(-0.21, 1.90)	1.57	0.121
	Denominator	-0.93	(-1.08, -0.78)	-12.27	<0.001

Note: Numerator Lag 0 represents immediate change in the level of HAH admissions;

Numerator lag 1 represents change in the level of HAH admissions after one month delay;

Denominator represents change in the slope of time-series.