

HARM REDUCTION DIGEST 38

Changing the density of alcohol outlets to reduce alcohol-related problems

MICHAEL LIVINGSTON¹, TANYA CHIKRITZHS², & ROBIN ROOM^{1,3}

¹AER Centre for Alcohol Policy Research, Turning Point Alcohol and Drug Centre, Melbourne, Australia, ²National Drug Research Institute, Curtin University of Technology, Australia, and ³School of Population Health, University of Melbourne, Australia

Increasingly, it seems, legal and political debates regarding the granting of new liquor licences are turning to the issue of whether the number and density of alcohol outlets makes a difference in rates of alcohol consumption and alcohol-related harm. But what is the state of the evidence on this question? In this Harm Reduction Digest Livingston, Chikritzhs and Room review the research literature on the effects of density of alcohol sales outlets on alcohol consumption and alcohol-related problems; suggest a new way of conceptualising the relationships; and discuss the implications for reducing alcohol-related harm.

KYP KYPRI

Guest Editor, Harm Reduction Digest

Introduction

Across many countries and cultures, restricting the number of places where alcohol may be sold has long been used as a strategy to reduce alcohol-related harms. The rationales behind restricting the numbers of alcohol sales outlets have been many. The aim may be to increase the trouble the average drinker has to take to be supplied, as a way of discouraging consumption. The aim may be to limit competition in retail alcohol sales, thus removing incentives for hard-pressed sellers to cut corners, for instance by selling to under-age customers; or the aim may be to leave space between sales establishments, to avoid the trouble that may accompany the bunching of outlets (particularly on-premise outlets).

Restricting the number of liquor outlets creates a loose form of oligopoly, where those with a permit to sell are given an advantage by the state, and other potential sellers are excluded from the market. In times and places with a dominant market liberalism, the

legitimacy of restricting outlet density may be met with scepticism. For instance, the Australian National Competition Policy has brought considerable pressure to bear upon state and territory governments (responsible for the content and administration of Liquor Acts) to replace needs-based tests for new licenses with public-interest tests [1,2]. Similarly, the Guidance issued for the 2003 Licensing Act in England states that ‘need’ is not a proper consideration for licensing authorities in deciding on an application for a new alcohol sales licence: “‘need’ concerns the commercial demand for another pub or restaurant or hotel. This is not a matter for a licensing authority’, but for the market [3].

In this context, the issue of the extent to which the number and density of alcohol outlets makes a difference in rates of alcohol consumption and alcohol-related harm has become a live political issue, fought in Victoria, for instance, case-by-case in licensing hearings. This paper summarises the research literature on the effects of density of alcohol sales outlets on

Michael Livingston BAppSc(Maths)/BArts (Criminology)Hons, Research Fellow, AER Centre for Alcohol Policy Research, Turning Point Alcohol and Drug Centre, Melbourne, Australia, Tanya Chikritzhs BA(Hons), Postgrad Dip Hlthsc, PhD, Senior Research Fellow, National Drug Research Institute, Curtin University of Technology, Australia, Robin Room PhD, Professor of Social Alcohol Research, School of Population Health, University of Melbourne and Director, AER Centre for Alcohol Policy Research, Turning Point Alcohol and Drug Centre, Melbourne, Australia. Correspondence to Michael Livingstone, 54 Gertrude Street, Fitzroy, Victoria, 3065, Australia. Tel: 03 8413 8407. Fax: 9416 3420. E-mail: michael@turningpoint.org.au

Received 28 May 2007; accepted for publication 4 June 2007.

alcohol consumption and alcohol-related problems, and discusses its implications for harm reduction strategies.

Historical background

Places where alcohol is sold have been linked to alcohol-related harm for many centuries [4], and to a greater or lesser degree have been subject to regulation. One recurrent theme in that history has been the issue of physical ‘density’ of alcohol outlets. Social surveyors in the United States a century ago, considering what might offer competition to the saloon as the ‘working man’s club’, drew maps of the downtown areas of American cities documenting the great density of drinking places, in comparison to the paucity of other attractions [5]. In the 1890s a British government inquiry, after hearing statistical evidence that there was a causal link between the number of licensed premises in a particular area and convictions for offences of drunkenness, recommended that the number of premises should be reduced systematically. Until 1981, the British licensing rules accordingly provided for the suppression of licenses deemed to be surplus, with compensation to the owners [6]. The systems of alcohol licensing and control which were the eventual settlement of the burning disputes of the temperance era accordingly often had provisions limiting the number of one or more types of alcoholic beverage licence. In a number of places, the limit was set as a rate per population; thus in California the number of liquor stores allowed in a county is tied to the county’s population [7]. In other places, the criterion was one of ‘need’, to be adjudicated by a magistrate or other authority.

As already indicated, in recent years in Australia such requirements have been seen as impermissible limits on the free market, and states have been under heavy pressure from the National Competition Council to remove these provisions from state and territory liquor licensing laws [1]. In part reflecting these pressures, changes in Victorian legislation have resulted in a steep rise in recent years in the number of alcohol licenses (unpublished data, Liquor Licensing Branch). Reflecting various commercial and ideological pressures, increases in the number of alcohol outlets have also occurred elsewhere.

Interest in the effects of licensing, and in particular of the density and clustering of alcohol sales outlets, as an issue for both policy and research has been renewed in recent years [8]. The modern literature on the effects of alcohol outlet density [9] can be seen as part of a wider contemporary literature on the effects of alcohol availability, defined in physical, economic and sometimes also psychological terms [10,11]. Limitations on availability which have been studied include taxation

and other price measures [11, pp. 101–15], restrictions on the minimum drinking age [12] and changes to opening hours and days of sale for alcohol outlets [13,14].

Overview of the outlet density literature

Effects on alcohol consumption

Studies examining the relationship between outlet density and alcohol consumption have produced mixed results. The studies fall into three broad categories: cross-sectional studies; natural experiments; and time-series analyses. Cross-sectional studies assess the spatial association between outlet density and alcohol consumption at a single point in time. These studies can provide some indication of the link between outlet density and consumption, but provide little insight into what will happen to consumption as outlet density changes within a particular region. Natural experiment studies examine what happens when a discontinuous change in the variable of interest takes place (e.g. allowing alcohol sales from supermarkets). Such studies are the most robust method (short of the chance for a full random-assignment experiment; e.g. [13]), generally allowing causal inferences to be made where subsequent changes in an outcome variable (e.g. consumption) are identified. However, by their nature, natural experiment studies examining outlet density rely on dramatic changes, while outlet density is more likely to change gradually. Time-series studies focus on the gradual, long-term changes in rates of outlets and consumption or problems. Rather than evaluating a specific systemic change, these studies attempt to determine whether, over a certain amount of time, changes in outlet rates are related to changes in problems.

Cross-sectional studies focusing on the relationship between outlet density and alcohol consumption at the local community level have produced mixed results. These studies have been based on multi-level models that combine individual-level data from population sample surveys with aggregate community-level data from administrative sources. Scribner *et al.* [15] found that neighbourhood-level outlet density, but not individual-level measures of accessibility, was related significantly to both drinking norms and consumption levels in 24 New Orleans census tracts. In contrast, an analysis of 82 neighbourhoods in California by Pollack *et al.* [16] found that, while bars and off-premise outlets were concentrated in the most economically disadvantaged neighbourhoods, alcohol consumption was highest in economically advantaged neighbourhoods. A series of studies focusing on college students consistently found a significant link between outlet densities around colleges and rates of binge-drinking and

drinking-relating problems, both for the students and the surrounding community [17–19].

Studies which have capitalised on natural experiments in alcohol availability have come largely from the Nordic countries, where access to alcohol has traditionally been more restricted than in many other developed countries. These studies have examined substantial changes in alcohol availability such as the opening of a store in a community that previously had none, or the introduction of beer or wine into supermarkets. Studies in Finland (summarised in [20]) used the introduction of outlets into rural villages and changes to regulations permitting grocery stores to sell beer to study the impact on changes in consumption. These changes resulted in a marked increase in the consumption of beer, with marginalised and heavy drinkers affected more than the average. Swedish studies have focused similarly on the introduction and removal of medium-strength beer (4.5% by volume) from supermarket shelves, finding substantial effects on consumption as well as alcohol-related hospitalisations, particularly among teenagers [21]. In contrast, similar studies in Norway found little effect on total alcohol consumption when beverage-specific (beer) outlet densities changed. Further studies found that changes in the physical availability of legal alcohol were often related to changes in consumption of illegal alcohol (moonshine), without changing overall consumption levels [20]. Outside the Nordic countries, studies have focused on the dismantling of government retail monopolies, generally resulting in substantial increases in numbers of outlets. The privatisation of the retail wine monopolies in five US states produced significant increases in wine sales, without substantial changes in beer or spirits sales [22]. Similar results were found when the privatisation of wine sales in Quebec was studied [23].

There have been few studies examining the effect of gradual changes in outlet density on alcohol consumption. An econometric analysis by Godfrey [24] in the United Kingdom attempted to ascertain the relationship between demand for alcohol (measured by consumption) and licensing. It aimed to determine whether demand drove licensing (i.e. increased demand resulting in new outlets opening) or vice versa (i.e. more licences producing more demand), using annual time-series data from 1956 to 1980. The analysis used instrumental variable regression to disentangle the simultaneous relationship between outlet density and demand. The study found that licensing and beer consumption were related, with new licences stimulating more demand, but found no relationship for wine and spirits. Gruenewald *et al.* [25] examined a similar question using a cross-sectional time-series analysis of sales, price and outlet data for wine and spirits from 38 US states. Their analyses, using a two-

stage regression model to examine the simultaneous relationships between outlet density and sales, found that outlet densities were related significantly to sales for both wine and spirits, and that the direction of the relationship was strongest from outlets to sales (i.e. increased outlets led to increased sales more than increased sales leading to increased outlets). However, a replication of this study at the neighbourhood level in five Californian communities [26] did not reproduce this result, finding no relationship between outlet densities and consumption. Outside the United States, Trolldal [27] conducted time-series analyses of spirits, wine and beer sales in four provinces of Canada, examining their relationship with price and availability. Price was the strongest predictor of sales, with physical availability significant in only two of 20 analyses, suggesting at most a small effect of outlet density on consumption.

Effects on violence

Many cross-sectional studies have examined the spatial relationship between outlet density and rates of violence, almost all of which have found significant positive relationships [28–41]. Despite the broad similarities in findings, the specifics of the relationships between outlet and violence vary markedly from place to place and from study to study. Different localities have found different effects by outlet type, with bars significant in some studies [34], off-premise outlets in others [32] and both types (sometimes in differing ways) in others [35,39]. Where interaction effects have been explored, results are also inconsistent. Smith *et al.* [41] found that the relationship between outlets and violence was stronger in socially disorganised areas, while Nielsen & Martinez [35] found that the effect of outlets on violence did not vary with social disorganisation. Gruenewald *et al.* [39] found that bars were related to violence in unstable, poor areas *and* in rural middle-income areas, but not otherwise. Finally, the results from analyses which have examined how surrounding areas affect violence in the target area have been complex. Gorman *et al.* [33] found that outlets in surrounding areas were not related to violence in the target area, while Zhu *et al.* [36] found that outlet density in neighbouring suburbs was related significantly to violence in a particular suburb.

Again, the best evidence on how changes in outlet-density will affect violence rates comes from longitudinal studies. Longitudinal analyses allow the examination of changes in outlet density within a particular region, minimising the possibility that the effects attributed to changes in outlet density are related to other, unobserved, variables. Norström [42] conducted a time-series analysis relating two measures of assault to on-premise outlet density in Norway between

1965 and 1990. This study found significant associations, suggesting that as the density of outlets in Norway changed, assault rates changed correspondingly. Further evidence of a longitudinal relationship was found by Gruenewald & Remer [43], who used 6 years of data from 581 Californian postal areas to undertake cross-sectional time-series analyses of the link between outlet density and assault. The study incorporated a range of environmental controls (e.g. other retail places) and socio-demographic controls (e.g. median household income) across the 6 years, as well as measures of densities of three types of outlet: bars, restaurants and off-premise retailers. The study found significant positive effects for both bars and off-premise outlets on violence, and a negative effect for restaurants. The density of bars in neighbouring regions was also associated positively with violence, suggesting that new bars influence violence not only in their local area, but in surrounding regions as well. The authors estimate that an average reduction of one bar in each of the 581 postal codes analysed would have resulted in 290 fewer assaults over the 6 years studied.

Effects on other alcohol-related problems

A substantial number of cross-sectional studies have examined the relationship between outlet density and a variety of alcohol-related problems. Recent studies which have examined the link between outlet density, drink-driving and motor vehicle accidents have generally found positive relationships ([44–46]; although see Meliker *et al.* [47] for an exception). In addition, studies have found cross-sectional links between outlet density and pedestrian injury [48], child maltreatment [49,50], neighbourhood amenity problems [17,51] and rates of sexually transmitted disease [52].

Longitudinal studies of these problems have been less common. Trollidal [53] used an interrupted time-series model to examine the impact of the privatisation of retail sales of alcohol in Alberta and found no impact on rates of fatal motor vehicle accidents. A more recent study, focusing on rates of gonorrhoea as a measure of risky sexual behaviour, presents the best evidence from a natural experiment on the effects of a reduction in alcohol outlets [54]. After the 1992 civil unrest in Los Angeles, in which many liquor stores were burned, 270 alcohol outlets surrendered their licenses in the wake of a community campaign to prevent damaged outlets from reopening. This provided an unusually unambiguous natural experiment, with a well-defined ‘intervention’ and a substantial reduction in outlets. Using data at the census tract level, Cohen *et al.* [54] examined the impact that this reduction in outlets had on rates of gonorrhoea. The study attempted to differentiate between alcohol

outlets as a causal factor (through alcohol consumption and risky behaviour) and as a marker of social disorganisation. The results of this study showed a marked impact of alcohol outlets on gonorrhoea rates, suggesting that outlets play a significant role in the spread of gonorrhoea, even when social disorganisation was controlled for. Although confounding effects related to social disorganisation were controlled for, it remains possible that some unmeasured features of the 1992 unrest were responsible for the observed reduction in gonorrhoea rates. None the less, this study provides some of the strongest evidence that reducing the number of alcohol outlets in a community will reduce the incidence of alcohol-related problems.

Alcohol outlet density and theory

The theoretical foundations of outlet density studies have not yet been developed fully. Many older studies [55,56] have relied heavily on classic ‘availability theory’, which posits three inter-related propositions: (i) as the availability of alcohol in a community increases, the mean consumption of its population also increases; (ii) as the mean alcohol consumption in a population increases so the number of heavy drinkers increases; and (iii) heavy drinking is associated with adverse health and social outcomes and as the number of heavy drinkers in a population increases, so too does the level of alcohol-related health and social problems [57]. There is a wealth of evidence to support the classical postulates of availability theory [58], but in itself the theory does not adequately explain the variable and complex relationships demonstrated by studies of outlet density and harm.

Stockwell & Gruenewald [9] have expanded the basic propositions of availability theory to take into account variation in how changes in availability may be experienced across drinking groups and the contribution of other factors to rates of harm. Changes in availability are redefined more precisely, in terms of changes in the ‘full price’ of alcohol, including the real price adjusted for the cost of living and convenience in terms of the time and effort required to obtain it. Thus Stockwell & Gruenewald’s first postulate states that:

Greater availability of alcohol in a society will increase the average consumption of its population when such changes reduce the ‘full price’ of alcohol, i.e. the real price of beverages at retail markets plus the convenience costs of obtaining them [9, p. 217].

In addition, Stockwell & Gruenewald recognise that alcohol-related harms can be affected by changes in availability that do not necessarily alter overall

consumption levels. Thus Stockwell & Gruenewald's second postulate asserts that:

Greater availability of alcohol in a society will directly affect alcohol-related harm when such changes affect the distribution of 'routine drinking activities'; behaviours drinkers engage in when consuming alcohol (e.g. drinking at bars vs. at home; drinking socially vs. alone) [9, p. 217].

The mention of 'routine activities' in this proposition, a term derived from criminology [59], signals that Stockwell & Gruenewald have moved towards integrating criminological theory with availability theory. This is indicative of the growing focus of analysts on theories which seek to explain how characteristics of drinkers and their neighbourhoods predispose to criminal activity (e.g. routine activities theory; social disorganisation theory). Routine activities theory [59] posits that crime takes place when potential offenders and victims come into contact during their day-to-day activities. Roncek & Maier [28] and Smith *et al.* [41] have both suggested that alcohol outlet density is linked to violence through the ability of the outlets to attract large numbers of uninhibited young males, who serve as ready supplies of both motivated offenders and potential victims. Social disorganisation theory, on the other hand, postulates that violence is more likely to take place in communities lacking in collective efficacy or informal social control [60]. Alcohol outlets have been suggested as a marker for social disorganisation; as well, organised communities may be better equipped than poorly organised ones to resist the addition of outlets to their community through legal and political means [61]. In addition, some researchers have suggested that alcohol outlets represent visible signs of neighbourhood decay, effectively announcing that the community cannot respond to problems collectively, thus making it a more attractive area in which to commit crime [33].

Most studies have discussed plausible theories that may explain their results, but little work has gone into developing how such theories might inform study design. In this section, we suggest a basic theoretical framework for outlet density studies. We propose that the effects of alcohol outlet density can be separated conceptually into: (i) a proximity effect (how easily one can access alcohol); and (ii) an amenity effect (how outlets influence the quality and characteristics of surrounds within the local community). This conceptual separation links the broad availability theory propositions put forward by Stockwell & Gruenewald [9] with the specific issue of outlet density. The proximity effect focuses on the impact of outlet density on the convenience costs described in their first postulate, while the amenity effect provides a specific

link between outlet density and specific types of routine drinking activities discussed in their second postulate.

The proximity effect (i) is the outcome focused upon by much of the work on outlet density, which approached the issue from the perspective of simple availability theory. Increased outlet density—whether for on-premise or off-premise sales—makes alcohol more accessible (each new store makes someone closer to a liquor store), and it is hypothesised that, *ceteris paribus*, this increases consumption and alcohol-related problems. It may also have a second effect in this direction: each new outlet potentially increases the competitive pressures on existing outlets, which may result in price reductions which tend to lead to increased levels of consumption [11].

The amenity effect (ii) relates to the negative effects (e.g. violence, street disturbances, etc.) of licensed premises on the neighbourhoods in which they operate (and possibly adjacent neighbourhoods). From this perspective, alcohol outlets are seen as attractors of trouble, particularly violence, which might or might not have happened elsewhere. This may involve increased alcohol consumption overall, but it may also involve a simple redistribution of where consumption takes place. Both on- and off-premise outlets may have an amenity effect, in terms of who they attract and how they behave, but the primary emphasis in Australia and the United Kingdom [8], for instance, has been on on-premise outlets. The amenity effect of bunches of alcohol outlets in the same district often results from crowds of young people, in various stages of intoxication, moving between outlets or spilling out onto the streets at closing time.

These two different aspects of density of alcohol outlets have different implications for the relationship between outlet density and alcohol-related problems. A proximity effect for alcohol outlets may operate in a similar way to the 'retail gravity model', whereby the effect of a new outlet declines with the square of the distance to the outlet. Norström [62] has demonstrated the applicability of this model to alcohol purchases, finding the effect of the availability of cheaper alcohol in Denmark on Swedish drinking diminished with the square of the distance from the main gateway between the two countries. If a similar effect were to exist for outlet density on consumption, the impact of extra outlets would diminish as the number of outlets per square kilometre increased. This is demonstrated in Figure 1, which illustrates the proximity effect of additional outlets added at random locations within a hypothetical 25-km² neighbourhood. Where there are large numbers of alcohol outlets in operation, the community will be in the flat part of the effect shown in Figure 1, with extra outlets adding little in terms of a proximity effect. It should be noted that this figure assumes that extra outlets reduce only convenience

costs, without attention to the possibility of price reductions from increased competition.

The nature of the amenity effect of outlet density is less clear. If each additional outlet attracts the same amount of additional problems, a straightforward linear relationship is plausible (at least until such time as the number of outlets reaches the maximum the market can support). However, addition of outlets in bunches may create a different effect. At a certain point, a growing bunch of outlets, particularly on-premise outlets such as hotels and bars, becomes fixed in people's mental maps as an entertainment district, and thus starts attracting crowds above and beyond what would be attracted by the same number of outlets on their own. In this situation, there are likely to be large numbers of people circulating from outlet to outlet, creating the potential for additional alcohol-related problems. Thus, it is possible that the amenity effect of outlet density on alcohol-related problems has a critical point—the point at which an area is seen as an entertainment district—after which alcohol-related trouble increases more sharply with extra outlets. An example of what this might look like is provided in Figure 2.

Broadly speaking, studies examining levels of consumption should be looking for a proximity effect of



Figure 1. Model of proximity effect of outlets based on the square of the average distance to the nearest outlet in a hypothetical community measuring 5×5 km.

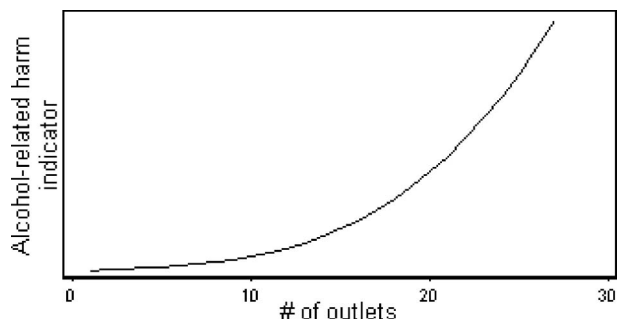


Figure 2. Model of amenity effect of outlets in an area where around 15 outlets stimulates the creation of an entertainment district.

outlet density, while studies focusing on alcohol-related disorder and violence should be looking for an amenity effect. The situation for motor vehicle accidents is less clear. Increased accessibility via the proximity effect will reduce the distance required to drive to the nearest outlet, which will reduce the risk of an accident on a particular trip but might increase the likelihood of someone deciding to make the trip. The amenity effect, particularly the creation of entertainment districts, may increase the number of people driving longer distances to and from licensed premises, although this will depend upon the accessibility of public transport and taxis and social norms regarding driving after drinking.

The implications of this theoretical framework are twofold. First, studies examining the effect of outlet density on alcohol consumption and related problems need to be clear about which type of effect they are studying. This will depend upon the setting, the type of outlet and the type of outcome being examined, and is something that needs to be discussed explicitly. Secondly, there is a good chance that the relationships between outlet density and alcohol-related problems are not strictly linear, and studies should not use statistical analyses that test only for/assume a straight-line relationship.

Gaps in the literature

The outlet density literature has grown dramatically in recent years, as advances in spatial data and methods for its analysis have taken place. However, the majority of the studies have taken a very similar approach, regressing rates of a particular outcome measure (consumption, violence, etc.) on outlet density, while controlling for socio-economic and demographic factors and statistical biases inherent in spatial analyses. The variety of results suggests that further thought is needed both in formulating an appropriate theoretical framework, as discussed above, and in developing new approaches to tease out the specifics of the relationships being examined.

One of the major weaknesses of most outlet density studies is the underlying assumption that every outlet (within broad licence categories) is equivalent. Thus, in most published studies both a small bar and a sprawling multi-level nightclub would be counted as one on-premise licence. This has obvious limitations. There are two plausible ways in which this can be overcome, at least in part. First, data relating the amount of alcohol sold by premises (or a proxy measure of sales such as wholesale alcohol purchases) would provide an extra dimension for analysis, allowing both density and consumption to be studied. Secondly, data linking alcohol-related harms to specific premises would allow a deeper understanding of the premise-specific drivers of alcohol-related harm.

Only a handful of studies [30,63,64] have incorporated both outlet density and wholesale alcohol purchases into their analyses. Wider application of these data would enable further exploration of how changes in outlet density actually influence levels of consumption. Such data could also be used to examine the degree to which changes in outlet density which affect levels of harm can be explained by changes in volumes of alcohol sales (or not) and in relation to particular types of beverages (e.g. [63]). Unfortunately, the systematic collection of alcohol sales or purchases made by individual licensed premises by administrative authorities is rare. In principle, private wholesalers could volunteer or be required to provide such data, but this is presently also very uncommon. In the main, alcohol consumption data is only available in aggregate for large geographical areas—a country as a whole (United Kingdom, Australia), or a state or province (United States, Canada), based usually on production, imports and exports data or tax collections. In Australia, only two jurisdictions collect wholesale purchase information from licensees and make the information available for research purposes (Northern Territory, Western Australia). Expanded collection of these types of data is essential to enable studies that can illuminate some of the complex effects of outlet density and, ultimately, to predict the likely outcomes of change.

Data relating to specifically identifiable individual premises associated with alcohol-related problems are not routinely collected in many jurisdictions. In many cases, therefore, it is not possible to distinguish rates of harms by type of licence (e.g. on-premise or off-premise) or other characteristics of the premises. However, there is good evidence to suggest that some types of liquor licences contribute disproportionately to alcohol-related harms [65]. Reporting systems such as the Alcohol Linking programme in New South Wales and New Zealand [66] or the recording of ‘place of last drink’ information for impaired drivers in Western Australia could be introduced more widely into standard policing practices. Further work using these types of data could explore the impact of bunching by examining whether or not people involved in alcohol-related problems had visited multiple alcohol outlets prior to the incident. These types of data will also allow for studies examining the impact on alcohol-related problems of changes in licensing conditions (e.g. opening hours) for particular premises by providing before and after data on alcohol-related harms associated with individual premises [67].

Finally, there is a lack of recent longitudinal studies assessing how individual alcohol consumption is affected by changes in outlet density. The Nordic studies provided some evidence that changes in alcohol availability were particularly likely to affect young or

marginalised drinkers [20]. In addition, studies that have examined extensions of opening hours [68,69] have found that problematic drinkers were the most likely to make use of increased availability. This raises the possibility that effects of outlet density which are specific to smaller subgroups may be difficult to detect using population-level data. Neither of the recent longitudinal studies that have examined the effect of outlet density on consumption [25,26] was able to examine the effects on subpopulations. Further study, particularly through longitudinal data collection on individual consumption, is necessary to ascertain whether outlet density is related to problematic consumption and long-term harm among some subgroups of drinkers.

On the whole, there is scant modern evidence applicable to the situation in many countries—where there is an abundance of alcohol outlets—of the effects of outlet density on alcohol consumption levels or on long-term alcohol-related health problems. The most compelling studies to have found positive relationships between outlet density and these outcomes have been undertaken in small-town Scandinavia and have generally examined situations of very low availability (e.g. the addition of a liquor store in a town where none previously existed) [20]. Recent longitudinal studies that have examined the effect of outlet density on consumption in regions with reasonably high alcohol availability found mixed results [25–27].

The implications for harm reduction

Despite this lack of clear evidence we propose that where the network of alcohol outlets is relatively dense, small changes in density are unlikely to affect alcohol consumption levels or rates of alcohol-related *chronic* health problems. There are two important caveats to this proposal. First, it should be noted that increased outlet density leads to an increasingly competitive alcohol market-place, possibly resulting in lower prices. In this circumstance, alcohol consumption levels would be expected to increase (see [11] for a summary of studies examining the impact of changes in price on alcohol consumption). Secondly, some studies [20] have suggested that socially marginalised drinkers are more likely to be influenced by changes in alcohol availability than other drinkers. This implies that changes to outlet density could markedly affect the consumption and long-term health problems of some population subgroups, sometimes without noticeable changes in population-level consumption estimates.

On the other hand, outlet density, and particularly bunching, are more likely to have an effect on rates of binge drinking, on alcohol-related injuries and violence, and on other short-term consequences related to concentrated drinking during discrete occasions. It is

in this area of problems that there are the strongest findings of an effect for outlet density. These effects are likely to take place at a local level: within a postcode or neighbourhood in urban areas. Hadfield [8] documents that, in Britain at least, a pub property is worth twice as much if it is located in proximity to existing attractive pubs and nightspots. There is thus substantial commercial value in bunching. Inherent in such bunching is the idea of night-time customers progressing from site to site in the course of a night out. This means that there are bound to be noise and disturbances in the neighbourhood while the night-time economy is flourishing. Close proximity of licensed premises makes it easier for customers to react to promotions such as cost undercutting. The movement of patrons between bars complicates the assignment of responsibility to any one server or establishment to forestall intoxication by cutting supply. These are all factors that can increase the level of problems from drinking.

Furthermore, although there are only a few cross-sectional studies that focus on it [18,51], the presence of a bar or liquor store can impact negatively upon neighbourhood amenity: noise late at night, street disturbances, disruptive behaviour, litter, vandalism and so on. More bars or liquor stores further reduce neighbourhood amenity. This is the classic situation that brought forward a common Australian response in terms of 'community accords' [70], where local police or authorities try to stimulate agreements among licensees to forswear overselling and limit promotions, with mixed results [71]. In Britain, the response has been provision for 'Alcohol Disorder Zones', where alcohol outlets within the zone are taxed to provide resources to counter alcohol-related disorder occurring as a result of the 'expansion in the night-time economy' [72].

This suggests that, where the primary aim is to limit or reduce rates of injury and other alcohol-related problems, particularly violence, greater attention might be paid to bunching than to density *per se*. Increasing the number of bars or stores close to each other, besides the additive effect from bringing together sources of trouble, is likely to increase competition (not a good thing in alcohol markets from a public health or order perspective), make server intervention more difficult and encourage disruptive strolling from pub to pub, increasing the likelihood of violence. It is worth noting, however, that bunching of alcohol outlets does make the targeted provision of some measures aimed at reducing alcohol related harm, such as policing and public transport, more straightforward.

Comprehensive policies for regulating outlet density and bunching should be based firmly on local level information, sound theoretical framework and well-designed research. Given the consistent links between outlet density and violence rates across a range of settings, study designs and data sources, a liquor

licensing regime serving the interest of public health and order should incorporate consideration of outlet density and bunching into licensing decisions.

References

- [1] National Competition Council. Assessment of governments' progress in implementing the National Competition Policy and related reforms. Melbourne: National Competition Council, 2001.
- [2] Marsden Jacob Associates. Identifying a framework for regulation in packaged liquor retailing. Report prepared for the National Competition Council as part of the NCC Occasional Series. Melbourne: Marsden Jacob Associates, 2005. Available at: <http://www.ncc.gov.au/pdf/PIReMJ-003.pdf> (accessed 10 May 2007).
- [3] Department of Culture Media and Sports. Guidance issued under Section 182 of the Licensing Act 2003. London, UK: Department for Culture, Media and Sport, 2004.
- [4] Bennet JM. Ale, beer and brewsters in England: women's work in a changing world, 1300–1600. Oxford: Oxford University Press, 1996.
- [5] Caulkins R. Substitutes for the saloon. Boston: Houghton, Mifflin Co., 1901.
- [6] Alcohol Education and Research Council (AERC). The AERC—a short account of its history and how it operates. London: AERC, 2007.
- [7] www.abc.ca.gov [homepage on the internet]. Sacramento: California Department of Alcoholic Beverage Control, c2001–2006. Available at: http://www.abc.ca.gov/questions/licenses_faq.html (accessed 15 May 2007).
- [8] Hadfield P. Bar wars: contesting the night in contemporary British cities. Oxford: Oxford University Press, 2006.
- [9] Stockwell T, Gruenewald PJ. Controls on the physical availability of alcohol. In: Heather N, Stockwell T, eds. The essential handbook of treatment and prevention of alcohol problems. Chichester: Wiley and Sons, 2004:213–33.
- [10] Smart RG. Availability and the prevention of alcohol-related problems. In: Harford TC, Parker DA, Light L, eds. Normative approaches to the prevention of alcohol abuse and alcoholism: Proceedings of a symposium, April 26–28, 1977, San Diego, CA. Rockville, MD: National Institute on Alcohol Abuse and Alcoholism, 1980:123–46.
- [11] Babor T, Caetano R, Casswell S, *et al*. Alcohol: no ordinary commodity—research and public policy. Oxford: Oxford University Press, 2003.
- [12] Wagenaar AC, Toomey TL. Effects of minimum drinking age laws: review and analyses of the literature from 1960 to 2000. *J Stud Alcohol* 2002;14:206–25.
- [13] Norström T, Skog O-J. Saturday opening of retail shops in Sweden: an experiment in two phases. *Addiction* 2005;100:767–76.
- [14] Chikritzhs T, Stockwell T. The impact of later trading hours for hotels on levels of impaired driver road crashes and driver breath alcohol levels. *Addiction* 2006;101:1254–64.
- [15] Scribner RA, Cohen DA, Fisher W. Evidence of a structural effect for alcohol outlet density: a multilevel analysis. *Alcohol Clin Exp Res* 2000;24:188–95.
- [16] Pollack CE, Cubbin C, Ahn D, Winkleby M. Neighbourhood deprivation and alcohol consumption: does the availability of alcohol play a role? *Int J Epidemiol* 2005;34:772–80.
- [17] Chaloupka FJ, Wechsler H. Binge drinking in college: the impact of price, availability, and alcohol control policies. *Contemp Econ Policy* 1996;14:112–24.

- [18] Wechsler H, Lee JE, Hall J, Wagenaar AC, Lee H. Secondhand effects of student alcohol use reported by neighbors of colleges: the role of alcohol outlets. *Soc Sci Med* 2002;55:425–35.
- [19] Weitzman ER, Folkman A, Folkman KL, Wechsler H. The relationship of alcohol outlet density to heavy and frequent drinking and drinking-related problems among college students at eight universities. *Health Place* 2003;9:1–6.
- [20] Mäkelä P, Rossow I, Tryggvesson K. Who drinks more and less when policies change? The evidence from 50 years of Nordic studies. In: Room R, ed. *The effects of Nordic alcohol policies: what happens to drinking and harm when control systems change?* Helsinki: Nordic Council for Alcohol and Drug Research, 2002: 17–70.
- [21] Ramstedt M. The repeal of medium-strength beer in grocery stores in Sweden—the impact on alcohol-related hospitalizations in different age groups. In: Room R, ed. *The effects of Nordic alcohol policies: what happens to drinking and harm when control systems change?* Helsinki: Nordic Council for Alcohol and Drug Research, 2002: 117–31.
- [22] Wagenaar AC, Holder HD. Changes in alcohol consumption resulting from the elimination of retail wine monopolies: results from five U.S. states. *J Stud Alcohol* 1995; 56:566–72.
- [23] Trollidal B. The privatization of wine sales in Quebec in 1978 and 1983 to 1984. *Alcohol Clin Exp Res* 2005; 29:410–6.
- [24] Godfrey C. Licensing and the demand for alcohol. *Appl Econ* 1988;20:1541–58.
- [25] Gruenewald PJ, Ponicki WR, Holder HD. The relationship of outlet densities to alcohol consumption: a time series cross-sectional analysis. *Alcohol Clin Exp Res* 1993; 17:38–7.
- [26] Gruenewald PJ, Millar AB, Ponicki WR, Brinkley G. Physical and economic access to alcohol: the application of geostatistical methods to small area analysis in community settings. In: Wilson R, DuFour M, eds. *Small area analysis and the epidemiology of alcohol problems*. Rockville: NIAAA, 2000:163–212.
- [27] Trollidal B. Availability and sales of alcohol in four Canadian provinces: a time-series analysis. *Contemp Drug Prob* 2005;32:343–72.
- [28] Roncek DW, Maier PA. Bars, blocks, and crimes revisited: linking the theory of routine activities to the empiricism of ‘hot spots’. *Criminology* 1991;29:725–73.
- [29] Speer PW, Gorman DM, Labouvie EW, Ontkush MJ. Violent crime and alcohol availability: relationships in an urban community. *J Public Health Policy* 1998;19:303–18.
- [30] Stevenson RJ, Lind B, Weatherburn D. The relationship between alcohol sales and assault in New South Wales, Australia. *Addiction* 1999;94:397–410.
- [31] Alaniz ML. Alcohol availability and targeted advertising in racial ethnic minority communities. *Alcohol Health Res World*. 1998;22:286–9.
- [32] Costanza SE, Bankston WB, Shihadeh E. Alcohol availability and violent crime: a spatial analysis. *J Crime Justice* 2001;24:71–83.
- [33] Gorman DM, Speer PW, Gruenewald PJ, Labouvie EW. Spatial dynamics of alcohol availability, neighborhood structure and violent crime. *J Stud Alcohol* 2001;62:628–36.
- [34] Lipton R, Gruenewald PJ. The spatial dynamics of violence and liquor outlets. *J Stud Alcohol* 2002;63:187–95.
- [35] Nielsen AL, Martinez R. Reassessing the alcohol-violence linkage: results from a multiethnic city. *Justice Q* 2003;20:445–69.
- [36] Zhu L, Gorman DM, Horel S. Alcohol outlet density and violence: a geospatial analysis. *Alcohol Alcohol* 2004; 39:369–75.
- [37] Britt HR, Carlin BP, Toomey TL, Wagenaar AC. Neighborhood level spatial analysis of the relationship between alcohol outlet density and criminal violence. *Environ Ecol Stat* 2005;12:411–26.
- [38] Gorman DM, Zhu L, Horel S. Drug ‘hot-spots’, alcohol availability and violence. *Drug Alcohol Rev* 2005;24:507–13.
- [39] Gruenewald PJ, Freisthler B, Remer L, LaScala EA, Treno A. Ecological models of alcohol outlets and violent assaults: crime potentials and geospatial analysis. *Addiction* 2006;101:666–77.
- [40] Gyimah-Brempong K, Racine J. Alcohol availability and crime: a robust approach. *Appl Econ* 2006;38:1293–307.
- [41] Smith WR, Frazee SG, Davison EL. Furthering the integration of routine activity and social disorganization theories: small units of analysis and street robbery as a diffusion process. *Criminology* 2000;38:489–524.
- [42] Norström T. Outlet density and criminal violence in Norway, 1960–1995. *J Stud Alcohol* 2000;61:907–11.
- [43] Gruenewald PJ, Remer L. Changes in outlet densities affect violence rates. *Alcohol Clin Exp Res* 2006;30:1184–93.
- [44] Treno AJ, Grube J, Martin SE. Alcohol availability as a predictor of youth drinking and driving: a hierarchical analysis of survey and archival data. *Alcohol Clin Exp Res* 2003;27:835–40.
- [45] Gruenewald PJ, Johnson FW, Treno A. Outlets, drinking and driving: a multi-level analysis of availability. *J Stud Alcohol* 2002;63:460–8.
- [46] Gruenewald PJ, Ponicki WR. The relationship of the retail availability of alcohol and alcohol sales to alcohol-related traffic crashes. *Accid Anal Prev* 1995;27:249–59.
- [47] Meliker JR, Maio RF, Zimmerman MA, Kim HM, Smith SC, Wilson ML. Spatial analysis of alcohol-related motor vehicle crash injuries in southeastern Michigan. *Accid Anal Prev* 2004;36:1129–35.
- [48] LaScala EA, Johnson FW, Gruenewald PJ. Neighborhood characteristics of alcohol-related pedestrian injury collisions: a geostatistical analysis. *Prev Sci* 2001;2:123–34.
- [49] Freisthler B. A spatial analysis of social disorganization, alcohol access, and rates of child maltreatment in neighborhoods. *Child Youth Serv Rev* 2004;26:803–19.
- [50] Freisthler B, Midanik LT, Gruenewald PJ. Alcohol outlets and child physical abuse and neglect: applying routine activities theory to the study of child maltreatment. *J Stud Alcohol* 2004;65:586–92.
- [51] Donnelly N, Poynton S, Weatherburn D, Bamford E, Nottage J. Liquor outlet concentrations and alcohol-related neighbourhood problems. *Alcohol Studies Bulletin* no. 8. Sydney: Bureau of Crime Statistics and Research, 2006.
- [52] Scribner R, Cohen DA, Farley TA. A geographic relation between alcohol availability and gonorrhoea rates. *Sex Transm Dis* 1998;25:544–8.
- [53] Trollidal B. An investigation of the effect of privatization of retail sales of alcohol on consumption and traffic accidents in Alberta, Canada. *Addiction* 2005;100:662–71.
- [54] Cohen DA, Ghosh-Dastidar B, Scribner RA, *et al.* Alcohol outlets, gonorrhoea, and the Los Angeles civil unrest: a longitudinal analysis. *Soc Sci Med* 2006; 62:3062–71.
- [55] Scribner RA, MacKinnon DP, Dwyer JH. The risk of assaultive violence and alcohol availability in Los Angeles County. *Am J Public Health* 1995;85:33–40.

- [56] Scribner RA, Cohen DA, Kaplan S, Allen SH. Alcohol availability and homicide in New Orleans: conceptual considerations for small area analysis of the effect of alcohol outlet density. *J Stud Alcohol* 1999;60:310–16.
- [57] Single EW. The availability theory of alcohol-related problems. In: Chaudron CD, Wilkinson DA, eds. *Theories on alcoholism*. Toronto: Addiction Research Foundation, 1988:325–51.
- [58] Edwards G, Anderson P, Babor TF, *et al.* *Alcohol policy and the public good*. New York: Oxford University Press, 1995.
- [59] Felson M. Routine activities and crime prevention in the developing metropolis. *Criminology* 1987;25:911–32.
- [60] Sampson RJ, Groves WB. Community structure and crime: testing social-disorganization theory. *Am J Sociol* 1989;94:774–802.
- [61] Peterson RD, Krivo LJ, Harris MA. Disadvantage and neighbourhood violent crime: do local institutions matter? *J Res Crime Delinq* 2000;37:31–63.
- [62] Norström T. The geography of cross-border trading of alcohol, in Sweden and the European Union. In: Holder HD, ed. *Changes in national alcohol policy and their consequences*. Stockholm: Almqvist and Wiksell International, 2000:121–37.
- [63] Stockwell T, Masters L, Philips M, *et al.* Consumption of different alcohol beverages as predictors of local rates of night-time assault and acute alcohol-related morbidity. *Aust NZ J Public Health* 1998;22:237–42.
- [64] Stevenson R, Lind B, Weatherburn D. Property damage and public disorder: their relationship with sales of alcohol in New South Wales, Australia. *Drug Alcohol Depend* 1999;54:163–70.
- [65] Stockwell T, Somerford P, Land E. The relationship between license type and alcohol-related problems attributed to licensed premises in Perth, Western Australia. *J Stud Alcohol* 1992;53:495–8.
- [66] Wiggers J, Jauncey M, Considine R, *et al.* Strategies and outcomes in translating alcohol harm reduction research into practice: the Alcohol Linking Program. *Drug Alcohol Rev* 2004;23:355–64.
- [67] Chikritzhs T, Stockwell T. The impact of later trading hours for hotels on levels of impaired driver road crashes and driver breath alcohol levels. *Addiction* 2006;101:1254–64.
- [68] McLaughlin KL, Harrison-Stewart AJ. The effect of a temporary period of relaxed licensing laws on the alcohol-consumption of young male drinkers. *Int J Addict* 1992;27:409–23.
- [69] Smith DI. Comparison of patrons of hotels with early opening and standard hours. *Int J Addict* 1986;21:155–63.
- [70] Lang E, Rumbold G. The effectiveness of community based interventions to reduce violence in and around licensed premises: a comparison of three Australian models. *Contemp Drug Prob* 1997;24:805–26.
- [71] Loxley W, Toumbourou J, Stockwell T, *et al.* The prevention of substance use, risk and harm in Australia: a review of the evidence. Canberra: Australian Commonwealth Department of Health and Aging, 2004.
- [72] Home Office [homepage on the internet]. Alcohol disorder zones. London: The Home Office, 2006. Available at: <http://www.homeoffice.gov.uk/documents/ria-violent-crime-bill-cov-0605/ria-violent-crime-bill-12-0605?version=1> (accessed 21 May 2007).