Associations between proximity and density of local alcohol outlets and alcohol use among Scottish adolescents

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ABSTRACT

Associations between different alcohol outcomes and outlet density measures vary between studies and may not be generalisable to adolescents. In a cross-sectional study of 979 15-year old Glaswegians, we investigated the association between alcohol outlet availability (outlet density and proximity), outlet type (on-premise vs. off-premise) and frequent (weekly) alcohol consumption. We adjusted for social background (gender, social class, family structure). Proximity and density of on-premise outlets were not associated with weekly drinking. However, adolescents living close (within 200 m) to an off-sales outlet were more likely to drink frequently (OR 1.97, $p=0.004$), as were adolescents living in areas with many nearby off-premises outlets (OR 1.60, $p=0.016$). Our findings suggest that certain alcohol behaviours (e.g. binge drinking) may be linked to the characteristics of alcohol outlets in the vicinity.

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1. Introduction

Over the past two decades both alcohol consumption (WHO Regional Office for Europe, 2010) and alcohol-related problems (liver cirrhosis, binge-drinking, alcohol-related violence and alcohol-related deaths) among adults have increased (MacNaughton and Evelyn, 2011; Room et al., 2005; Room et al., 2011) along with growing concern about parallel rises in problematic drinking among adolescents. There is increasing public health concern about how excessive and problem drinking among adolescents may be exacerbated by exposure to environments which facilitate access to alcohol (Bryden et al., 2011). The European region is designated the 'Heaviest drinking region in the world' (WHO Regional Office for Europe, 2010) and when ranked by overall alcohol-risk score and frequency of binge drinking the UK is among the most problematic drinking nations within Western Europe (Anderson and Baumberg, 2006). Based on 2007 commercial sales, Scotland ranks as the eighth heaviest alcohol consumer in the world with the majority of sales purchased at off-premises (off-sales) outlets (McNeill, 2009). Similarly, within the European context British adolescents are among the most excessive alcohol users and problematic drinkers (Hibell et al., 2009). A recent Scottish government review of the links between off-sales outlets, excessive underage drinking and alcohol-related trouble acknowledges such relation ships are likely to be complex and non-direct, but concludes that researchers outside North America may have 'missed'

the importance of alcohol outlets as a major influence on alcohol consumption (Pattoni et al., 2007).

Adolescents are an important age group to focus upon as drinking patterns are being established (potentially with long-term effects) and both adolescents and young adults are considered disproportionately heavy targets of alcohol advertising (Pattoni et al., 2007). One plausible explanation for this growth in consumption, especially among adolescents, is the increased opportunity to access alcohol locally.

A key factor that may facilitate alcohol consumption is availability or 'ease of access', with research focusing on the impact of outlet density (the number of alcohol outlets within a particular area) or type of outlet (on- or off-premise drinking; Hay et al., 2009). Reviewing the evidence The (American) Task Force on Community Preventive Services (2009) concluded '*There was sufficient evidence to recommend controlling the density and nature of alcohol outlets by regulatory authority (e.g., licensing and zoning) as a means of reducing or controlling excessive alcohol consumption and related harms*'. They also note that (on balance) alcohol outlet density tends to be higher in socially deprived neighbourhoods. In contrast a Californian study by Pollack et al. (2005), while confirming that deprived areas had the greatest number of local alcohol outlets, found that those living in the least deprived areas had the *highest* levels of alcohol consumption. One recurring difficulty is that much of the research comes from North America and may not be generalisable to other contexts, although a contemporary study using aggregate local council-level data in England also links outlet density with alcohol-related problems (Coghill, 2011).

A recent systematic review of the influence of alcohol availability on alcohol use identified only five studies with outcomes for adolescents (Bryden et al., 2011). All five studies reported some

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association with alcohol use and outlet density, but the nature of the relationship varied considerably by individual study. Three studies looked at the relationship between off-premise outlet density and alcohol use, two found associations with both drinking and heavy drinking (Chen et al., 2010; Rootman and Oakey, 1973) and one found no association (Kuntsche et al., 2008). Two additional studies found alcohol use linked to overall outlet density; in one study (of on- and off-premises outlet density) this was only significant for heavy drinking (Truong and Sturm, 2009), in the other only with total quantity consumed (Huckle et al., 2008). Finally, one previously mentioned study found an association between density of on-premises outlets and drinking, but not heavy drinking (Kuntsche et al., 2008). Both studies conducted outside North America (New-Zealand (Huckle et al., 2008) Switzerland (Kuntsche et al., 2008)) report conflicting results.

The conflicting literature may be explained by differences in how 'availability of alcohol' is measured. Most studies count the number of outlets in a particular administrative district, some measure the number of outlets within a certain radius of participant's home address or regular travel route, a few measure the proximity of residence to nearest outlet—as the crow flies or via accessible road networks. Studies that actually measure adolescence exposure to passing outlets by tracking their daily route using global positioning satellite technology remain a minority (Basta et al., 2010). Importantly, research has concentrated on adults, yet given the qualitative difference in adult and adolescent drinking behaviour may not be entirely relevant. For example, in Scotland and in many other nations it is illegal for those under the age of 18 to purchase alcohol, thus adolescents typically use a different range of practices and outlets to access alcohol than adult drinkers (MacNaughton and Evelyn, 2011).

Throughout adolescence and adulthood, males tend to drink more than females and there is evidence that for both biological and social reasons each gender may behave differently when intoxicated (Young et al., 2008). Accordingly, it is important to investigate the interaction between gender and alcohol availability. Family structure and young people's patterns of alcohol use are interrelated (Foxcroft and Lowe, 1991); while at the same time household composition (proportion of one-parent households) is a component of some indexes of neighbourhood deprivation and fragmentation. A neighbourhood is sometimes characterised by the social class composition of its population and there is evidence that social class is associated with differing patterns of alcohol use (Norstrom and Romelsjo, 1998). Consequently, it is important to include both family structure and social class as potential confounders.

In general, the alcohol outlet literature developed as an atheoretical response to a public health concern, rather than developing from any particular theoretical perspective. However, Campbell et al. (2009) outline an analytical model which draws together the key factors and sketches the major pathways linking modifiable alcohol outlet density factors to health outcomes (Fig. 1). We used this model to guide our study.

2. Aim

This paper aims to measure the association between alcohol consumption among adolescents (aged 15) and the availability of alcohol outlets, measured by both proximity, density, and type of outlet, while adjusting for social background (social class and family structure) and investigating gender interactions.

3. Methods

3.1. Sample

Data came from a subsample of 979 adolescents, drawn from a larger broadly representative school-based study of 3194 15-year olds from 22 schools conducted in 2006; full details of the design sample and ethical approval are provided elsewhere (Sweeting et al., 2008). The subsample comprised all pupils in the study who resided within the geographical boundary of Glasgow City Council. Only pupils resident within Glasgow were included in this study as reliable data on licensed premises was only available for outlets within Glasgow City. Pupils came from a wide range of social backgrounds and neighbourhoods within Glasgow. We excluded seven cases where less than five pupils attended a single school, pupils attending private/independent schools (66 pupils) and those with missing data (42 pupils), reducing the final sample to 868 cases from 11 schools.

3.2. Measures

3.2.1. Data zones

Look-up tables were used to link each adolescents unit post-code address to Scottish data zones, the key small-area statistical geography in Scotland (Scottish Executive, 2004). Data zones are groups of 2001 Census output areas and the majority have populations between 500 and 1000 residents. They nest within local government boundaries, and where possible, they respect physical boundaries and natural communities, have a regular shape and contain households with similar social characteristics. There are 694 data zones in the Glasgow City Council boundary, with a mean population of 832 (range 248–2243) (Scottish Executive, 2004).

3.2.2. Mapping alcohol outlets

A list of alcohol outlets in Glasgow City with street addresses was obtained from Glasgow City Council in 2006. The list included seven categories of outlet: public houses, off-sales (including super-markets), private members' clubs (e.g. social clubs, sports clubs, student unions, etc.), entertainment (e.g. bingo halls, casinos, concert halls, nightclubs, etc.), restaurants, refreshment (cafe style premises where alcohol may be served with food) and hotels. If an outlet had two types of license, e.g. public house and off-sales, they were included once in the analysis with all outlets together, but included both in the public house analysis and off-sales analysis. We chose to combine clubs, entertainment, restaurants, refreshments and hotels because of small numbers, details reported elsewhere (Ellaway et al., 2010).

3.2.3. Alcohol outlet, type, density and proximity

We distinguished between four types of outlet (1) public houses (2) off-sales (3) 'other' alcohol outlets (clubs, entertainment, restaurants, refreshments and hotels combined) and (4) all outlets combined. Measures were calculated separately for each type of outlet. We calculated the total count of outlets in each data zone, coded as 0, 1, 2, or 3+ for each category of outlet.

Network analysis (i.e. finding the shortest path between two locations on a road network) was carried out for each outlet using Arc GIS version 9.1. Streetmaps (including point addresses) were obtained from UK Ordnance Survey (Ordnance Survey, 2006). Every outlet and participant address was geocoded by unit postcode. Network analysis was undertaken to calculate the distance (in metres) between each participant's postcode and their nearest outlet. This was coded: 0–200, 200.01–400, 400.01–600, 600.01–800, or 800.01+ metres from nearest outlet. Additionally for each type of outlet, we calculated the number within 1200 m distance of participants postcode, this represents an approximately 15 min walk. This was recoded into four approximately equal categories containing 0–10, 11–20, 21–30 or 31+ local off-sales outlets and 0–3, 4–9, 10–19 or 20+ local public houses (pubs).