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Abstract

Objective: In response to concerns about the health consequences of high-risk drinking by young people, the Australian Government increased the tax on pre-mixed alcoholic beverages ('alcopops') favoured by this demographic. We measured changes in admissions for alcohol-related harm to health throughout Queensland, before and after the tax increase in April 2008.

Methods: We used data from the Queensland Trauma Register, Hospitals Admitted Patients Data Collection, and the Emergency Department Information System to calculate alcohol-related admission rates per 100,000 people, for 15 – 29 year-olds. We analysed data over 3 years (April 2006 – April 2009), using interrupted time-series analyses. This covered 2 years before, and 1 year after, the tax increase. We investigated both mental and behavioural consequences (via F10 codes), and intentional/unintentional injuries (S and T codes).

Results: We fitted an auto-regressive integrated moving average (ARIMA) model, to test for any changes following the increased tax. There was no decrease in alcohol-related admissions in 15 – 29 year-olds. We found similar results for males and females, as well as definitions of alcohol-related harms that were narrow (F10 codes only) and broad (F10, S and T codes).

Conclusions: The increased tax on 'alcopops' was not associated with any reduction in hospital admissions for alcohol-related harms in Queensland 15 – 29 year-olds.

Among young Australians, unintentional and intentional injuries due to alcohol are the commonest cause of hospital admission.^{1,2} They are also the major contributing cause of death.³ Young people account for 52% of all serious road injuries related to alcohol³ and for 32% of hospital admissions for injuries from alcohol-related violence.⁴ Most road injuries, suicides, assaults and drownings in young people arise from intoxication.⁵ Measures to reduce the burden of risky alcohol use have included minimum unit pricing for alcohol,⁶ taxation,⁷ reduction in the number of outlets selling alcohol⁸ and law enforcement.^{9,10} In a further measure, a tax on ready-to-drink (RTD) alcohol or 'alcopops' was introduced in April 2008.¹¹ The premise was that this tax would reduce alcohol consumption among young people,¹² as teenagers of both sexes prefer pre-mixed spirits over other forms of alcohol.¹³

There is debate about the effectiveness of this measure and whether young people either absorbed the price increase or changed to other alcoholic drinks, engendering no effect on alcohol-related harm.^{14–16} Alcohol sales data showed a fall in RTD beverages in the 3 months after introduction of the tax, but with a shift to other beverages (beer and spirits);¹⁷ however, sales data cannot assess changes in longer-term effects of alcohol use, and so indicators of health outcomes, such as health service use, may be more appropriate.

A study by Access Economics¹⁸ of the trends in alcohol-related hospital separations and emergency department (ED) presentations by young people across Australia found no decrease in these harms after the tax increase. This study was limited by a short followup and restricted range of mental and behavioural diagnoses, which represent only a small number of the alcohol-attributable conditions for which young people present.¹ Among 15 – 24 year-olds, unintentional and intentional injuries are the most common causes of hospital admission in Australia that are attributable to alcohol, for both males (66%) and females (59%).¹

Furthermore, many of these alcohol-attributable health conditions reflect the long-term effects of heavy drinking, which would not be affected in the few months after the ‘alcopops’ tax increase. Finally, the analytic approach did not adjust for underlying secular trends.

Studies that include all alcohol-related harms, including trauma, may be more representative. One study, which was confined to the Gold Coast, compared 15 – 29 year-olds presenting to ED for alcohol-related harms, with the following ED controls: (a) 30 – 49 year-olds with alcohol-related harms; (b) 15 – 29 year-olds with asthma or appendicitis; and (c) 15 – 29 year-olds with any non-alcohol and non-injury-related admissions.¹⁹

The study covered 3 years before, and 2 years after, the ‘alcopops’ tax increase. There was no significant decrease in alcohol-related ED presentations in 15 – 29 year-olds, compared to any of the controls. There were similar results for males and females, narrow and broad definitions of alcohol-related harms, those under 19 years old, and visitors and residents of the Gold Coast.¹⁹

However, it is possible that findings from the Gold Coast, a popular tourist destination for end-of-school celebrations, may not apply to elsewhere in Australia. For instance, people may behave differently on holiday. Thus, we aimed to measure admissions for alcohol-related harms throughout Queensland, before and after the increase in the ‘alcopops’ tax.

Methods

Data sources

We used data from the following three datasets: the Queensland Trauma Registry (QTR), the Queensland Hospitals Admitted Patients Data Collection (QHAPDC), and the Queensland-wide Emergency Department Information System (EDIS). The QTR was established in 1998 and covers all admissions to Queensland hospitals, following trauma from pre-hospital care through to hospital discharge as one injury event. It includes injury-specific and clinical data that are not available in other health systems. The QHAPDC covers all admissions to Queensland hospitals, including both traumatic and non-traumatic alcohol-related presentations. The Queensland-wide EDIS covers presentations to EDs within the State. During the study period, the coverage of the EDIS was expanding to include more EDs throughout the state. In this study, we only used those departments that submitted data to Queensland Health for the full duration of the study and for which information was available. This research was approved by Queensland Health's Human Research Ethics Committee.

Data were extracted from the dates 28 April 2006 to 28 April 2009, for patients aged between 15 – 29 years, for the following ICD-10 (ICD, 10th revision) codes in the principal diagnosis and/or additional diagnosis fields: F10 codes for mental and behavioural disorders due to alcohol; T51.0 and .9 for alcohol poisoning; Z04.0 for a blood-alcohol test; and the S and T codes for injury. Where present, we also extracted external cause of injury codes (e.g. W, X or Y codes). These give information on the cause of the injury, such as intentional selfharm or assault. We used both narrow and broad definitions of alcohol-related harm. The former included codes that are solely associated with alcohol (F10, T51.0 and .9, Z04.0); the latter, this narrow definition plus all the injury codes (S and T codes). We used alcohol-attributable fractions (AAFs) to adjust for the fact that not all injuries are due to alcohol. AAFs assign the likelihood that any given condition has an association with alcohol, using previously published clinical data. Alcoholic cirrhosis, for example, has an AAF of 1.0, while assault has a value of 0.27. We used AAFs for external cause of injury from Australia or Britain, appropriate to the relevant gender and age group.^{20,21} Where we were unable to apply cause-specific AAFs, we calculated an average across all injuries of that type or used gender-appropriate AAFs for injuries as a whole. When we could not find some Australian and British AAFs, we used Swiss data.²²

Data preparation

The trauma registry data only contained an external cause of injury code, and this was used to determine alcohol-related harm by applying AAFs. The hospital admission data contained both a primary diagnosis and an external injury code. We assigned an AAF to both codes, using the greater of the two for the analysis. The emergency data contained multiple records for the same event, either because multiple tests were requested, with each

documented on a separate line, or multiple diagnosis codes had been assigned. Records indicating multiple tests that were otherwise duplicates were deleted, while those indicating multiple diagnosis codes were re-structured to have one record with multiple diagnosis fields. Where more than one diagnosis was recorded, AAFs were assigned to each diagnosis, and the maximum AAF was applied to the record.

Analysis

As presentations for alcohol-related harm may be subject to seasonal fluctuations, we employed time series analysis techniques to test for any significant change in the percentage of presentations among 15 – 29 year olds for alcohol-related harms, before and after the tax increase. We calculated rates for each database (QTR, QHAPDC, EDIS), the denominator being the resident population of Queensland.²³ We used the X-11 procedure to identify and adjust the series for trend, seasonality and auto-correlated data errors.²⁴ The X-11 procedure seasonally adjusts monthly or quarterly time series, using the Census X-11 or X-11 auto-regressive integrated moving average (ARIMA) method, based on the US Bureau of the Census X-11 seasonal adjustment program.²⁴ We used ARIMA modelling to fit interrupted time series models, to test for any significant change in the series following the increase in tax while taking into account seasonal fluctuations.²⁵

First, ARIMA modelling is used to estimate seasonal components in the time series and account for autocorrelated errors, and then the interruption component is tested. This establishes whether the intervention adds significantly to predicting the behaviour of a time series, over and above the prediction derived from understanding the regular and seasonal components of the series.

Results

Queensland Trauma Registry data

As solely external injury codes are recorded on this trauma registry, only the broad definition of alcohol-related harm could be employed. Over the 3 years, 5319 of the presentations were made by males and 1013 by females, with an average age of 21.9 and 22.2 years, respectively. The number of presentations was steady at 2041 in 2006 – 2007, 2139 in 2007 – 2008, and 2152 in 2008 – 2009. We performed a time series decomposition to further investigate the rate of alcohol-related harms in 15 to 29 year-olds, by identifying the seasonal, irregular and trend components of the series. Figure 1 shows the original series, the seasonally adjusted series that smoothes out seasonal fluctuations, and the trend series that removes both seasonal variation and random fluctuations from month to month. As differencing was not required, an ARIMA (1,0,0) (1,0,0)¹² model was applied to these data. We found no change following the introduction of the 'alcopops' tax at the end of

April 2008 (Table 1). We found similar results when we looked at males and females separately (Table 1).

Queensland Hospitals Admitted Patients data

Using the broad definition of alcohol-related harm (all codes), this data set showed 42,093 male and 16,798 female admissions, over the 3 years of the study. They had an average age of 21.8 and 21.7 years, respectively. There were 18,160 admissions in 2006 – 2007, rising to 19,506 in 2007 – 2008, and 21,225 in 2008 – 2009. By restricting the definition to mental, behavioural and related problems, there were 1089 admissions in 2006 – 2007, rising to 1148 in 2007 – 2008 and 1324 in 2008 – 2009.

As before, we applied an ARIMA (1,0,0)(1,0,0)₁₂ model without differencing. Figure 2 shows that there was no change in the rate of admissions using the broad definition, following the increase in the ‘alcopops’ tax. Similar results were found using the narrow definition of alcohol-related health harm, and when males and females were analysed separately (Table 1).

Emergency department visits

Eight emergency departments (EDs) contributed data to Queensland Health for the entire 3 years of the study. There were 87,665 ED visits using the broad definition over the 3 years of the project, with little variation in the number of visits per year. The group was 71% male (n = 62,225), with an average age of 21.5 years. As with the other databases, we applied an ARIMA (1,0,0)(1,0,0)₁₂ model, again with similar results (Figure 3). There was no change following the introduction of the ‘alcopops’ tax, for both narrow and broad definitions of alcohol-related harms, nor when we looked at males and females separately (Table 1).

Discussion

Although binge drinking in young people is a considerable public health concern, the effectiveness of the increase in ‘alcopops’ tax is unclear. On the one hand, the alcohol industry claimed that young people were substituting ‘alcopops’ with stronger alcoholic drinks, leading to greater rather than less harm, while on the other hand, the government pointed to changes in alcohol sales as evidence of effectiveness. Neither approach addressed the issue of health-related harms. This study may inform policy, by establishing whether increases in this tax targeted at particular drinks led to reduced alcohol-related harms, as measured by young people’s health service contacts. The results extend previous

work restricted to the Gold Coast, and may therefore be more generalisable to the rest of Australia, given that the former is a popular tourist destination.¹⁹

Using time series analysis of data from the QTR, QHAPDC and EDIS databases, we identified that the rate of alcohol-related presentations for 15 – 29 year olds did not significantly fall, following the introduction of the ‘alcopops’ legislation in April 2008. This suggests that although there is considerable evidence that price influences consumption at a population level, there is less evidence of this for tax increases targeted at specific drinks favoured by young people. Any approach to binge drinking in young people must, therefore, be comprehensive and encompass both demand and supply.

Babor et al.⁹ rates the effectiveness of policy choices developed globally, to address problems due to alcohol. Those rated the strongest include policies to restrict affordability and physical availability. Increased alcohol availability leads to a greater number of related harms, while more restrictive policies reduce problems.⁹

Particular attention has been focused on the association between liquor outlet density and alcohol-related harm,^{9,26} including accidents and assaults among young people.²⁷

Administrative health data have several advantages over other data sources.²⁸ For instance, alcohol sales data only indicate what and how much was purchased, not who bought it, how it was used, or the consequences of the way it was consumed.²⁹ Sales data cannot provide information on the amount of risky drinking,³⁰ nor take into account changes in the alcohol content of drinks over time.³¹

There are several limitations to this study. Administrative data are subject to reporting bias and we cannot be certain that all of the events included in the analyses were alcohol-related, nor due to other causes such as substance use. In addition, there were minor changes to the ICD-10 codes, in some of the administrative data, in 2008;¹⁸ however, this did not affect either the narrow or broad definitions of alcohol-related harm that we used. Although the data from QTR and QHPADC are Queensland-wide, the EDIS data were more limited, as only eight EDs contributed data that could be accessed for the length of the study, and so be included in the analysis. These account for only one-third of the total number of EDs that were open by the end of the study. Because of privacy concerns, we did not know where the selected EDs were and therefore we were unable to calculate rates for their respective catchment areas. The only way to take into account population growth was to use estimated resident population figures for all of Queensland. On the other hand, the fact that several EDs opened during the course of the study, and therefore potentially siphoned off patients who were presenting with alcohol-related harms from one of the EDs included in the study, would have lowered our presentation rate. It would not explain that the rate remained steady during the course of the study. Therefore, any bias would have over-estimated, rather than under-estimated, any reduction in presentations captured by the study following the tax increase. A final drawback was the time taken to obtain the

necessary approvals, and then to extract, code and link the data. This means we only have data up to 2009.

In conclusion, the increase in tax on 'alcopops' was not associated with any reduction in alcohol-related harms in this population. Targeting one particular alcoholic drink may be less effective than comprehensive approaches to harm reduction that combine fiscal measures (such as volumetric taxation for all alcoholic beverages) with other supply and demand initiatives.

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Disclosure

The authors report no conflict of interest. The authors alone are responsible for the content and writing of the paper.

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