

The impact of later trading hours for hotels (public houses) on breath alcohol levels of apprehended impaired drivers

Tanya Chikritzhs¹ & Tim Stockwell^{1,2}

National Drug Research Institute, Curtin University of Technology, Perth, Western Australia, Australia¹ and Centre for Addiction Research of British Columbia, University of Victoria, Canada, V8Y 2E4²

ABSTRACT

Aim To examine the impact of extended trading permits (ETPs) for licensed hotels in Perth, Western Australia on impaired driver breath alcohol levels (BALs) between July 1993 and June 1997. **Design** Forty-three hotels obtained ETPs allowing later closing hours and 130 maintained standard closing time (controls). Impaired driver BALs were linked to 'last place of drinking' hotels. Before and after period BALs of drivers who last drank at ETP or non-ETP hotels were compared by time of day of apprehension and sex, controlling for age. **Findings** Impaired female drivers apprehended between 10.01 p.m. and 12 midnight (before closing time) had significantly lower BALs after drinking at ETP hotels. Male drivers aged 18–25 years and apprehended between 12.01 and 2.00 a.m. after drinking at ETP hotels had significantly higher BALs than drivers who drank at non-ETP hotels. **Conclusions** At peak times for alcohol-related offences, late trading is associated with higher BALs among those drinkers most at risk of alcohol-related harm.

Keywords Alcohol, breath alcohol levels, drunk-driving, impaired driver, licensed premises, random breath testing, regulation, trading hours.

Correspondence to: Dr Tanya Chikritzhs, National Drug Research Institute, GPO Box U1987, Perth, WA 6845, Australia.

E-mail: t.n.chikritzhs@curtin.edu.au

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INTRODUCTION

In Australia, as in many other parts of the world, a substantial amount of alcohol is consumed on licensed premises. A recent national survey estimated that over half of all drinkers aged 14 years or older usually drink at licensed premises (i.e. hotels, nightclubs but not restaurants). For 20–29-year-old drinkers, usual consumption at licensed premises (76%) is more common than drinking at private parties, the homes of friends or restaurants/cafes [1].

Although not substantiated, it has been proposed by some that longer trading hours for licensed premises allows drinkers to 'pace themselves', thereby slowing the rate of drinking, ultimately reducing intoxication and related harms, (e.g. [2–4]). This argument is often used to support the deregulation of trading hours, a notable and recent example of which can be found in the UK Home

Office White Paper, 'Time for reform: proposals for the modernization of our licensing laws' [2].

General research evidence relating to alcohol availability runs contrary to this line of reasoning and predicts that increasing alcohol availability via longer trading hours is likely to result in increased consumption [5,6]. Despite several decades of indirect evidence to support this proposition, there has been little specific research on the impact of extended trading hours for licensed premises on patron consumption levels to support informed debate.

Using a series of surveys, Knight & Wilson [7] examined the impact of extended late-night trading hours introduced in December 1976 and Sunday trading introduced in October 1977 on alcohol consumption levels among Scottish residents. Three months after the first change they found no evidence of any impact on consumption levels, although it is possible that not enough

time had elapsed to effect significant behaviour change. Some 18 months later, after Sunday trading had also been introduced, consumption among males, especially those aged 18–25 years, had increased. Also, heavy drinkers were more likely than moderate drinkers to have increased their consumption. A similarly designed study [8] did not find any evidence of change among males between 1976 and 1984, although female consumption had apparently risen significantly. Scotland was, however, undergoing a major economic recession at the time, the impact of which was unable to be accounted for by either study.

A short-term increase in late-night trading hours for the city of Fremantle, Western Australia did not appear to affect self-reported consumption levels among local males aged 18–28 years; however, few respondents actually attended licensed premises during the extended times (although heavier drinkers were more likely to report using the extended trading hours) [9].

In Western Australia (WA) 1993, the then Liquor Licensing Director of the Department of Racing, Gaming and Liquor (LLD) began granting Extended Trading Permits (ETPs) to hotels in the metropolitan area which allowed standard closing time (midnight) to be extended, mostly to 1 a.m.. (The term 'hotel' refers to business establishments, the primary function of which is the service of alcohol on the premises, and known otherwise as public houses, taverns, bars, ale houses and saloons.) The vast majority of licensees who applied for an ETP were successful, but most licensees chose not to apply and continued to trade with standard hours. Data on hotels and their trading hours were linked to police reports identifying the 'last place of drinking' and breath alcohol levels (BALs) of impaired drivers involved in road crashes. A recently published study (by the same authors) used a controlled, interrupted time-series design, with mean monthly BALs as the dependent variable, to examine the impact of ETPs on crash frequency and driver BALs [10]. No overall impact of ETPs on driver BALs was indicated—despite evidence of increased numbers of driver-impaired crashes and substantially increased wholesale alcohol purchases by the hotels where they last drank. The study also found evidence for intrinsic differences between hotels which applied for late trading hours and those that continued to trade with standard hours. One of the most salient differences was the younger age of the impaired drivers who last drank at hotels with late trading.

Age and sex have been demonstrated repeatedly as important factors for determining the risk of alcohol-related harms to individuals (including road injury) [11]. In addition, frequency of alcohol-related offences has been shown to vary considerably by time of day. Alcohol-related offences tend to peak at midnight and remain high

for several hours thereafter; coinciding with closing times for licensed premises [12–14].

A better understanding of the relation between ETPs and other contributing factors such as time of day, age and sex is required. To this end, the current study applied a before-and-after design which supported disaggregation of driver BALs by time of day of apprehension, sex and age of impaired driver and combinations of these factors. (Small numbers of cases precluded similar analysis on impaired drivers involved in road crashes.)

METHODOLOGY

Design overview

The aim of this study was to determine whether impaired driver BALs were affected by the granting of ETPs to some hotels after mid-1993. The WA Police Service (WAPS) provided official reports of offenders exceeding the legal limit for driving and their BALs for the period July 1990–June 1997. Random breath testing had been in operation in WA since 1988, with some of the highest test rates in the country [15].

The LLD provided data on the late trading status of hotels. In June 1993, the legal BAL for driving was reduced from 0.08 mg/ml to 0.05 mg/ml and was launched with a highly publicized media campaign. This was likely to have influenced impaired driver behaviour, including levels of intoxication with overall impact increasing over time [10]. To reduce the confounding effect of this change, only those offences which occurred subsequent to the '05 campaign' were examined; that is, the 4 consecutive years between July 1993 and June 1997.

Hotels which traded with standard hours throughout the entire study period were employed as controls (non-ETPs). Based on actual start dates of ETPs between 1993 and 1997, non-ETP hotels were assigned ETP start dates randomly to create a group of control hotels with 'after periods'. Mean BALs of patrons from ETP and non-ETP hotels were compared before and after actual (ETP hotels) and assigned (non-ETP hotels) ETP start dates. Separate analyses were conducted by time of day of apprehension, with time-periods structured in order to delineate between critical hours relating to closing time, e.g. immediately before and during/after closing time. Analyses were conducted separately for males and females and age was included as a continuous variable.

Procedure

Liquor licensing information and extended trading permits

The LLD provided data on start dates of all hotel liquor licenses as well as individual ETP hours and timing of extensions, terminations and suspensions, type of liquor

licence and licence identification number. Hotel-specific information was used to identify which had obtained an ETP and which had not. Primary liquor licences may be terminated or suspended by the LLD; it was therefore necessary to identify whether hotels had operated continuously throughout the study period and to exclude those that had not. Moreover, several hotels were only granted conditional ETPs which required the provision of substantial meals and entertainment. Selection criteria were therefore specified as follows:

- the hotel must possess an extension of trading hours that extended closing time;
- the hotel ETP must not be subject to any special conditions specifying the mandatory provision of food with alcohol during the extended hours or which render the ETP licence intermittent or non-continuous; and
- the hotel must not have closed down for any undetermined or extended period of time.

Re-application for an ETP was required every 6–12 months; however, none of the ETPs included in this analysis were halted at any time during the study period—once an ETP was granted, approval for continuation was largely assured given that the primary liquor licence remained active. All hotels that gained ETPs during the study period applied later for permit continuations and all were granted. It can be reasonably assumed, therefore, that where granted ETPs were used in the large majority of cases. This was confirmed in discussions with key LLD informants.

There were about three times as many non-ETP than ETP hotels operating throughout the metropolitan area during the 4-year study period: 43 ETP and 130 non-ETP.

Driver-impaired BACs

Unit record data on all police-reported impaired driving offences where the driver exceeded the legal BAL for driving between July 1993 and June 1997 was obtained from the WAPS. This information was derived from a range of traffic-related police duties, including: random breath testing, 'booze bus' operations (see [10]) and routine traffic patrol activity where the driver was asked to submit to a breath test. In order to maintain consistency with a previous related study [10] and to limit the likelihood of confounding by the '0.05 campaign', only those offences recording a BAL of 0.08 mg/ml or greater were included. Only impaired drivers aged 18 years and older were included (legal minimum age for drinking at licensed premises). Less than 0.5% of impaired drivers admitting to having last drunk at a licensed premise were younger than 18 years.

A total of 9880 offences was associated with eligible hotels between 1993/94 and 1996/96. The majority of impaired drivers were male (86%). The mean age among

offenders was about 31 years for males and 28 years for females. Some 38% of all offenders were aged 18–25 years and 20% between 26 and 30 years. Males aged between 18 and 25 years made up the single largest group of impaired drivers (32%).

Data quality and potential confounders

To our knowledge, the accuracy of responses by impaired drivers to police questioning about 'last place of drinking' has not been validated formally in Australia. Although error is undoubtedly present—the magnitude of which is unknown—there is no evidence to suggest that driver response errors are not distributed randomly.

Apart from the '05 campaign', several events occurred during the study period which may have affected reported BALs, including the Fremantle and Northbridge Liquor Accords, police introduction of a 'zero tolerance' policy and introduction of 'booze buses' (see [10] for detailed descriptions). Results from earlier time-series analyses suggest that none of these interventions had a significant impact on the BALs of impaired drivers involved in road crashes when measured in aggregate [10].

Date and time of day

The WAPS also provided information regarding the date and time of day when the apprehension was made. Date of offence was used to determine whether the offence occurred before or after commencement of an ETP. For the purposes of this study, three mutually exclusive time-periods reflecting key times of day were constructed:

- 1 10.01 p.m. to 12 midnight, the two hours immediately preceding a midnight closing time ($n = 2614$);
- 2 12.01 a.m. to 2.00 a.m., the two hours immediately following a midnight closing time/first hour preceding and first hour immediately following extended closing time ($n = 2526$); and
- 3 all other remaining times of day ($n = 4740$).

The 2-hour time-periods ensured that adequate sample sizes were available for primary analyses, including three main effects, two- and three-way interaction effects as well as *post hoc* analyses of specific age groupings (and interaction effects), where ETP hotels and associated BALs contribute about 25% of the total sample.

Last place of drinking

It was WAPS policy to (i) ask all offenders: 'Where was your last place of drinking?' and (ii) if a driver's 'last place of drinking' was a licensed premise, then the name of the venue was recorded. This information was used to identify directly which offences were associated with standard and late trading hotels (major changes to WAPS privacy

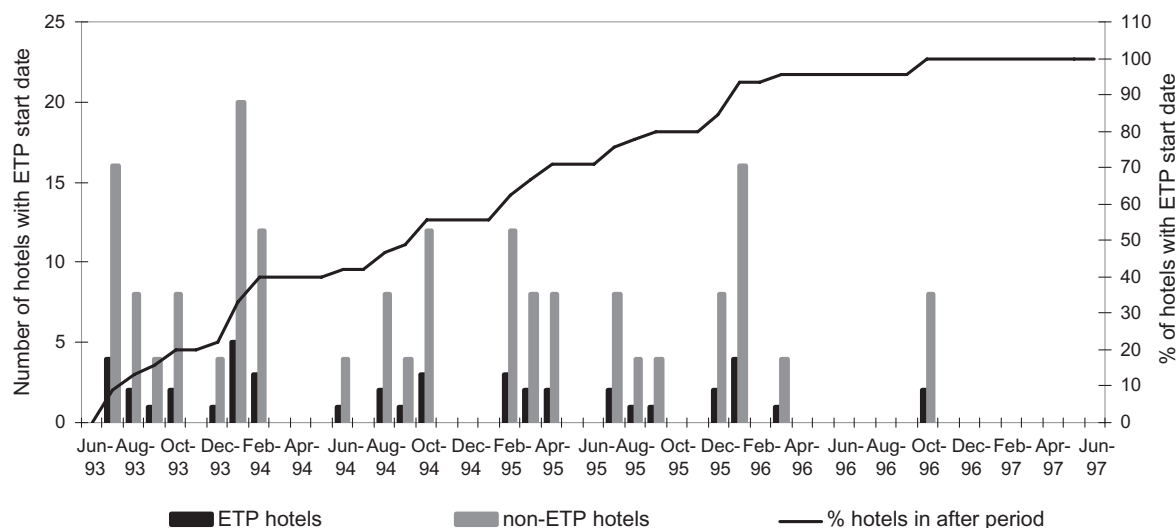


Figure 1 Distribution of non-ETP and ETP start dates and cumulative proportion of hotels operating within the after period. ETP = extended trading permit

policy in relation to 'last place of drinking' information have precluded inclusion of subsequent years for analysis). Between 1993/94 and 1996/97 police failed to record the actual name of a licensed premise in about 12% of reported cases [16]. There was no reason to suspect that either ETP or non-ETP hotels were over-represented among un-named hotels [10].

Each Perth metropolitan hotel meeting the selection criteria (i.e. did not close down for any undetermined or extended period of time) was identified at least once as a last place of drinking for an impaired driver.

Assignment of before-and-after periods to non-ETP hotels (control group)

Where the last place of drinking was an ETP hotel, the allocation of an associated offence to either a before or after period was straightforward. Associated offences that occurred before the ETP for the specific hotel commenced were assigned to the before group and those that occurred after the ETP start date for that specific hotel were allocated to the after group. For the 130 non-ETP hotels identified as a last place of drinking (i.e. all remaining eligible hotels in the metropolitan area which did not obtain an ETP during the study period), start dates from each of the 43 ETP hotels were assigned randomly (Microsoft Excel rand function). Thus, for each one ETP hotel there were three control hotels which had been assigned the same start date randomly (one ETP start date was allocated four times) but which did not actually receive any increase in trading hours. Figure 1 shows the distribution of start dates allocated to non-ETP hotels and their ETP counterparts. It also shows the cumulative proportion of hotels operating within the 'after period', e.g. by October 1994 about 55% of all

hotels had passed either their real (in the case of ETP hotels) or randomly assigned (in the case of non-ETP hotels) start date.

Analyses

Univariate before period comparisons between ETP and non-ETP hotels were performed on a range of characteristics using independent *t*-test and cross-tabulations procedures.

Multiple linear regression analyses (MLR) were conducted separately on male and female BALs and for each of the three time-periods (six regressions). Mean driver BALs were the dependent variables in all analyses. Analyses examined three main effects, including:

- 1 'after period', binary categorical variable identifying offences occurring during the associated hotel's before (0) or after period (1);
- 2 'ETP hotel', binary categorical variable identifying offences occurring with non-ETP (0) and ETP hotels (1); and
- 3 'age', continuous variable.

All two-way and three-way interactions were also tested. Of particular interest were interactions which included both the variables 'after period' and 'ETP hotel' (i.e. 'after period' by 'ETP hotel') which functionally identified driver BALs where last place of drinking was an ETP hotel which had an active ETP at the time of the offence.

To address skewed distributions all BALs and age variables were natural log-transformed prior to analysis. All coefficients presented in Tables 2 and 3 have been transformed back to the original scale. All analyses were conducted using SPSS version 12.

Table 1 Before period comparisons between ETP and non-ETP hotels.

Statistic	Non-ETP hotels	ETP hotels	% Difference (<i>t</i> -value/ χ^2)
Mean impaired driver breath alcohol level mg/ml (95% CI)	0.144	0.138	4.2 (5.23)***
Mean drunk-driver age (years)	30.1	28.8	4.3 (8.07)***
Percentage male drunk-drivers	88.1	83.1	5.7 (27.30)***
Mean annual volume of wholesale alcohol purchases for hotels associated with impaired driving			
Regular strength beer (litres)	227 360	223 506	1.7 (1.05)
Low/mid strength beer (litres)	94 267	80 476	14.6 (7.33)***
Regular strength wine (litres)	34 186	31 492	7.9 (3.45)**
Full strength spirits (litres)	12 998	12 087	7.0 (3.65)***

Statistical significance (*t*-test) ***P* < 0.01, ****P* < 0.001. ETP = extended trading permit.

RESULTS

Prior to the introduction of extended trading hours, ETP and non-ETP hotels were significantly different on a range of measures (Table 1). ETP hotels purchased significantly less low/mid-strength alcohol content beer, wine and spirits but similar quantities of regular strength beer to non-ETP hotels. Drivers associated with ETP hotels were younger and more likely to be female than patrons who last drank at non-ETP hotels.

Table 2 shows final model coefficients and parameters for each of the six groups (sex \times time-period) with non-significant interactions and/or main effects removed (main effects retained where part of a higher interaction effect). Normal probability plots indicated symmetrical and approximately normal distributions among residuals.

Overall, driver BALs were lower during the after period, reflecting an overall downward trend (0.05 BAL limit introduced in June 1993). With the exception of female drivers apprehended between 10.01 p.m. and midnight, older drivers had higher BALs. The adjusted R^2 remained at less than 5% in all cases. Two sets of regressions showed evidence of an interaction effect: a two-way interaction for females and a three-way interaction for males.

Females apprehended between 10.01 p.m. and midnight who had last drunk at an ETP hotel with active extended trading hours (ETP hotel \times after period) had significantly lower BALs than all other females apprehended during that time-period. Solving the MLR equation, the average BAL for females apprehended between 10.01 p.m. and midnight after drinking at an ETP hotel with late closing was 0.113 mg/ml. The mean BAL for drivers associated with non-ETP hotels during the after period was 0.137 mg/ml. In addition, mean BALs for impaired drivers during the before period were 0.133 mg/ml and 0.130 mg/ml for non-ETP and ETP hotels, respectively. Thus, among females apprehended between 10.01 p.m. and midnight, mean BALs associ-

ated with non-ETP hotels increased by about 3%, whereas BALs associated with ETP hotels decreased by about 14%.

Figure 2 shows the three-way interaction effect among males charged between 12.01 a.m. and 2.00 a.m. At all ages, highest BACs occurred during the before period and were associated with non-ETP hotels. Conversely, BACs associated with non-ETP hotels during the after period were lowest overall, while patrons who last drank at ETP hotels had the second-highest BACs.

Post hoc analyses grouped impaired drivers by age. As shown in Table 3, the higher BALs demonstrated for male drivers apprehended between 12.01 a.m. and 2.00 a.m. who last drank at hotels with active extended trading were, in fact, specific to 18–25-year-olds.

Solving the MLR equation produced an average BAL of 0.126 mg/ml for males who were apprehended between 10.01 p.m. and midnight after drinking at an ETP hotel. The mean BAL for drivers associated with non-ETP hotels during the after period was 0.123 mg/ml. Mean BALs for impaired drivers during the before period were 0.135 mg/ml and 0.124 mg/ml for non-ETP and ETP hotels, respectively. Thus, mean BALs associated with non-ETP hotels among males apprehended between 12.01 a.m. and 2.00 a.m. declined by about 9%, whereas mean BALs among drivers who last drank at an ETP hotel increased by about 1.5% over the study period.

DISCUSSION

This study possesses a number of strengths, including an objective measure of intoxication (as opposed to self-reports), before-and-after design, control group, linkage of offences to specific hotels identified as 'last place of drinking' and identification of offences by time of day of apprehension.

Limiting factors include: inability to identify whether the majority of alcohol consumed occurred at 'last place

Table 2 Final model parameters for impaired driver BALs by time of apprehension and sex (coefficients converted back to original measurement scale).

	10.01–12.00 p.m.						12.01–2.00 a.m.						Remaining hours					
	n	Adj. R ²	Beta	Std. b	t-value	n	Adj. R ²	Beta	Std. b	t-value	n	Adj. R ²	Beta	Std. b	t-value			
	Males	2242	0.024	-0.96	-0.94	-2.87**	1991	0.049	-0.85	-0.75	-0.78	4245	0.014	-0.98	-0.97	-2.29*		
ETP group			-0.95	-0.91	-4.32***			-0.77	-0.63	-1.27			-0.94	-0.91	-6.21***			
After period			1.11	1.11	5.15***			1.20	1.19	4.64***			1.06	1.06	4.09***			
Age			-	-	-			2.03	2.79	2.27*			-	-	-			
ETP hotel × after period			-	-	-			1.03	1.18	0.44			-	-	-			
ETP hotel × age			-	-	-			1.06	1.38	0.89			-	-	-			
After period × age			-	-	-			-0.82	-0.38	-2.13*			-	-	-			
ETP hote × after period × age			-	-	-			-	-	-			-	-	-			
Females	372	0.049	-0.98	0.96	-0.55	535	0.025	-	-	-	495	0.043	-	-	-			
ETP hotel			1.04	1.06	0.36			-0.93	-0.88	-2.86**			-0.94	-0.89	-2.58*			
After period			-	-	-			1.15	1.14	3.03**			1.21	1.21	4.31***			
Age			-0.84	-0.79	-2.87**			-	-	-			-	-	-			
ETP hotel × after period			-	-	-			-	-	-			-	-	-			
ETP hotel × age			-	-	-			-	-	-			-	-	-			
After period × age			-	-	-			-	-	-			-	-	-			
ETP hotel × after period × age			-	-	-			-	-	-			-	-	-			

Statistical significance (P value) *P < 0.05, **P < 0.01, ***P < 0.001. BAL = breath alcohol level; ETP = extended trading permit.

Table 3 Regression statistics for BALs of impaired male drivers apprehended between 12.01 a.m. and 2.00 a.m. by age group (coefficients converted back to original measurement scale).

Age group	n	Adjusted R ² for model	t-value for variable entered	Beta
18–25 years	986	0.020		
ETP hotel			-3.77***	0.92
After period			-4.09***	0.91
ETP hotel × after period			3.12**	1.11
26–30 years	437	0.019		
ETP hotel			-1.69	0.94
After period			-2.75**	0.90
ETP hotel × after period			1.04	1.06
31–40 years	400	0.041		
ETP hotel			-1.59	0.94
After period			-0.265	0.99
ETP hotel × after period			-1.43	0.92
41+ years	168	0.017		
ETP hotel			-0.704	0.96
After period			-1.877	0.90
ETP hotel × after period			-0.247	1.02

Statistical significance (P value) *P < 0.05, **P < 0.01, ***P < 0.001. BAL = breath alcohol level; ETP = extended trading permit.

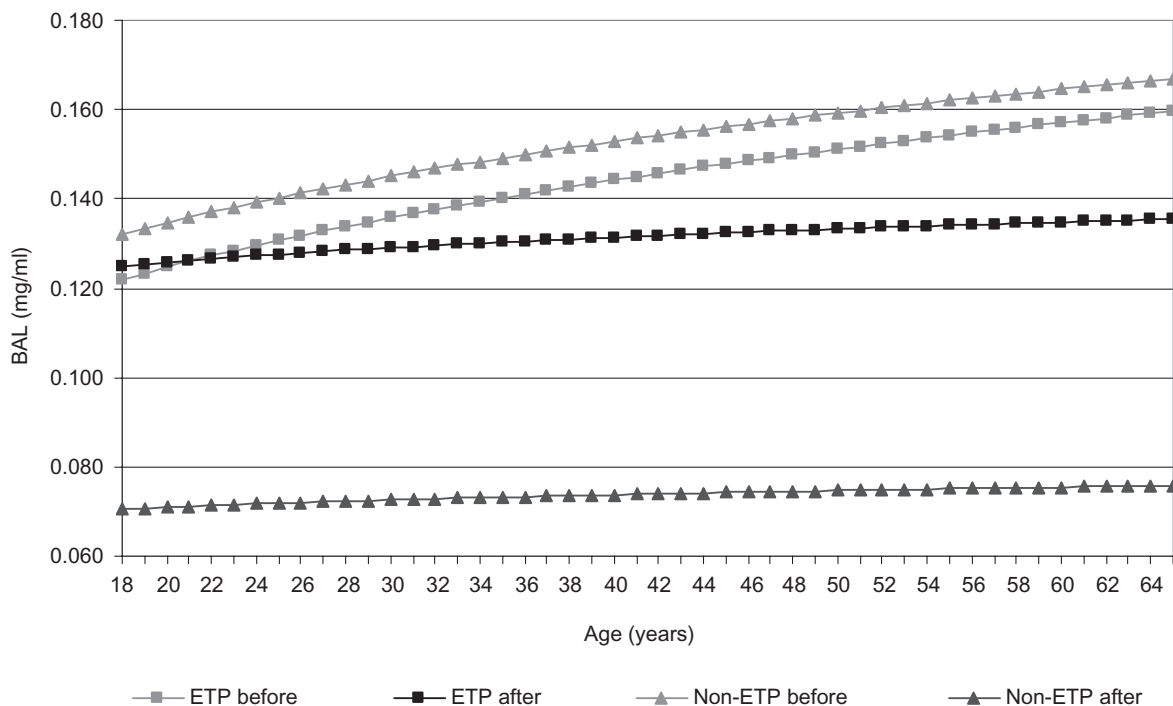


Figure 2 Three-way interaction effect between ETP hotel, after period and age for impaired male drivers apprehended between 12.01 and 2.00 a.m. BAL = breath alcohol level; ETP = extended trading permit

of drinking’ or some other location; no information on accuracy of impaired driver responses; self-selection of ETP hotels; and the ecological design. The ‘05 campaign’ also appeared to have had a bearing on the results with significant overall declines in driver BALs.

In keeping with our earlier study [10], the current study has found that even before ETPs were widely

introduced, Perth hotels that applied later for an ETP were dissimilar to those that did not apply. Most notably, ETP hotels purchased significantly smaller quantities of low/mid-strength alcohol beer and associated impaired drivers were younger and more likely to be female. The apparent lower consumption of low/mid-strength beer among patrons of ETP hotels is of particular interest, as

evidence suggests that consumption of low-strength beer may be protective for some alcohol-related harms [17]. Moreover, it is likely that there are other characteristics unable to be measured by this study (e.g. management practices, proportion of under-aged drinkers and quality of security staff), which also differ between premises which do and do not apply to trade for extended hours.

None the less, this study has shown that extensions of hotel closing hours influence average BALs among some patrons and that the outcome varies by time of day, age and gender. Having last drunk at a hotel with active extended trading hours was associated with lower BALs among some female drivers (but not males)—the effect specific to those apprehended between 10.01 p.m. and midnight (i.e. before closing time). However, it is unlikely that extended trading hours encouraged female drinkers to ‘pace themselves’, as these patrons actually departed at least 1 hour before closing time and therefore did not partake of the additional drinking hours on offer. In any case, the questions raised cannot be answered by these data and further investigation is required.

Males aged 18–25 years, who were apprehended between 12.01 a.m. and 2.00 a.m. and last drunk at a hotel with active extended trading hours, had significantly higher BALs than patrons of non-ETP hotels. This is in keeping with other studies which have identified pub closing hours as peak times for alcohol-related injury and crime [12–14], but counters our own earlier study, which failed to find an effect of ETPs on average driver BALs [10]. Given the apparent specific nature of the relationship between ETPs and driver BALs, it is possible that failure to detect a change in overall BALs was due in part to the diluting effect of the aggregate method of analysis applied in the earlier study (i.e. time-series analysis of mean monthly BALs).

It is possible that the results may be due to differences in the time taken to leave a hotel and begin driving (i.e. ETP patrons apprehended while BAC inclining, non-ETP patrons apprehended while BAC declining). Alternatively, when driving during the early morning hours, impaired patrons of ETP hotels may have been more visible and more easily apprehended. Although possible, both these scenarios seem unlikely. In the case of the former it is improbable that such an effect would be specific only to patrons of a specific age and sex. In the case of the latter, there is some evidence to suggest that the reverse is true and that patrons of ETP hotels are more likely to escape police attention due to the lower numbers of police on patrol during the early morning shift [18].

Over 50% of serious alcohol-related road crash injuries in Australia occur among young people aged

15–24 years, more than 70% of whom are male [19]. It is of considerable concern, therefore, that extended trading hours for hotels appears to influence adversely drinking behaviour among those drinkers most at risk— young males.

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