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# Underage purchasing of alcohol from packaged liquor outlets: an Australian study

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## Summary

Access to the supply of alcohol is an important factor influencing adolescent alcohol consumption. Although alcohol sales outlets are prohibited from selling alcohol to underage youth, there has been limited research investigating compliance. The present study sought to estimate the extent to which adolescents that appeared underage were successfully able to purchase alcohol from packaged liquor outlets in Australia; and to identify store and sales characteristics associated with illegal purchasing. In 2012, purchase surveys were conducted (*n* = 310) at packaged liquor outlets in 28 urban and rural communities across three states of Australia: Western Australia, Queensland and Victoria. Confederates successfully purchased alcohol at 60% (95% CI: 55–66) of outlets. The density of general alcohol outlets in the surrounding area and the type of liquor outlet were predictors of successful alcohol purchases; however, this was moderated by the state in which the purchase was made. Regional geographical location was also found to predict underage alcohol purchase. The majority of alcohol sales outlets in Australia breach regulations prohibiting sales to underage youth. Consistent enforcement of policies across the states of Australia, and reducing the number of alcohol outlets, will help prevent alcohol outlets in Bustralia, and reducing the number of alcohol outlets, will help prevent alcohol outlets lites illegally selling alcohol to underage adolescents.

Key words: alcohol, adolescence, community-based intervention

## INTRODUCTION

Based on evidence of long- and short-term harms, public health guidelines throughout the world recommend that children and adolescents should not consume alcohol. For Australia and most of the countries of Europe, guidelines endorse that children and adolescents should refrain from consuming alcohol under the age of 18. Despite these recommendations, up to 80% of Australian children aged 17 years report consumption of alcohol in their lifetime (White and Bariola, 2012). In the USA 52% (Johnston *et al.*, 2014) and in the UK 90% (Hibell *et al.*, 2012) of similar aged children have consumed alcohol in their lifetime. Identifying how adolescents access alcohol and intervening at these points are critical in reducing the proportion of adolescents under the age of 18 who consume alcohol.

Australia has a national harm minimization policy framework around the sale of alcohol (Ministerial

Council on Drug Strategy, 2011). This means that alcohol policies focus on reducing the demand, supply and harm of alcohol. However, while the framework is consistent across the country, the six States and two Territories in Australia have primary responsibility for how this is regulated. For example, in the State of Victoria liquor licensing laws allow a child to drink alcohol on a licensed premises with a meal when supervised by a parent/carer (Trifonoff *et al.*, 2011a). This is not the case in the neighbouring state of New South Wales (NSW).

While alcohol can be accessed in a variety of ways (e.g. shops, friends, stolen from home), a substantial proportion (i.e. 33%) of Australian children, who report recently consuming alcohol, indicate that it was provided to them by their parents. In Australia, it is not illegal for a parent or guardian to provide alcohol to children in their care (Trifonoff *et al.*, 2011a). However, currently in the States of Victoria, Queensland, New South Wales, Western Australia, Tasmania and the Northern Territory, 'Secondary Supply' legislation forbids the provision of alcohol from an adult to a child who is not his or her own, without specific permission from the child's parent or guardian. Western Australia has only recently introduced this legislation; there are two States/Territories (South Australia, Australian Capital Territory) that do not have this legislation.

In most states in Australia, anyone who serves, sells or supplies alcohol in a licensed venue is required to complete a mandatory Responsible Service of Alcohol (RSA) course (Trifonoff et al., 2011b). This course provides general and state-specific instructions on the skills and knowledge required to work in a position involving the service of alcohol. One core component of the RSA course involves providing training on underage drinking laws, specifically checking for photo/age identification of patrons to verify they are of legal purchasing age. Many packaged liquor outlets promote in-house policies of asking for proof of age if the person attempting to purchase alcohol looks <25 years old (Aldi Liquor, 2015; BWS, 2015; Dan Murphy's, 2015; First Choice Liquor, 2015; Liquorland, 2015). These polices are also endorsed by government bodies (Government of Western Australia Drug and Alcohol Office, 2015) and industry-led groups (Australian Liquor Stores Association, 2015).

Environments and communities characterized by high consumption of alcohol and easy access to alcohol are described as 'alcogenic' (Huckle *et al.*, 2008). One indicator of an alcogenic environment is the density of alcohol outlets—the number of alcohol supply points in a given area per capita of a geographic population (Livingston *et al.*, 2007). Higher density of alcohol outlets is associated with greater rates of adult alcohol-related behaviour (Campbell *et al.*, 2009; Popova *et al.*, 2009) and also adolescent consumption (Rowland *et al.*, 2014) and greater rates of adolescent purchasing of alcohol (Rowland *et al.*, 2015). Social cognitive theory (Baranowski *et al.*, 2002), ecological theory (Bronfenbrenner, 1979) and availability theory (Stockwell and Gruenewald, 2001) all support the

fluence on behaviour. Thus, local legislation and the extent that alcohol is available may act as a cue, or may also act to reinforce existing or developing alcohol-related behaviour. It is possible that State legislation creates a context where vendors are less vigilant about checking for relevant age identification. It is also possible, as the density of outlets increases, outlet vendors experience competition and thus greater pressure to be lenient with liquor licensing standards, as one way of ensuring that sales and income do not decrease (Freisthler *et al.*, 2003). Greater density could also mean that there are greater environmental factors—advertising, access, and the promotion of more liberalized norms influencing adolescents to purchase alcohol (Campbell *et al.*, 2009).

notion that environmental and policy factors have a large in-

The present study examined whether youth who appeared to look <18 years of age were able to purchase alcohol from takeaway liquor stores (i.e. packaged liquor outlets) across three Australian states. To our knowledge, no Australian study has been published examining this topic. The study examined whether there were State differences in rates of youths being able to purchase alcohol, and whether the density of alcohol outlets in a given area was associated with this behaviour. The hypothesis was that in States that do not have secondary supply legislation, there would be a higher probability of a confederate purchasing alcohol. It was also hypothesized that as the density of alcohol outlets increased, the probability that a confederate would be able to purchase alcohol would also increase.

## METHODS

## Procedure

The study was conducted in 28 Statistical Local Areas (SLA) across Victoria, Queensland and Western Australia. The packaged liquor outlets were sampled within a 6 km radius of schools involved in a national community trial (Rowland *et al.*, 2013). A list of packaged liquor outlets was obtained through each State's Liquor Licencing body. In Australia, packaged liquor stores are those that sell alcohol to be consumed off the premises. All 28 communities were visited between August and December 2012. A total of 310 stores were visited across the three Australian states. The greatest number of packaged liquor stores visited within the stipulated 6 km radius was in the State of

Victoria (n = 160); a smaller number of stores were visited in Queensland (n = 79) and Western Australia (n = 71).

As it is illegal in Australia to sell alcohol to anyone under the age of 18 years of age, individuals who were perceived to look under the age of 18 (confederates) were used to purchase alcohol. Confederates were recruited through the university and selected by an expert panel. The panel included individuals from professions that are associated with youth: the Victorian Police, secondary school teachers, medical health professionals, undergraduate University lecturers, staff who work in the service of alcohol, and security staff who work in licensed venues (n = 7). Each panel member was given a photograph of a potential confederate that had been taken in the previous 12 months. Using these photographs, panel members were then asked to provide an estimate of perceived age of the confederates. If 80% of the panel judged the person to look under the age of 18, the person was selected as a confederate for the study. Seven confederates were chosen for the study; the majority were female (89%), and the average actual biological age of confederates was 20 years 4 months. The average perceived age of confederates was 17.05 years (range 13-18). Confederates were required to attend a half day training session, where the procedure and safety strategies were discussed and practiced. The method of panel and confederate selection was consistent with other study protocols (Grube and Stewart, 1999).

Confederates were given \$15 per outlet visited, and were instructed to purchase alcohol he or she would typically drink on a night out, such as a four pack of pre-mixed drinks, a six pack of beer or cider, or a bottle of wine. Confederates were instructed to dress as they normally would on a night out with friends; females were asked to wear minimal make-up; males were asked to wear minimal facial hair. Confederates did not carry any form of identification. All confederates were accompanied to store visits by a research supervisor; however, the supervisor remained in the car and did not enter the store. Alcohol purchases were verified by the supervisor sighting the sales invoice of the purchased alcohol. Purchased alcohol was subsequently taken back to the research office and discarded. Purchasing attempts were done on Friday nights, Saturday nights, and Sunday afternoons between 12 noon and 10 pm.

While in the store, confederates were asked to observe characteristics of the store environment, and sales staff. On completion of the purchase attempt, confederates recorded this information on a prepared survey. The survey was based on previous confederate surveys (Grube and Stewart, 1999), which was modified for the Australian context (Alcohol Advisory Council of New Zealand, 2004; Toomey *et al.*, 2004; Lang and Zappelli, 2007; Maltman and Douglas, 2007). This study was registered with the Australian New Zealand Clinical Trials Registry (ACTRN12612000384853) and was approved by Deakin University Human Research Ethics Committee (2011-102).

## Measures

## Confederate characteristics

For each purchase attempt, the gender of the confederate was recorded.

## Sales staff characteristics

Confederates were asked a variety of questions pertaining to sales staff characteristics: 'In your (confederate) opinion, approximately how old was the staff member who served you? (18–24 years/25–30 years/31–35 years/ 36–40 years/41–45 years/46–50 years/51–55 years/56+ years)'; 'What was the gender of the person who served you? (male/female)'; 'In your opinion what was the race/ ethnicity of the staff member who served you? (African/ Asian/Australian/European/Indigenous Australian/Other)'.

#### Alcohol sales venue characteristics

Confederates were also asked questions about the packaged liquor outlet: 'date of purchase attempt', 'time of entry/exit to outlet', 'day of the week (Friday/Saturday/Sunday)', 'name of venue', 'address', 'licence number', 'type of offlicence retail venue (liquor store with no drive through/liquor store with drive through/liquor store attached to hotel with no drive through/liquor store attached to hotel with drive through)', 'type of venue? (chain store/independent)', and the 'trading hours of the venue'.

## Alcohol sales behaviour of venues

The dependent variable for the study was whether the confederate successfully purchased alcohol (yes/no). Confederates were also asked: 'what type of alcohol they purchased'; 'what brand of alcohol they purchased'; the 'total volume of alcohol', and the 'percentage of alcohol'; 'how much the alcohol cost'; and 'whether the item was on sale (yes/no)'.

Confederates were also asked about the store environment: 'Approximately how many customers were in the store when they attempted to purchase the alcohol?'; 'Was the store busy? (i.e. very busy/quite busy/not busy)'; 'Was there signage prohibiting the sale of alcohol to underage customers clearly visible? (yes—clearly visible/yes—not clearly visible/not visible/not sure)'; 'If signage was visible, where was it located? (checkout counter/doors/windows/ other)'.

Confederates were also asked 'whether the venue had security staff (responses: yes/no/if yes, how many?)' and identification: 'Were you asked for identification [upon entering the venue (yes/no); upon purchase (yes/no); other time...(yes/no)?'; 'What did the staff member say when they asked you for identification?'

## Community-level factors

## Density

The density of alcohol outlets for the Local Government Area (LGA) where the store was located was calculated. The number of liquor licences in each LGA was obtained from relevant State Liquor Licensing database, accessed through respective websites. Licences were organized into categories: overall, packaged, general (public bar), on-premise (restaurant or café), and club. The population of each LGA was obtained through the Australian Bureau of Statistics. Density was calculated as the number of outlets per 10 000 population. Four densities (packaged, general, on-premise, and club) were calculated and represented the number of outlets per 10 000 residents in each LGA.

Some LGAs had wineries; however, these were excluded from the density calculations, as they could only be accessed by road and car, and it was concluded that these venues were unlikely to influence adolescent purchasing behaviour. Prior research documents a range of methods to measure density (e.g. the number of outlets per population, number of outlets per road miles) (Scribner *et al.*, 2000). These measures provide an alternative and possibly more accurate way of capturing this information; however, they have their own biases (e.g. area-based density measures often underestimate density in rural areas) (Livingston, 2012). The present study measured density based on the number of alcohol outlets per LGA. Calculating density this way has meaningful application for potential government action in Australia.

## Socio-economic status

The advantage/disadvantage Socio-Economic Index for Areas (SEIFA), provided by the Australian Bureau of Statistics, and based on the respondent's zip (post) code, was used to measure socio-economic status (SES) (ABS, 2006). The variable was used as a continuous variable; values represented a decile (1–10). Thus, low values indicate areas of relative disadvantage, high numbers indicate areas of relative advantage.

## Rural/metropolitan

Whether the alcohol outlet was in a metropolitan or nonmetropolitan (rural/ regional) area was also recorded (ABS, 2015).

## Data analysis

Multilevel modelling was used to analyse the data. Following West *et al.* (2007), first a null model provided a baseline estimation of the community variance in predicting adolescent purchasing. As density has been shown to be strongly implicated in both adult and adolescent alcohol-related behaviour (Campbell et al., 2009; Popova et al., 2009; Rowland et al., 2014; Rowland et al., 2015), the four density variables were entered into the model at the start (Model 1). An overall model was then built by adding in stages the remaining variables; beginning with the most proximal variables and finishing with the most distal. The order for variable entry was (i) confederate demographic variables; (ii) sales staff and store characteristics, including RSA requirements; and (iii) community characteristics. As variables were entered into the model, random effects and interactions between- and within-levels were examined. Non-significant predictors were removed throughout the model-building process. The log likelihood, Akaike and Bayesian statistics were used to assess model fit and model improvement. Wald tests were used to test interactions. Predicted probabilities were produced for the final model to assist in interpretation of model and interactions. All analyses were performed using Stata version 13 (StataCorp, College Station, TX, USA). The 'melogit' command was used to build the multilevel model; the random intercept was allowed to vary by LGA.

## RESULTS

Table 1 presents data collected by confederates. The majority of the stores visited were in Victoria (52); 58% of the stores were located in regional areas. Close to half of the stores were independently owned. Stores were mostly visited on Friday and Saturday evenings, between 4 and 6pm or between 6 and 8pm. Most stores did not have any other customers present. Confederates observed that a majority of stores displayed the mandatory RSA signage. Overall, a total of 310 purchase attempts were made, and 187 (i.e. 60%; 95% CI: 54.8-65.8) of these attempts successfully purchased alcohol. Broken down by State, purchases were the greatest in Western Australia (85%; 95% CI: 77.62-94.20), and lowest in the Queensland (34%; 95% CI: 23.49-44.87). The purchase rate in Victoria was similar to the average across the three States (61%; 95% CI: 54.27-69.48).

The mean overall density of liquor outlets in each LGA was ~25.3 stores per 10 000 residents (SD = 21.4). When broken down by categories, average on-premise density was the highest (M = 12.1, SD = 16.3). However, for most LGAs, the density of on-premise stores ranged between 0.43 and 22. One LGA had a density of 77. The mean packaged density was ~5.7 (SD = 3.5); general density was ~3.3 (SD = 2.8); and mean club density was ~4.2 (SD = 2.4).

Results of the multilevel regression models are shown in Table 2. Model 1 (only density variables) identified

Table 1:	Distribution an	d univariate	regression	of key va	riables	predicting	confederate	purchasing	of alcoho
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State     State       VIC     160     52% $3.40(1.44-8.01)$ 0.005       QLD     79     25%     referent     0.000       Region     12.89(4.26-38.95)     0.000       Regional     130     42%     referent     0.393       Regional     130     42%     referent     0.393       Store Type     1     149     48%     referent     0.55(0.32-0.96)     0.035       Day of purchase attempt     17     38%     0.87(0.31-2.45)     0.790       Store Type     117     38%     0.87(0.31-2.45)     0.790       Sunday     67     21%     1.22(0.30-4.88)     0.779       Time of visit     12-2 pm     15     5%     1.14(0.24-5.49)     0.871       2-4 pm     28     9%     0.69(0.19-2.55)     0.616       6-8 pm     139     45%     1.67(0.47-4.99)     0.332       No. of staff in outlet     121     39%     referent     8-10:30 pm     53     1.7%     1.48(0.67-3.26)     0.332	Variable	п	%	OR (95% CI)	<i>p</i> -value
VIC     160     52%     3.40 (1.44.4.0.1)     0.005       QLD     79     25%     referent	State				
QLD     79     25%     referent       WA     71     23%     12.89 (4.26-38.95)     0.000       Region	VIC	160	52%	3.40 (1.44-8.01)	0.005
WA     71     23%     12.89 (4.26-38.95)     0.000       Region	QLD	79	25%	referent	
Region     uthan     180     58%     1.5.0 (.5.7.4.1.2)     0.0.30       Regional     130     42%     referent       Store Type	WA	71	23%	12.89 (4.26–38.95)	0.000
Ucban     180     58%     1.53 (0.57-4.12)     0.393       Regional     130     42%     referent       Independent     149     48%     referent       Chain     161     22%     0.55 (0.32-0.96)     0.035       Day of purchase attempt           Friday     126     41%     referent        Saturday     67     21%     0.22 (0.31-2.45)     0.790       Sunday     67     21%     0.22 (0.31-2.45)     0.790       Sunday     67     21%     0.22 (0.30-4.88)     0.779       Time of visit       1.41 (0.24-5.49)     0.871       2-4 pm     28     9%     0.69 (0.19-2.55)     0.576       4-6 pm     75     24%     1.21 (0.57-2.50)     0.618       6-8 pm     139     45%     referent     2       1 staff     101     33%     1.00 (0.53-1.90)     0.989       3 staff     79     26%     0.80 (0.40-1.61)     0.538	Region				
Regional     130     42%     referent       Store Type	Urban	180	58%	1.53 (0.57-4.12)	0.393
Store Type     Independent     149     48%     referent       Chain     161     52%     0.55 (0.52-0.96)     0.035       Day of purchase attempt           Friday     126     41%     referent         Saturday     171     38%     0.87 (0.31-2.45)     0.790        Sunday     67     21%     1.22 (0.30-4.88)     0.779       Time of visit       1.22 (0.30-4.88)     0.779       12-2 pm     15     5%     1.14 (0.24-5.49)     0.871       12-4 pm     28     9%     0.69 (0.19-2.55)     0.576       6-8 pm     139     45%     referent      0.332       8-10.30 pm     53     17%     1.48 (0.67-3.26)     0.332       No. of staff in oulet           2 staff     108     35%     1.00 (0.53-1.90)     0.899       3 staff     79     26%     0.80 (0.40-1.61)     0.332       No of customers in	Regional	130	42%	referent	
Independent     149     48%     referent       Chain     161     52%     0.55 (0.32-0.96)     0.035       Day of purchase attempt         0.375     0.370     0.375     0.370     0.375     0.370     0.372     0.370     0.372     0.370     0.372     0.373     0.470     <	Store Type				
Chain   161   52%   0.55 (0.32-0.96)   0.035     Day of purchase attempt       Friday   126   41%   referent     Saturday   117   38%   0.87 (0.31-2.45)   0.790     Sunday   67   21%   1.22 (0.30-4.88)   0.779     Saturday   15   5%   1.14 (0.24-5.49)   0.871     12-2 pm   15   5%   1.14 (0.24-5.49)   0.871     2-4 pm   28   9%   0.69 (0.19-2.55)   0.576     4-6 pm   75   24%   1.20 (0.57-2.55)   0.618     6-8 pn   139   4%   referent   0.332     8-10:30 pm   53   17%   1.48 (0.67-3.26)   0.332     No. of staff in outlet   121   39%   referent   0.332     Security staff fresent   122   2 staff   0.80 (0.40-1.61)   0.538     Security staff present   14   5%   1.67 (0.47-4.99)   0.430     No of customers in outlet   29   67%   referent     How busy was the store   100   0.757   0.712<	Independent	149	48%	referent	
Day of purchase attempt     Friday     126     41%     referent       Friday     167     21%     1.22 (0.30-4.88)     0.779       Sunday     67     21%     1.22 (0.30-4.88)     0.779       Time of visit       1.14 (0.24-5.49)     0.871       12-2 pm     15     5%     1.14 (0.24-5.49)     0.871       2-4 pm     28     9%     0.69 (0.19-2.55)     0.576       4-6 pm     75     24%     1.21 (0.57-2.55)     0.618       6-8 pm     139     45%     referent     3.32       No. of staff in outlet      1.48 (0.67-3.26)     0.332       No. of staff in outlet      1.43 (0.67-3.26)     0.332       Scourity staff present       0.45 (0.67-3.26)     0.389       3 + staff     19     35%     1.00 (0.53-1.90)     0.898       3 + staff     79     26%     0.80 (0.40-1.61)     0.538       Security staff present       0.47 (0.32-2.52)     0.844       More chan one customer	Chain	161	52%	0.55 (0.32-0.96)	0.035
Friday     126     41%     referent       Saturday     117     38%     0.87 (0.31-2.45)     0.790       Sunday     67     21%     1.22 (0.30-4.88)     0.779       Time of visit     12-2 pm     15     5%     1.14 (0.24-5.49)     0.871       2-4 pm     28     9%     0.69 (0.19-2.55)     0.576       4-6 pm     75     24%     1.21 (0.57-2.55)     0.618       6-8 pm     139     45%     referent     0.332       8-10:30 pm     53     17.4     10.40 (0.67-3.26)     0.332       No. of staff in outlet     121     39%     referent     0.332       2 staff     108     35%     1.00 (0.53-1.90)     0.989       3+ staff     108     35%     1.00 (0.61-61)     0.538       Security staff present	Day of purchase attempt				
Saturday     117     38%     0.87 (0.31-2.45)     0.790       Sunday     67     21%     1.22 (0.30-4.88)     0.779       Time of visit      1     1.22 (0.30-4.88)     0.871       2-4 pm     15     5%     1.14 (0.24-5.49)     0.871       2-4 pm     28     9%     0.69 (0.19-2.55)     0.576       4-6 pm     75     24%     1.21 (0.57-2.53)     0.618       6-8 pm     139     45%     referent     0.332       No. of staff in outlet      14     8.05%     1.00 (0.53-1.90)     0.898       3 + staff     79     2.6%     0.80 (0.40-1.61)     0.538       Security staff present        3.3%     1.67 (0.47-4.99)     0.430       No of customers in outlet         3.3%     1.60 (0.91-2.80)     0.102       More than one customer     209     67%     referent       3.3%     1.60 (0.91-2.80)     0.102       More than one customer     209     67%	Friday	126	41%	referent	
Sunday     67     21%     1.22 (0.30-4.88)     0.779       Time of visit	Saturday	117	38%	0.87 (0.31-2.45)	0.790
Time of visit 12 pm 15 5% 1.14 (0.24-5.49) 0.871   2-4 pm 28 9% 0.69 (0.19-2.55) 0.618   4-6 pm 75 24% 1.21 (0.57-2.55) 0.618   6-8 pm 139 45% referent   8-10.30 pm 53 17% 1.48 (0.67-3.26) 0.332   No. of staff in outlet 11 39% referent   2 staff 108 35% 1.00 (0.53-1.90) 0.989   3 * staff 79 26% 0.80 (0.40-1.61) 0.538   Security staff present 79 26% 0.80 (0.40-1.61) 0.368   Security staff present 79 26% 0.60 (0.91-2.80) 0.102   More than one customer 209 67% referent   Very busy 22 7% 0.47 (0.32-2.52) 0.834   Quire busy 66 21% 1.10 (0.57-2.13) 0.771   Nearly empty 221 71% referent   Signage 7 referent 75   Visible 248 80% 1.34 (0.68-2.65) 0.399   Not visible 61 20% referent   Male 34 11% 0.99 (0.23-6.08) <td>Sunday</td> <td>67</td> <td>21%</td> <td>1.22 (0.30-4.88)</td> <td>0.779</td>	Sunday	67	21%	1.22 (0.30-4.88)	0.779
12-2 pm     15     5%     1.14 (0.24-5.49)     0.871       2-4 pm     28     9%     0.69 (0.19-2.55)     0.576       4-6 pm     75     24%     1.21 (0.57-2.55)     0.618       6-8 pm     139     45%     referent     0.332       No. of staff in outlet     73     1.48 (0.67-3.26)     0.332       No. of staff in outlet     39%     referent     2       1 staff     121     39%     referent     2       2 staff     108     35%     1.00 (0.53-1.90)     0.989       3 + staff     79     26%     0.80 (0.40-1.61)     0.538       Security staff present     14     5%     1.67 (0.47-4.99)     0.400       No of customers in outlet     76     96%     referent     1010       More than one customer     209     67%     referent     1010     33%     1.60 (0.91-2.80)     0.102       More than one customer     209     67%     referent     104     0.49     0.41 (0.65-2.65)     0.399       Not of customers in outlet<	Time of visit				
2-4 pm     28     9%     0.69 (0.19-2.55)     0.576       4-6 pm     75     24%     1.21 (0.57-2.55)     0.618       6-8 pm     139     45%     referent     8       8-10:30 pm     53     17%     1.48 (0.67-3.26)     0.332       No. of staff in outlet     1     39%     referent     2       1 staff     121     39%     referent     2       2 staff     108     35%     1.00 (0.53-1.90)     0.989       3+ staff     79     2.6%     0.80 (0.40-1.61)     0.532       Security staff present	12–2 pm	15	5%	1.14 (0.24–5.49)	0.871
4-6 pm     75     24%     1.21 (0.57-2.55)     0.618       6-8 pm     139     45%     referent       8-10:30 pm     53     17%     1.48 (0.67-3.26)     0.332       No. of staff in outlet     1     39%     referent     0.332       2 staff     108     35%     1.00 (0.53-1.90)     0.989       3 staff     79     26%     0.80 (0.40-1.61)     0.538       Security staff present     7     26%     0.80 (0.40-1.61)     0.538       Security staff present     7     26%     0.80 (0.40-1.61)     0.538       Security staff present     7     26%     0.80 (0.47-4.99)     0.430       No of customers in outlet     7     7     0.67 (0.47-4.99)     0.430       No of customers in outlet     7     7     0.67 (0.47-4.99)     0.102       More than one customer     209     67%     referent       How busy was the store     7     1.60 (0.91-2.80)     0.102       Very busy     66     21%     1.10 (0.57-2.13)     0.771       Nearl	2–4 pm	28	9%	0.69 (0.19-2.55)	0.576
$6-8 \ pm$ 13945%referent $8-10:30 \ pm$ 5317%1.48 (0.67-3.26)0.332No. of staff in outlet1139%referent2 staff10835%1.00 (0.53-1.90)0.9893 + staff7926%0.80 (0.40-1.61)0.538Security staff present7926%0.80 (0.40-1.61)0.530Yes145%1.67 (0.47-4.99)0.430No of customers in outlet7926%0.47 (0.32-2.52)0.102More than one customer20967%referentHow busy was the store740.477 (0.32-2.52)0.834Very busy227%0.477 (0.32-2.52)0.834Quite busy6621%1.10 (0.57-2.13)0.771Nearly empty22171%referentSignage7420%referent0.499Sales staff gender7689%referentFemale27689%referentMale39062%0.90 (0.52-1.57)0.712Sales staff gender7689%referentFemale11838%referentMale19062%0.90 (0.52-1.57)0.712Percived age of staff11434%referent18-24 years10434%referent25-30 years13042%1.34 (0.70-2.56)0.378	4–6 pm	75	24%	1.21 (0.57-2.55)	0.618
8-10:30 pm     53     17%     1.48 (0.67-3.26)     0.332       No. of staff in outlet     1     1 staff     121     39%     referent       2 staff     108     35%     1.00 (0.53-1.90)     0.989       3+ staff     79     26%     0.80 (0.40-1.61)     0.538       Security staff present        0.430       Yes     14     5%     1.67 (0.47-4.99)     0.430       No of customers in outlet           Only pseudo-underage purchaser     101     33%     1.60 (0.91-2.80)     0.102       More than one customer     209     67%     referent         How busy was the store   <	6–8 pm	139	45%	referent	
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Security staff present   14   5%   1.67 (0.47-4.99)   0.430     No of customers in outlet   01   33%   1.60 (0.91-2.80)   0.102     More than one customer   209   67%   referent     How busy was the store $(0.47 (0.32-2.52))$ 0.834     Quire busy   22   7%   0.47 (0.32-2.52)   0.834     Quire busy   66   21%   1.10 (0.57-2.13)   0.711     Nearly empty   221   7%   referent   0.99     Signage   Visible   248   80%   1.34 (0.68-2.65)   0.399     Not visible   61   20%   referent   0.99 (0.23-6.08)   0.849     Signage   Visible   276   89%   referent   0.99 (0.23-6.08)   0.849     Sales staff gender   118   38%   referent   0.849   0.849   0.849   0.849   0.849     Sales staff gender   118   38%   referent   0.849   0.849   0.849   0.849   0.849   0.849   0.849   0.849   0.849   0.849   0.849   0.849   0.849   0.8	3+ staff	79	26%	0.80 (0.40-1.61)	0.538
Yes145%1.67 (0.47-4.99)0.430No of customers in outlet<	Security staff present				
No of customers in outlet $101$ $33\%$ $1.60 (0.91-2.80)$ $0.102$ More than one customer $209$ $67\%$ referentHow busy was the store $222$ $7\%$ $0.47 (0.32-2.52)$ $0.834$ Quite busy $66$ $21\%$ $1.10 (0.57-2.13)$ $0.771$ Nearly empty $221$ $71\%$ referentSignage $21\%$ $71\%$ referentVisible $248$ $80\%$ $1.34 (0.68-2.65)$ $0.399$ Not visible $61$ $20\%$ referentPseudo-underage purchaser gender $76$ $89\%$ referentFemale $276$ $89\%$ referentMale $34$ $11\%$ $0.99 (0.23-6.08)$ $0.849$ Sales staff gender $76$ $99\%$ $0.90 (0.52-1.57)$ $0.712$ Perceived age of staff $18$ $38\%$ referent $18-24$ years $104$ $34\%$ referent $25-30$ years $74$ $24\%$ $0.98 (0.48-1.99)$ $0.958$ $30-56+$ years $130$ $42\%$ $1.34 (0.70-2.56)$ $0.378$	Yes	14	5%	1.67 (0.47-4.99)	0.430
	No of customers in outlet				
More than one customer209 $67\%$ referentHow busy was the store22 $7\%$ $0.47 (0.32-2.52)$ $0.834$ Quite busy $66$ $21\%$ $1.10 (0.57-2.13)$ $0.771$ Nearly empty $221$ $71\%$ referentSignage $71\%$ referent $0.399$ Not visible $61$ $20\%$ referentPseudo-underage purchaser gender $76$ $89\%$ referentFemale $276$ $89\%$ referentMale $34$ $11\%$ $0.99 (0.23-6.08)$ $0.849$ Sales staff gender $76$ $89\%$ referentMale $190$ $62\%$ $0.90 (0.52-1.57)$ $0.712$ Perceived age of staff $114$ $34\%$ referent $18-24$ years $104$ $34\%$ referent $25-30$ years $74$ $24\%$ $0.98 (0.48-1.99)$ $0.958$ $30-56+$ years $130$ $42\%$ $1.34 (0.70-2.56)$ $0.378$	Only pseudo-underage purchaser	101	33%	1.60 (0.91-2.80)	0.102
How busy was the store22 $7\%$ $0.47 (0.32-2.52)$ $0.834$ Quite busy $66$ $21\%$ $1.10 (0.57-2.13)$ $0.771$ Nearly empty $221$ $71\%$ referentSignage $71\%$ referent $0.399$ Not visible $248$ $80\%$ $1.34 (0.68-2.65)$ $0.399$ Not visible $61$ $20\%$ referentPseudo-underage purchaser gender $76$ $89\%$ referentMale $34$ $11\%$ $0.99 (0.23-6.08)$ $0.849$ Sales staff gender $76$ $89\%$ referentMale $190$ $62\%$ $0.90 (0.52-1.57)$ $0.712$ Perceived age of staff $11\%$ $34\%$ referent $18-24$ years $104$ $34\%$ referent $25-30$ years $74$ $24\%$ $0.98 (0.48-1.99)$ $0.958$ $30-56+$ years $130$ $42\%$ $1.34 (0.70-2.56)$ $0.378$	More than one customer	209	67%	referent	
$\begin{array}{c c c c c c c c c c c c c c c c c c c $	How busy was the store				
Quite busy     66     21%     1.10 (0.57–2.13)     0.771       Nearly empty     221     71%     referent       Signage     71%     referent     71%       Visible     248     80%     1.34 (0.68–2.65)     0.399       Not visible     248     80%     1.34 (0.68–2.65)     0.399       Not visible     248     80%     referent     0.399       Pseudo-underage purchaser gender     276     89%     referent       Male     34     11%     0.99 (0.23–6.08)     0.849       Sales staff gender     76     89%     referent     0.849       Sales staff gender     118     38%     referent     0.712       Perceived age of staff     190     62%     0.90 (0.52–1.57)     0.712       Perceived age of staff     118     34%     referent     1.012       Perceived age of staff     118     34%     referent     2.5–30 years     74     24%     0.98 (0.48–1.99)     0.958       30–56+ years     130     42%     1.34 (0.70–2.56) </td <td>Very busy</td> <td>22</td> <td>7%</td> <td>0.47 (0.32-2.52)</td> <td>0.834</td>	Very busy	22	7%	0.47 (0.32-2.52)	0.834
Nearly empty     221     71%     referent       Signage     Signage     Signage     Signage       Visible     248     80%     1.34 (0.68–2.65)     0.399       Not visible     61     20%     referent     0.399       Pseudo-underage purchaser gender     76     89%     referent     0.849       Sales value     34     11%     0.99 (0.23–6.08)     0.849       Sales staff gender     76     89%     referent     0.849       Sales staff gender     76     0.99 (0.23–6.08)     0.849       Female     118     38%     referent     0.712       Perceived age of staff     190     62%     0.90 (0.52–1.57)     0.712       18–24 years     104     34%     referent     25–30 years     74     24%     0.98 (0.48–1.99)     0.958     0.378	Quite busy	66	21%	1.10 (0.57-2.13)	0.771
Signage     Visible     248     80%     1.34 (0.68–2.65)     0.399       Not visible     61     20%     referent     0.399       Pseudo-underage purchaser gender     76     89%     referent     0.399       Male     276     89%     referent     0.849       Male     34     11%     0.99 (0.23–6.08)     0.849       Sales staff gender     74     38%     referent     0.849       Female     118     38%     referent     0.712       Perceived age of staff     190     62%     0.90 (0.52–1.57)     0.712       Perceived age of staff     18     34%     referent     0.712       18–24 years     104     34%     referent     1.75     0.958       30–56+ years     130     42%     1.34 (0.70–2.56)     0.378	Nearly empty	221	71%	referent	
Visible     248     80%     1.34 (0.68–2.65)     0.399       Not visible     61     20%     referent       Pseudo-underage purchaser gender     76     89%     referent       Male     276     89%     referent       Male     34     11%     0.99 (0.23–6.08)     0.849       Sales staff gender     74     38%     referent     0.849       Female     118     38%     referent     0.712       Perceived age of staff     190     62%     0.90 (0.52–1.57)     0.712       Perceived age of staff     18     34%     referent     0.712       18–24 years     104     34%     referent     0.958       30–56+ years     130     42%     1.34 (0.70–2.56)     0.378	Signage				
Not visible     61     20%     referent       Pseudo-underage purchaser gender     276     89%     referent       Female     276     89%     referent       Male     34     11%     0.99 (0.23-6.08)     0.849       Sales staff gender     1     38%     referent       Female     118     38%     referent       Male     190     62%     0.90 (0.52-1.57)     0.712       Perceived age of staff     1	Visible	248	80%	1.34 (0.68–2.65)	0.399
Pseudo-underage purchaser gender       Female     276     89%     referent       Male     34     11%     0.99 (0.23-6.08)     0.849       Sales staff gender     11%     38%     referent       Female     118     38%     referent       Male     190     62%     0.90 (0.52–1.57)     0.712       Perceived age of staff        18–24 years     104     34%     referent       25–30 years     74     24%     0.98 (0.48–1.99)     0.958       30–56+ years     130     42%     1.34 (0.70–2.56)     0.378	Not visible	61	20%	referent	
Female     276     89%     referent       Male     34     11%     0.99 (0.23-6.08)     0.849       Sales staff gender        0.849       Female     118     38%     referent        Male     190     62%     0.90 (0.52–1.57)     0.712       Perceived age of staff           0.712       18–24 years     104     34%     referent        0.958      0.958       0.958      0.958      0.958       0.958       0.378       0.378       0.378	Pseudo-underage purchaser gender				
Male     34     11%     0.99 (0.23-6.08)     0.849       Sales staff gender	Female	276	89%	referent	
Sales staff gender       Female     118     38%     referent       Male     190     62%     0.90 (0.52–1.57)     0.712       Perceived age of staff     18–24 years     104     34%     referent       25–30 years     74     24%     0.98 (0.48–1.99)     0.958       30–56+ years     130     42%     1.34 (0.70–2.56)     0.378	Male	34	11%	0.99 (0.23-6.08)	0.849
Female11838%referentMale19062%0.90 (0.52–1.57)0.712Perceived age of staff18–24 years10434%referent25–30 years7424%0.98 (0.48–1.99)0.95830–56+ years13042%1.34 (0.70–2.56)0.378	Sales staff gender				
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Perceived age of staff     18–24 years     104     34%     referent       25–30 years     74     24%     0.98 (0.48–1.99)     0.958       30–56+ years     130     42%     1.34 (0.70–2.56)     0.378	Male	190	62%	0.90 (0.52-1.57)	0.712
18-24 years10434%referent25-30 years7424%0.98 (0.48-1.99)0.95830-56+ years13042%1.34 (0.70-2.56)0.378	Perceived age of staff				
25-30 years7424%0.98 (0.48-1.99)0.95830-56+ years13042%1.34 (0.70-2.56)0.378	18–24 years	104	34%	referent	
30-56+ years 130 42% 1.34 (0.70-2.56) 0.378	25–30 years	74	24%	0.98 (0.48-1.99)	0.958
	30–56+ years	130	42%	1.34 (0.70–2.56)	0.378

Continued

## Table 1: Continued

Variable	n	%	OR (95% CI)	<i>p</i> -value
Density	М	SD	Min	Max
Overall density	25.29	21.35	5.93	104.56
General density	3.27	2.77	0.61	10.73
On-premise density	12.06	16.33	0.43	77.01
Packaged density	5.73	3.51	1.03	14.44
Club density	4.22	2.37	1.41	9.95
Socio-economic index (decile)				
Advantage/disadvantage	7.47	2.11	3	10

Table 2: Multilevel regression models predicting confederate purchasing of alcohol

	Null	Model 1 OR (95% CI)	Model 2 OR (95% CI)	Model 3 OR (95% CI) (Final)
General		0.91 (0.71, 1.17)	0.90 (0.70, 1.16 )	0.85 (0.61, 1.19)
Club		0.93 (0.74, 1.16)	0.93 (0.73, 1.17)	0.78 (0.58, 1.04)
On-premise		0.95 (0.92, 0.99)**	0.95 (0.91, 0.98)**	0.95 (0.91, 1.0)*
Package		1.47 (1.12, 1.94) **	1.49 (1.12, 1.97)**	1.10 (0.75, 1.62)
Staff female			0.20 (0.06, 0.74)*	n/a
Staff age				
18-24			0.57 (0.23, 1.39)	n/a
25-30			referent	
31-56			0.78 (0.33, 1.82)	n/a
Staff age#staff femal	e			
Female#18-24			6.14 (1.25, 30.18)*	n/a
Female#25-30			referent	
Female#31–56			5.94 (1.29, 27.4)*	n/a
State				
VIC				0.33 (0.7, 1.54)*
QLD				0.4 (0.04, 4.04)
WA				referent
Chain				6.11 (0.7, 53.76)*
Urban				0.39 (0.15, 0.97)*
State#general				
VIC#general				1.65 (1.04, 2.61)*
QLD#general				0.71 (0.41, 1.25)
WA#general				referent
State#chain				
VIC#chain				0.07 (0.01)*
QLD#chain				0.06 (0.01, 0.75)*
WA#chain				referent
Constant	1.72 (0.56, 2.96)*	0.66 (0.28, 1.56)		21.39 (2.23, 205.46)**
$\sigma^2$ (cons)	1.28	0.64	0.66	0.16
n (individual)	310	310	308	310
n (stores)	28	28	28	28
LL	-190.07	-184.02	-178.94	-170.19
AIC	384.15	380.05	379.89	368.39
BIC	391.62	402.47	420.91	420.70

LL, Log-likelihood; AIC, Akaike information criterion; BIC, Bayesian information criterion.

 $^{*}p<0.05;\ ^{**}p<0.01;\ ^{***}p<0.001.$ 



Fig. 1: Predicted probabilities for confederate purchase of alcohol by vendor type and state and predicted probabilities for confederate purchase of alcohol by general density, for each state. VIC, Victoria; QLD, Queensland; WA, Western Australia.

that on-premise density was associated with reduced odds (OR = 0.95) and package density increased odds (OR = 1.47) of confederates being sold alcohol without being asked for identification. When the individual confederate variables were entered (Model 2), a significant interaction between the perceived age of the sales person and the gender of the confederate was observed; this interaction was no longer significant in latter models. None of the store level variables were significant predictors of a confederate being sold alcohol.

In the final model, an interaction between store type (chain) and State was identified. Predicted probabilities (fixed effects only) for this interaction are plotted in Figure 1. For both Queensland and Western Australia, the probability of being sold alcohol was greater with chain stores compared with independent stores (Queensland chain Prob = 0.65, p = 0.002; independent Prob = 0.34, p = 0.004; and Western Australia chain Prob = 0.90, p =0.000; independent Prob=0.69, p=0.000). In Victoria, the probability was higher in independent stores, compared with chain stores (chain Prob = 0.57, p = 0.000; independent Prob=0.75, p=0.000). Wald tests indicated that the interaction coefficient for Western Australia was different from that for Victoria ( $\chi^2(1) = 4.93$ , p =0.026) and Queensland ( $\chi^2(1) = 4.81$ , p = 0.028). The interaction did not differ significantly between Victoria and Queensland ( $\chi^2(1) = 0.05$ , p = 0.821).

General density and on-premise density were the only density variables associated with the probability of being sold alcohol. However, this association with general density was also found to be moderated by State. Predicted probabilities (fixed effects only) by State, per unit increase of general density, are plotted in Figure 1. Wald tests indicated that the coefficient for this interaction differed between Victoria and Queensland ( $\chi^2(1) =$  7.37, p = 0.007), and between Victoria and Western Australia ( $\chi^2(1) = 4.57$ , p = 0.032). The interaction was not significantly different between Queensland and Western Australia ( $\chi^2(1) = 1.4$ , p = 0.237).

For Queensland, predicted probabilities were nonsignificant above the density of three outlets per 10 000 members of the population. However, for Victoria, the probability of being sold alcohol increased as general density increased (e.g. density = 1, Prob = 0.55, p = 0.0000; density = 10, Prob = 0.94, p = 0.0000). For Western Australia, the probability of being sold alcohol decreased, as general density increased (e.g. density = 1, Prob = 0.85, p = 0.0000; density = 10, Prob = 0.64, p = 0.0001). As onpremise density increased, the likelihood that a confederate would be sold alcohol decreased (OR = 0.95, p < 0.05). The risk of being sold alcohol was lower in urban areas compared with rural (OR = 0.39, p = 0.004).

## DISCUSSION

This is the first Australian study ever undertaken that examines confederates purchasing alcohol. It was identified that 60% of confederates were able to purchase alcohol, with different rates in the States of Victoria, Queensland and Western Australia. The hypothesis that the proportion of confederates sold alcohol would vary by State was partially supported. The odds of a confederate being sold alcohol differed by State; however, this was moderated by the type of store (i.e. chain or independent). The hypothesis that the density of alcohol outlets would increase the likelihood of a confederate being sold alcohol was also partially supported. As the number of general alcohol outlets (public bars) increased, the likelihood that a confederate would be able to purchase alcohol increased; however, this was also moderated by the State in which it was purchased. The findings suggest that a mix of local and possibly State policy factors are associated with young people illegally purchasing alcohol.

The association of the density of alcohol outlets and adolescent purchasing is consistent with previous research (Rowland *et al.*, 2014). It has been proposed that as the number of outlets selling alcohol increases vendors experience competition and thus greater pressure to be lenient with liquor licensing standards, as one way of ensuring that sales and income do not decrease. It is possible that general outlets [public houses ('pubs') and bars] place the most pressure on packaged liquor stores because they are settings where other forms of competitive pricing occur, through happy hours, drink promotions and extended trading hours. Promotions in general outlets may also be interpreted as liberal community norms, and thus promote lax sales practices.

Greater density of general outlets and likelihood of a confederate being sold alcohol was only significant for purchases made in Victoria and Western Australia. A possible reason could be that the State of Queensland has had secondary supply legislation since 1992; Victoria has had the legislation in place since 2011, whereas at the time of the survey Western Australia did not have secondary supply legislation. Perhaps secondary supply laws create a context where there is a stronger norm of not supplying alcohol to adolescents. This does not, however, explain why increases in density were associated with lower odds for purchases made in Western Australia, and why increases in density were associated with greater odds of purchasing in Victoria.

Difference in confederates purchasing from independent and chain stores in Australia has not been previously reported in the literature. The finding whereby chain stores were generally less likely than independent stores to sell alcohol to the confederates (Table 1) could be associated with store enforcement policies. Stores that are part of a larger chain, perhaps, are more likely to have resources to consistently enforce a policy around the sales of alcohol. They also have greater reputational risk with sales to underage customers, because chains like Woolworths and Coles have many different elements to their businesses and negative publicity can have widespread consequences.

The state differences in store types (i.e. chain or independent) could be linked to the extent that in some states like Victoria, there has been a rapid increase in the rate of liquor licences. For example, in Victoria, there has been a 120% increase in licenced premises from 1996 to 2010 (Trifonoff *et al.*, 2011a). Further, there has been substantial change in the characteristics of Victoria's liquor licencing in the past decade, including the introduction of risk-based licensing legislation, which penalizes operators for breaches of the Liquor Act in subsequent annual fees as well as the incident penalty. Queensland liquor licenses are also tied to the provision of electronic gaming machines (EGM) (or pokies/slot machines). This massive source of revenue is contingent on having a liquor licence, and, therefore, may serve as a substantial incentive for operators like Woolworths (Australia's largest retailer of liquor, EGM and tobacco) to comply to the regulations more closely. Overall, these dynamics may suggest that having regulation linked to very substantial financial and reputational risks improves compliance to underage service laws.

While the findings provide information about alcohol supply, they need to be interpreted with consideration to several issues. First, the data are cross-sectional so do not permit claims about causation. Second, the survey audit relies on retrospective recall of information by the pseudo-underage purchaser. Since no direct audit was undertaken by a second observer, it was not possible to verify the observations reported, and there is a possibility that errors were made during observation and/or these observations were recorded incorrectly.

Third, it is possible that supply behaviour is influenced by other non-measured variables. Fourth, the results come from surveys conducted in 28 communities in three Australian states, and these may not be representative of other Australian communities or communities in other contexts. There were differences in sales between rural and urban stores, with sales staff in urban stores 61% less likely to sell alcohol compared with staff working in rural stores. Rural and urban differences should be examined further in future research.

A strength of the study is the inclusion of individuallevel purchaser and supplier characteristics as well as venue-level and contextual-level variables into the modelbuilding process. While many of individual and supplier characteristics were not significant, the inclusion of these variables and the adjustment of these effects enabled a more precise estimate of other community-level effects on underage alcohol supply.

In the UK, 'test purchasing' is a procedure in which trained underage volunteers attempt to buy alcohol from retailers, to enable authorities to identify and prosecute those who break the law. It can be random or targeted towards high-risk premises and a successful sale can result in sanctions or license suspensions (Hughes *et al.*, 2010). An initial evaluation by the Home Office found that across 3 months, test purchase failure rate was reduced from 25 to 15% (Hughes *et al.*, 2010). Similar practices such as 'reward and reminder' programmes have also been found to be effective in the USA (Moore *et al.*, 2012; Flewelling *et al.*, 2013). While this approach may be considered primarily a State government responsibility, local communities can also engage in test purchasing.

This method should be trialled in Australia as a method of reducing the supply of alcohol to underage adolescents.

The findings of the present study identify that there is a complex mix of local and possibly State policy factors associated with confederates purchasing alcohol. This study has not identified the mechanisms but has highlighted variation between States. Future research should investigate what these local mechanisms are. Overall the findings suggest that a mix of local (e.g. density, chain store, urban location) and possibly State policy factors are associated with young people illegally purchasing alcohol. Implementing consistent and effective policies and using monitoring across the States of Australia, and reducing the density of alcohol outlets, show promise as being potentially modifiable factors that may prevent underage sales and subsequent consumption by Australian adolescents.

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