



# Liquor landscapes: Does access to alcohol outlets influence alcohol consumption in young adults?



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## ABSTRACT

Few longitudinal studies have examined the impact of liquor licences on alcohol consumption, and none in young adults, the life stage when alcohol intake is at its highest. We examined associations between liquor licences (i.e., general licences, on-premise licences, liquor stores, and club licences) and alcohol consumption at 20-years (n=988) and 22-years (n=893), and whether changes in the licences between time-points influenced alcohol consumption (n=665). Only general licences were associated with alcohol consumption at 20-years (p=0.037), but by 22-years, all licence types were positively associated with alcohol consumption (p < 0.05). Longitudinal analyses showed that for each increase in liquor stores over time, alcohol consumption increased by 1.22 g/day or 8% (p=0.030), and for each additional club licence, consumption increased by 0.90 g/day or 6% (p=0.007). Limiting liquor licences could contribute to a reduction in young adults' alcohol intake.

## 1. Introduction

Alcohol use is endemic in many countries, with widespread health, community and economic consequences (Australian Institute of Health and Welfare, 2014; NHMRC, 2009; Collins and Lapsley, 2008; World Health Organization, 2014). Global alcohol consumption in 2010 was estimated at 6.3 l of pure alcohol per person per annum, and in 2012 some 3.3 million deaths were attributed to alcohol use (World Health Organization, 2014). The highest levels of alcohol consumption occur in developed countries (World Health Organization, 2014). For example, in Australia, total alcohol consumption per capita for drinkers is estimated at 19.7 l of pure alcohol for males and 9.0 l for females (World Health Organization, 2014), and 20% of Australians drink at levels that place them at risk of harm over their lifetime (Australian Institute of Health and Welfare, 2014). Alcohol use is particularly pervasive among adolescents and young people, with an Australian national survey reporting that 24% of people aged 15–24 engaged in drinking sessions that risked alcohol-related injury at least once a week (Australian Institute of Health and Welfare, 2014). Indeed, adolescents and young adults in Australia are more likely than other age groups to

drink at risky levels (Australian Institute of Health and Welfare, 2014).

One of the factors implicated in the pervasive consumption of alcohol is its widespread availability. A growing body of evidence indicates that alcohol outlet density is associated with community-level alcohol consumption and harms, including violent crime, domestic violence, traffic injury and child maltreatment (Bryden et al., 2012; Popova et al., 2009; Gmel et al., 2015; Campbell et al., 2009; Livingston, 2011a, 2011b). Studies also show that alcohol outlet density has implications for individual-level alcohol consumption (Livingston et al., 2008; Kavanagh et al., 2011; Pereira et al., 2013; Connor et al., 2011; Kypri et al., 2008). For example, a study of West Australian adults found that for each additional liquor store present in the neighbourhood (i.e., within 1.6 km of home), the mean number of standard drinks of alcohol consumed/drinking day increased by 1% and the mean number of days of harmful alcohol consumption increased by 6% (Pereira et al., 2013). Other studies suggest that the type of outlet matters, and that licences where people can purchase packaged alcohol (typically referred to as off-licence or off-premise outlets) are particularly problematic. For instance, a New Zealand study identified an association between off-premise outlet density

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within 1 km of home and binge drinking, but found no association for overall outlet density (Connor et al., 2011). Similarly, another New Zealand study of university students found that the effect sizes for the associations between liquor licences and increased alcohol consumption and alcohol-related problems were consistently larger for off-premise outlets than on-premise venues (Kypri et al., 2008).

Despite considerable cross-sectional evidence, few longitudinal studies have tested whether there is a relationship between alcohol outlet density and adults' individual-level alcohol consumption (Bryden et al., 2012; Gmel et al., 2015). Three studies have examined associations between the density of, or proximity to, *on-premise* venues (e.g., bars, nightclubs, taverns) (Picone et al., 2010; Brenner et al., 2015; Halonen et al., 2013), but just one identified a significant relationship. For a sample of Finnish adults (mean age=44.2 years), decreasing the distance to the nearest on-premise venue was associated with increases in heavy alcohol use (Halonen et al., 2013). In contrast, two studies have examined the relationship between *off-premise* licences (e.g., liquor stores) and alcohol consumption, and both identified significant effects (Brenner et al., 2015; Cooper et al., 2013). Brenner et al. (2016) found that increasing off-premise licence density within 1 mile from home was associated with increased alcohol consumption among older adults (mean baseline age=61.9 years), and Cooper et al. (2013) found that a reduction in outlet density/square mile equated to reduced odds of binge drinking among public housing tenants who relocated (mean baseline age=43.1 years). On balance, these longitudinal studies suggest that off-premise outlets, rather than on-premise licenced venues, may have a greater impact on alcohol consumption, however few longitudinal studies have tested the role of different licence types. Moreover, these longitudinal studies focus on mid-age and older populations, and there is a paucity of studies relating to younger adults.

Strategies to curb the widespread community availability of alcohol are advocated to help minimise alcohol consumption and harms (Kypri et al., 2008; Brenner et al., 2015; Rowland et al., 2016; Badland et al., 2015). Indeed, a decade ago, Stockwell and Gruenewald (2004) concluded that on balance, studies 'strongly suggest that limits on outlet density may be an effective means of controlling alcohol problems and need to be taken more seriously as an effective policy tool for the reduction of alcohol-related harm' (p.225) (Stockwell and Gruenewald, 2004). Yet others are hesitant to advocate for policy interventions to reduce outlets without a stronger, more consistent body of evidence, including evidence on different licence types (Gmel et al., 2015). Thus, this study seeks to provide a finer grain understanding of the influence of different liquor licences on alcohol consumption at a life-stage when alcohol use is at its highest (Australian Institute of Health and Welfare, 2014). We tested the cross-sectional and longitudinal associations between four liquor licence categories in the home neighbourhood (i.e., general licences, liquor stores, on-premise venues and club licences) and alcohol consumption in young adults in Perth, Western Australia.

Our overall hypothesis was that there would be a stronger relationship between off-premise licences and alcohol consumption than on-premise licences. Packaged licences sell larger volumes of alcohol for consumption in uncontrolled environments, whereas on-premise drinking is, to some extent, regulated by venue management or social norms about acceptable levels of alcohol consumption (Piontek et al., 2013; Stockwell et al., 1993; Sandiford and Divers, 2014). We also examined whether associations differed by gender (all analyses), as females are more likely to abstain from alcohol use, typically consume less alcohol than males, and are less likely to drink at harmful levels (Babor et al., 2010). Furthermore, we tested for differences by whether participants moved house (longitudinal analyses only), as respondents who prefer to consume alcohol may self-select into neighbourhoods that support this behaviour (i.e., with more liquor licences). Non-significant differences between stayers and movers would provide stronger support for the hypothesis that changes in neighbourhood liquor licences impact on alcohol consumption.

## 2. Methods

Participants were drawn from the Western Australian Pregnancy Cohort (Raine) Study, a prospective cohort study that has followed participants from gestation to early adulthood. The Raine Study is described in detail elsewhere (Newnham et al., 1993). Briefly, 2900 pregnant women at 16–20 weeks gestation were recruited between 1989 and 1991 through the public antenatal clinic and local private clinics in Perth, Western Australia. Of these, 2804 women (97%) delivered live birth babies. Due to multiple births, the initial cohort included 2868 infants. These children and their families have since been followed at regular intervals. Informed consent was obtained from mothers from enrolment until child participants were aged 18-years. Assent was obtained from the participants at age 14 and 17-years, and informed consent obtained at 20 and 22-years. The Raine study protocol was approved by the ethics committees of King Edward Memorial Hospital for Women and Princess Margaret Hospital for Children, Perth, Western Australia. Ethical approval for the 20 and 22-year follow-ups was obtained from the University of Western Australia Human Research Ethics Committee (RA/4/1/2646 & RA/4/1/5202). This study focuses on participants who provided alcohol consumption data and lived in the Perth metropolitan area between 2009–2011 (20-year follow-up) and 2012–2014 (22-year follow-up).

**Outcome - Alcohol consumption:** The self-administered Anti-Cancer Council of Victoria Food Frequency Questionnaire (ACCVFFQ) was used to collect alcohol consumption data at 20 and 22-years (note: the legal drinking age in Australia is 18). The ACCVFFQ has been previously used in large epidemiological studies and compares well with other validated measures (Hodge et al., 2000). Participants were asked how often they drank low strength beer, full strength beer, red wine, white wine (including sparkling), fortified wines, and spirits/liqueurs over the last 12 months. Response options were: never; less than once a month; 1–3 days per month; 1 day per week; 2 days per week; 3 days per week; 4 days per week; 5 days per week; 6 days per week and every day. Participants were also asked the amount that they usually consumed on days that they drank (total number of glasses) and the maximum number of glasses that they drank in a 24 h period. All these items were converted into a total alcohol consumption variable (grams of ethanol/day). For reference, one standard drink contains 10 g of ethanol (NHMRC, 2009). Maximum glasses drank in a 24 h period was also examined separately as a measure of risky/binge drinking.

**Independent variables - Liquor licences:** Participants' home addresses at each time-point were geo-coded in Geographic Information Systems (GIS) (ArcGIS v10.2.2, ESRI). Licence locations that temporally matched the 20 and 22-year follow-ups were sourced from the Western Australian Department of Racing, Gaming and Liquor (DRGL) (i.e., 20-year sample matched with 2011 data; 22-year sample matched with 2014 data). All liquor licence locations were mapped in GIS and counts within a 1600 m road network distance of each participant's address computed. This equates to the maximum distance participants' could briskly walk in about 15 min (Foster et al., 2014). Four licence types were examined: (1) general licences (i.e., on-premise consumption and take away sales, such as unrestricted hotels and taverns); (2) liquor stores (i.e., packaged liquor sales only); (3) on-premise venues (i.e., consumption at the venue only, such as restricted hotels and taverns, nightclubs, restaurants and small bars); and (4) club licences (i.e., sporting and social clubs that allow members and guests to consume alcohol at the club, and restricted club licences that allow the sale of packaged liquor to members).

**Adjustment variables:** Socio-demographic variables included sex, highest education level at 20 and 22-years (secondary or less; TAFE/college; university), family income at 17-years (less than \$25,000; \$25,000–\$50,000; \$50,000–\$78,000; \$78,000 or more; not reported - income was only available at 17-years), area disadvantage at 20 and 22-years based on the Australian Bureau of Statistics (ABS) Index of

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